



# BEARINGS



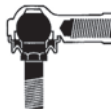
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| IKO INDEX OF DIMENSION TABLES                                                                                                                                 |  |                                                                                                              |                                                                                                                              | General Explanation                                                                                                         |                                                                                                                               |
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Gifu factory main entrance



Assembling process in a clean room

# IKO

## Needle Roller Bearing Series

### CAT-1590E

The IKO Needle Roller Bearing Series are manufactured through a control system that alleviates their impact on the global environment to meet the quality requirements of ISO 14001 in compliance with the quality requirements level of ISO 9001 for quality improvement. The standard products listed in this catalog comply with the specifications of the ten hazardous materials mentioned cited in the European RoHS Directive.

This catalog adopts the SI system (system of international units) in conformance with ISO (International Organization for Standardization) Standard 1000.

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In the table of dimensions, standard products are referred to using identification numbers marked with  . The products are reputed for high quality, reasonable price and quick delivery. The identification numbers marked with   refer to our semi-standard products. The specifications and dimensions of products in this catalogue are subject to change without prior notice.

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## General Explanation



Nippon Thompson Co., Ltd. is a bearing manufacturer that launched the technical development of needle roller bearings for the first time in Japan and is proud of the high quality level and abundant varieties of its products.

Needle roller bearings are bearings for rotary motion that incorporate needle-shaped thin rollers instead of ordinary bearing balls or rollers. Compared with other rolling bearings, they are small-sized and lightweight but have a large load capacity. They are widely used with high reliability in the fields of automobiles, industrial machinery, OA equipment, etc. as resource-saving type bearings that make the whole machine compact.

# Characteristics of Needle Roller Bearings

Bearings can be classified into two main types, namely rolling bearings and sliding bearings. Rolling bearings can be subdivided further into ball bearings and roller bearings according to the rolling elements. IKO Needle Roller Bearings are high-precision rolling bearings with a low sectional height, incorporating needle rollers as the rolling element. They have the following features.

## Merits of Rolling Bearings

Compared with sliding bearings, rolling bearings have the following merits:

### ① Static and kinetic friction is low.

Since the difference between static friction and kinetic friction is small and the frictional coefficient is also small, drive units or machines can be made more compact and lightweight, saving machine costs and power consumption.

### ② Stable accuracy can be maintained for long periods.

Owing to less wear, stable accuracy can be maintained for long periods.

### ③ Machine reliability is improved.

Since the bearing life can be estimated based on rolling fatigue, machine reliability is improved.

### ④ Lubrication is simplified.

Since grease lubrication is sufficient in most cases, lubrication can be simplified for easy maintenance.

## Merits of Needle Roller Bearings

Compared with other rolling bearings, IKO Needle Roller Bearings have the following advantages:

### ① With a low sectional height, they can withstand heavy loads.

Since they have a low sectional height compared with other rolling bearings and yet can withstand heavy loads, machines can be made more compact and lightweight, thus saving costs.

### ② Rotating torque is small, improving mechanical efficiency.

Since the rotating radius is small, the rotating torque is also small under the same frictional conditions, thus improving mechanical efficiency.

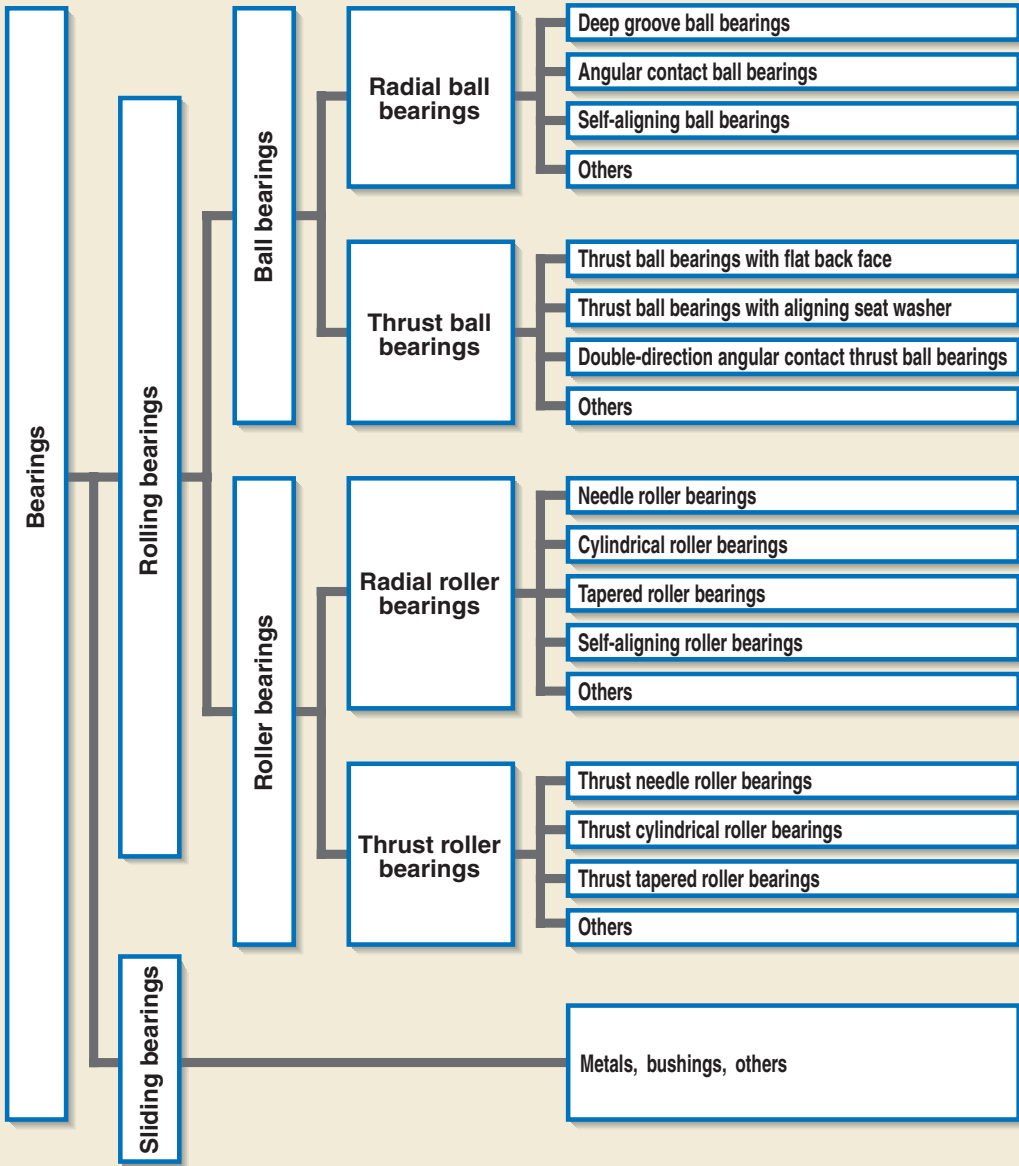
### ③ Inertia is minimized.

Since the bearing volume and weight are small, the moment of inertia of the bearing is minimized when it is put in motion.

### ④ Most suited to oscillating motions.

Many rolling elements are arranged at a small spacing pitch, and this configuration is most suited to oscillating motions.

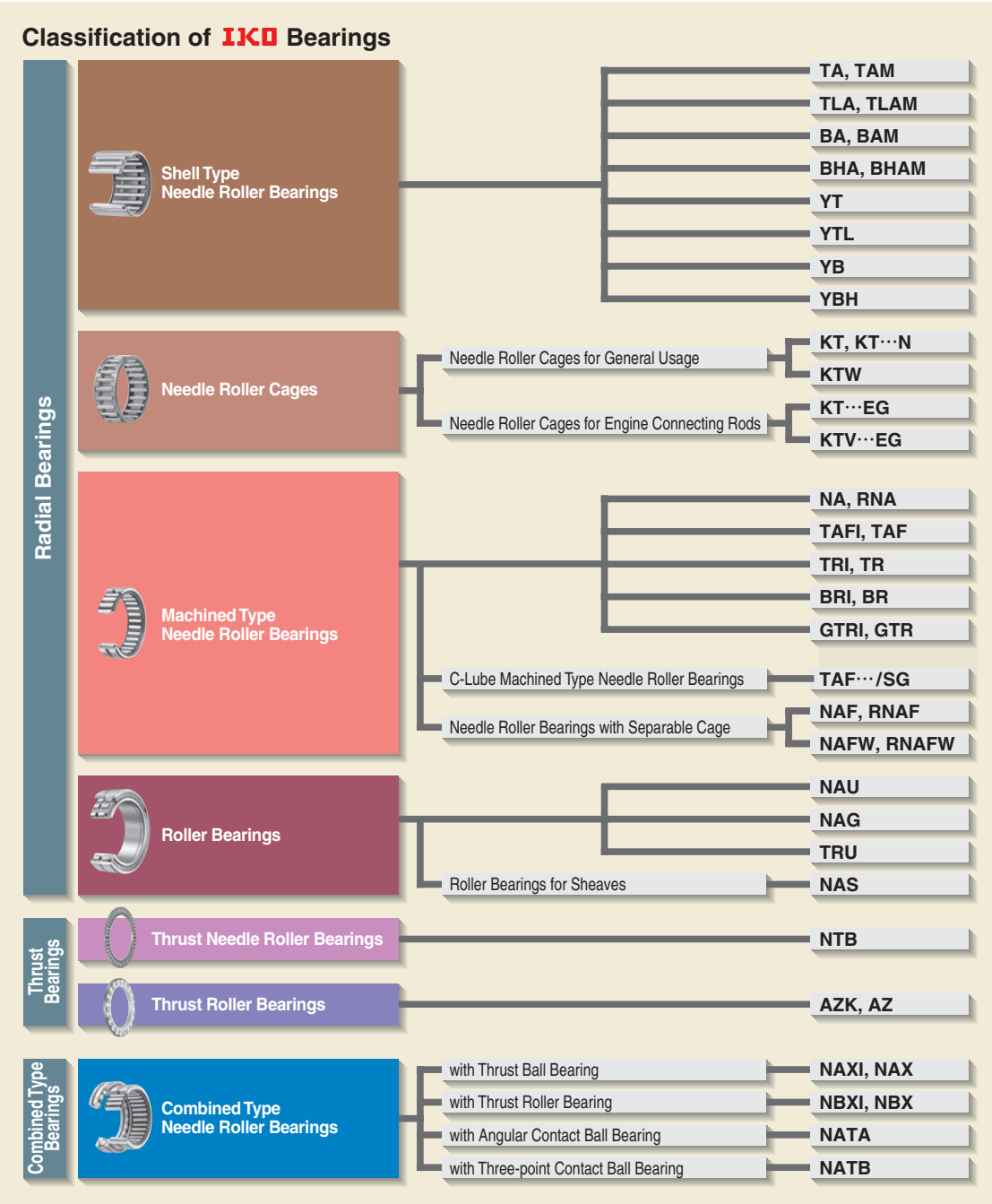
## Classification of bearings



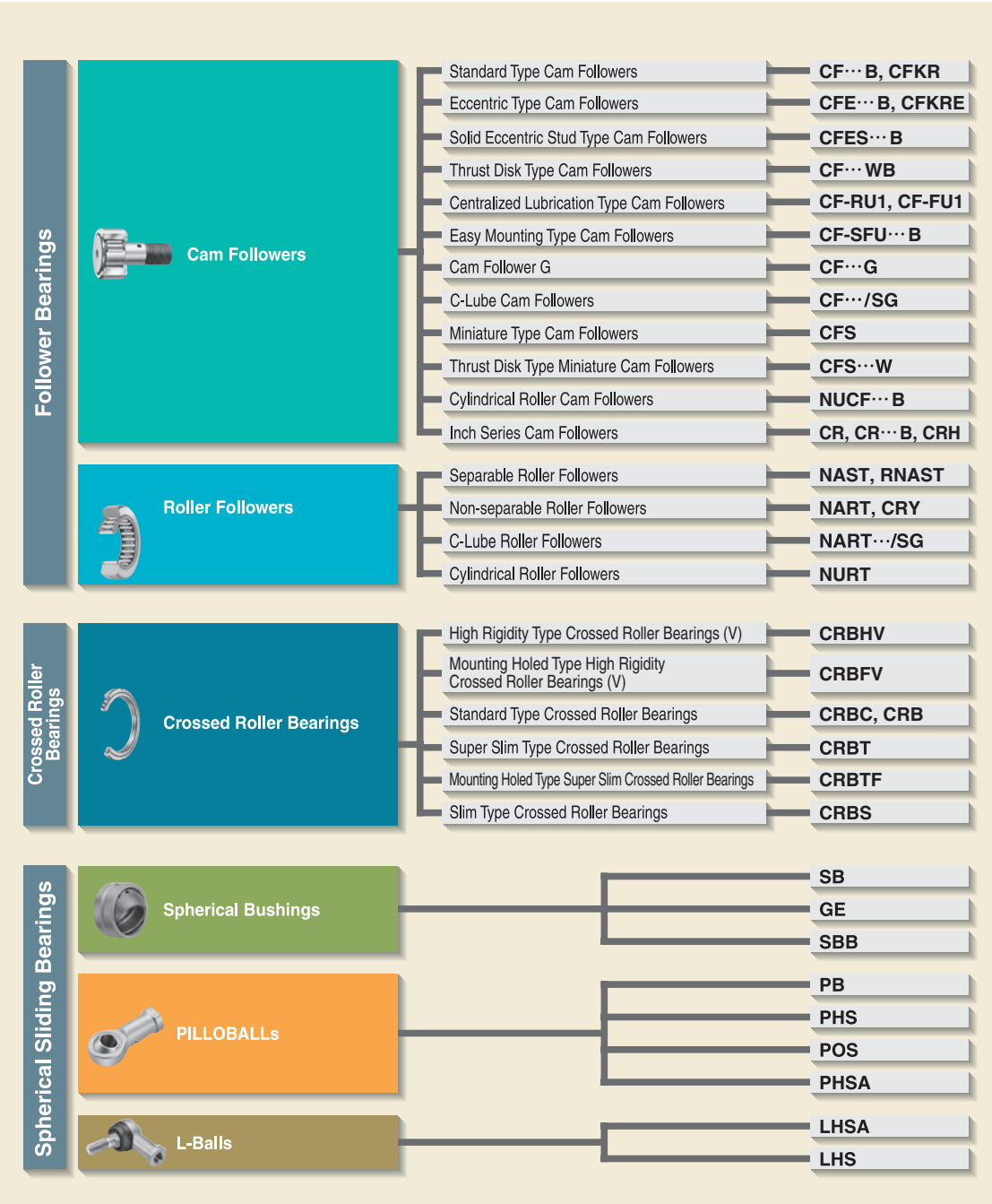
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Types and Features of Bearings

IKO Bearings can be roughly classified into radial bearings and thrust bearings according to applicable load direction. Radial Bearings are grouped into Shell Type Needle Roller Bearings, Machined Type Needle Roller Bearings, and various other types. Thrust Bearings are grouped into Thrust Needle Roller Bearings and Thrust Roller Bearings. Follower Bearings that are used for cam mechanisms and linear motion are grouped into Cam Followers and Roller Followers.



Crossed Roller Bearings are special shape bearings that can simultaneously receive loads in all directions with a single bearing. Bearings other than rolling bearings, such as self-aligning Spherical Bushings that can support radial loads and axial loads and PILLOBALLs and L-Balls that are used for link mechanisms, are also available.



Shell Type Needle Roller Bearings



Shell Type Needle Roller Bearings are lightweight with the lowest sectional height among needle roller bearings with outer ring, because they employ a shell type outer ring made from a thin special-steel plate which is accurately drawn, carburized and quenched. Since these bearings are press-fitted into the housing, no axial positioning fixtures are required. They are ideal for use in mass-produced articles that require economy.

Radial Bearings Page B1

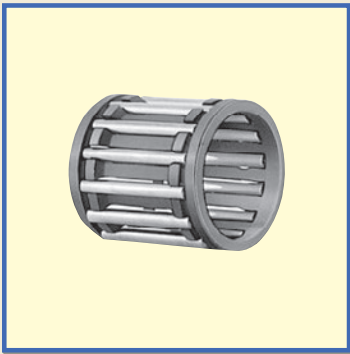
Needle Roller Cages for General Usage



Needle Roller Cages for General Usage are bearings that display excellent rotational performance. Their specially shaped cages with high rigidity and accuracy, precisely guide the needle rollers. Since needle rollers with extremely small dimensional variations in diameter are incorporated and retained, Needle Roller Cages for General Usage are useful in small spaces when combined with shafts and housing bores that are heat treated and accurately ground as raceway surfaces.

Radial Bearing Page C1

Needle Roller Cages for Engine Connecting Rods



Needle Roller Gages for Engine Connecting Rods are used for motor cycles, small motor vehicles, outboard marines, snow mobiles, general-purpose engines, high-speed compressors, etc. that are operated under extremely severe and complex operating conditions such as heavy shock loads, high speeds, high temperatures, and stringent lubrication. Needle Roller Cages for Engine Connecting Rods are lightweight and have high load ratings and high rigidity as well as superior wear resistance.

Radial Bearing Page C17

Machined Type Needle Roller Bearings



Machined Type Needle Roller Bearings have an outer ring made by machining, heat treatment, and grinding. The outer ring has stable high rigidity and can be easily used even for light alloy housings. These bearings are available in various types and optimally selectable for different conditions such as heavy loads, high-speed rotation and low-speed rotation. They are most suitable for general-purpose applications.

Radial Bearing Page D1

Needle Roller Bearings with Separable Cage



In Needle Roller Bearings with Separable Cage, the inner ring, outer ring and Needle Roller Cage are combined, and they can be separated easily. This type has a simple structure with high accuracy. In addition, the radial clearance can be freely selected by choosing an assembly combination. These bearings have excellent rotational performance, because Needle Roller Cages are used.

Radial Bearing Page D79

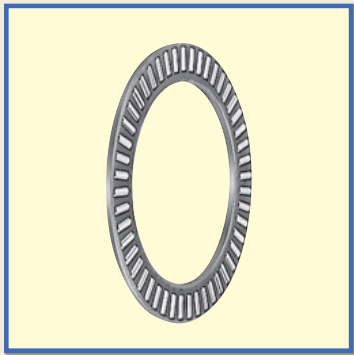
Roller Bearings



Roller Bearings, in which rollers are incorporated in double rows, are non-separable heavy-duty bearings. They can withstand not only radial loads but axial loads as well, which are supported at the contacts between the shoulders of inner and outer rings and the end faces of rollers. Therefore, they are most suitable for use at the fixing side of a shaft.

Radial Bearing Page E1

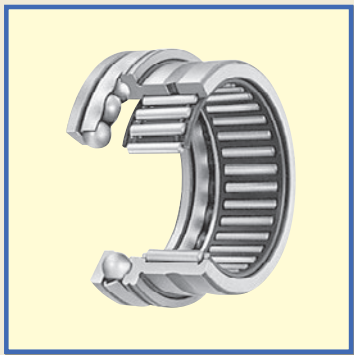
Thrust Bearings



Thrust Bearings consist of a precisely made cage and rollers, and can receive axial loads. They have high rigidity and high load capacities and can be used in small spaces. Thrust Needle Roller Bearings use needle rollers, while Thrust Roller Bearings use cylindrical rollers.

Thrust Bearing Page F1

Combined Type Needle Roller Bearings



Combined Type Needle Roller Bearings are combinations of a radial bearing and a thrust bearing. Caged Needle Roller Bearings are used as radial bearings and Thrust Ball Bearings or Thrust Roller Bearings are used as thrust bearings. They can be subjected to radial loads and axial loads simultaneously.

Combined Type Bearing Page G1

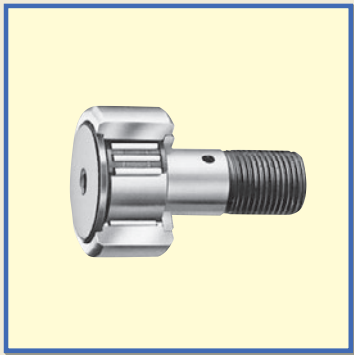
Inner Rings



Inner Rings are heat-treated and finished by grinding to a high degree of accuracy and are used for Needle Roller Bearings. In the case of Needle Roller Bearings, normally the shafts are heat-treated and finished by grinding and used as raceway surfaces. However, when it is impossible to make shaft surfaces according to the specified surface hardness or surface roughness, Inner Rings are used.

Component part Page H1

Cam Followers



Cam Followers are bearings with a stud incorporating needle rollers in a thick walled outer ring. They are designed for outer ring rotation, and the outer rings run directly on mating cam guide surfaces. Various types of Cam Followers are available. They are widely used as follower bearings for cam mechanisms and for linear motions.

Follower Bearing Page I1

Roller Followers



Roller Followers are bearings in which needle rollers are incorporated in a thick walled outer ring. These bearings are designed for outer ring rotation, and the outer rings run directly on mating cam guide surfaces. They are used as follower bearings for cam mechanisms and for linear motions.

Follower Bearing Page I81

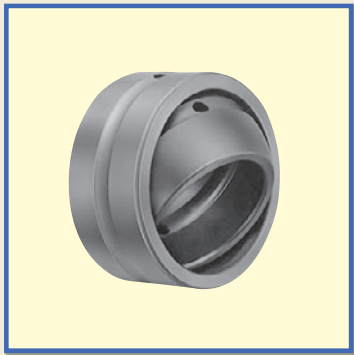
Crossed Roller Bearings



Crossed Roller Bearings are high-rigidity and compact bearings with their cylindrical rollers alternately crossed at right angles to each other between inner and outer rings. A single Crossed Roller Bearing can take loads from any directions at the same time such as radial, thrust, and moment loads. These bearings are widely used in the rotating parts of industrial robots, machine tools, medical equipment, etc. which require compactness, high rigidity and high rotational accuracy.

Crossed Roller Bearing Page J1

Spherical Bushings



Spherical Bushings are self-aligning spherical plain bushings, which have inner and outer rings with spherical sliding surfaces. They can take a large radial load and a bi-directional axial load at the same time. They are divided into steel-on-steel types that are suitable for applications where there are alternate loads or shock loads, and maintenance-free types which require no lubrication.

Spherical Sliding Bearing Page K1

PILLOBALLS



PILLOBALLs are compact self-aligning spherical plain bushings which can support a large radial load and a bi-directional axial load at the same time. PILLOBALL Rod Ends have either a female thread in the body or a male thread on the body, so they can be easily assembled onto machines. PILLOBALLs are used in control and link mechanisms in machine tools, textile machines, packaging machines, etc.

Spherical Sliding Bearing Page K29

L-Balls



L-Balls are self-aligning rod-ends consisting of a special zinc die-cast alloy body and a stud ball which has its axis at right-angles to the body. They can perform tilting movement and rotation with low torque, and transmit power smoothly due to the uniform clearance between the sliding surfaces. They are used in link mechanisms in automobiles, construction machinery, farm and packaging machines, etc.

Spherical Sliding Bearing Page K45

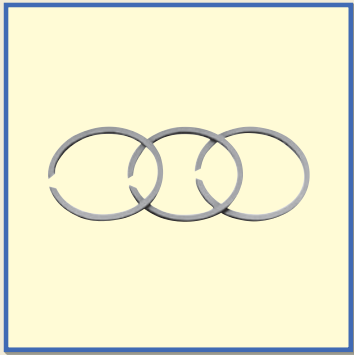
Seals for Needle Roller Bearings



Seals for Needle Roller Bearings have a low sectional height and consist of a sheet metal ring and special synthetic rubber. As these seals are manufactured to the same sectional height as Needle Roller Bearings, grease leakage and the penetration of foreign particles can be effectively prevented by fitting them directly to the sides of combinable bearings.

Component Part Page L1

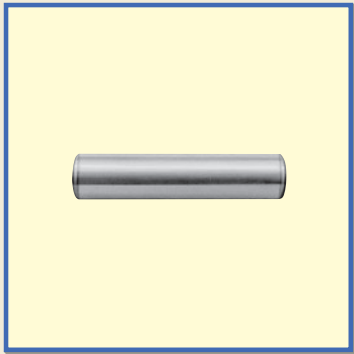
Cir-clips for Needle Roller Bearings



Cir-clips for Needle Roller Bearings have been specially designed for needle roller bearings on which, in many cases, generally available Cir-clips cannot be used. They have a low sectional height and are very rigid. There are Cir-clips for shafts and for bores, and they are used for positioning to prevent bearing movement in the axial direction.

Component Part Page L17

Needle Rollers



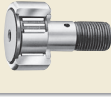
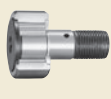
Needle Rollers are used for needle roller bearings and are rigid and highly accurate. These needle rollers are widely used as rolling elements for bearings, and also as pins and shafts.

Component Part Page L23

Features of IKO Bearings

| Bearing series                             |                            | Appearance                                                                          | Direction of motion                                                                 | Load direction and capacity                                                         | Allowable rotational speed                                                          | Friction                                                                             | Sectional height                                                                      | Reference page |
|--------------------------------------------|----------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------|
| Shell Type Needle Roller Bearings          | Caged type                 |    |    |    |    |    |    | B1~            |
|                                            | Full complement type       |    |    |    |    |    |    |                |
| Needle Roller Cages                        | For general usage          |    |    |    |    |    |    | C1~            |
|                                            | For engine connecting rods |    |    |    |    |    |    | C17~           |
| Machined Type Needle Roller Bearings       | Caged type                 |    |    |    |    |    |    | D1~            |
|                                            | Full complement type       |   |    |    |    |    |    |                |
| Needle Roller Bearings with Separable Cage | Caged type                 |  |  |  |  |  |  | D79~           |
| Roller Bearings                            | Caged type                 |  |  |  |  |  |  | E1~            |
|                                            | Full complement type       |  |  |  |  |  |  |                |
|                                            | For sheaves                |  |  |  |  |  |  |                |

Symbol  Rotation  Oscillating motion  Radial load  Axial load  Light load  Medium load  Heavy load  Especially excellent  Excellent  Normal

| Bearing series                       |                                       | Appearance                                                                            | Direction of motion                                                                   | Load direction and capacity                                                           | Allowable rotational speed                                                            | Friction                                                                              | Sectional height                                                                      | Reference page |
|--------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------|
| Thrust Bearings                      | Needle roller bearings                |    |    |    |    |    |    | F1~            |
|                                      | Roller bearings                       |    |    |    |    |    |    |                |
| Combined Type Needle Roller Bearings | With thrust ball bearing              |    |    |    |    |    |    | G1~            |
|                                      | With thrust roller bearing            |    |    |    |    |    |    |                |
|                                      | With angular contact ball bearing     |    |    |    |    |    |    |                |
|                                      | With three-point contact ball bearing |   |   |   |    |    |    |                |
| Cam Followers                        | Caged type                            |  |  |  |  |  |  | I1~            |
|                                      | Full complement type                  |  |  |  |  |  |  |                |
| Roller Followers                     | Separable caged type                  |  |  |  |  |  |  | I81~           |
|                                      | Non-separable caged type              |  |  |  |  |  |  |                |
|                                      | Non-separable full complement type    |  |  |  |  |  |  |                |

Features of IKO Bearings

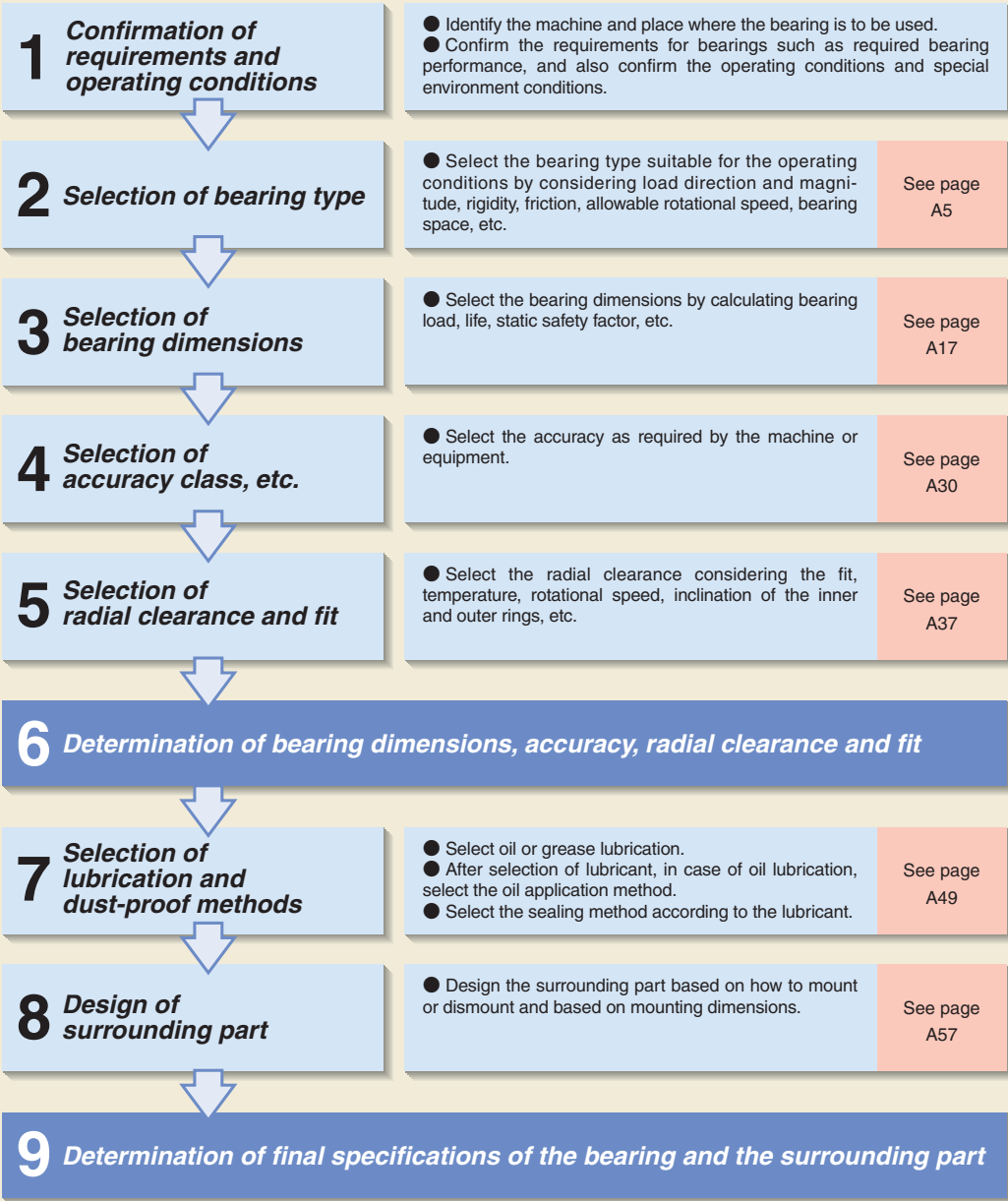
| Bearing series          |                                    | Appearance | Direction of motion | Load direction and capacity | Allowable rotational speed | Friction | Sectional height | Reference page |
|-------------------------|------------------------------------|------------|---------------------|-----------------------------|----------------------------|----------|------------------|----------------|
| Crossed Roller Bearings | Caged type, Separator type         |            |                     |                             |                            |          |                  | J1~            |
|                         | Full complement type               |            |                     |                             |                            |          |                  |                |
|                         | Slim type                          |            |                     |                             |                            |          |                  |                |
| Spherical Bushings      | Steel-on-steel type                |            |                     |                             |                            |          |                  | K1~            |
|                         | Maintenance-free type              |            |                     |                             |                            |          |                  |                |
| PILLOBALLS              | Insert type, Lubrication type      |            |                     |                             |                            |          |                  | K29~           |
|                         | Die-casting type, Lubrication type |            |                     |                             |                            |          |                  |                |
|                         | Maintenance-free type              |            |                     |                             |                            |          |                  |                |
| L-Balls                 | Lubrication type                   |            |                     |                             |                            |          |                  | K45~           |

Symbol Rotation Oscillating motion Radial load Axial load Light load Medium load Heavy load Especially excellent Excellent Normal

Outline of Bearing Selection

IKO Bearings are available in many types and sizes. To obtain satisfactory bearing performance in machines and equipment, it is essential to select the most suitable bearing by carefully studying the requirements for the application. Although there is no particular procedure or rule for bearing selection, an example of a commonly adopted procedure is shown in the figure below.

An example of procedure for bearing selection



Basic Dynamic Load Rating and Life

Life

Rolling bearings will suffer damage due to various causes during service. Damage such as abnormal wear, seizure, and cracks is caused by improper use, including incorrect mounting, lack of oil, dust intrusion and so on, and can be avoided by remedying these causes. However, bearings will eventually be damaged due to fatigue-flaking even if used properly. When a bearing rotates under load, the raceways and the rolling elements are subjected to repeated stresses concentrated on the part close to the surface. Fatigue, therefore, occurs in the surface layer, producing damage in the form of scaling. This is called flaking (spalling). When this occurs, the bearing can no longer be used.

Bearing Life

Bearing life is defined as the total number of revolutions (or total service hours at a constant rotational speed) before a sign of the first flaking appears on the rolling surface of raceway or rolling elements. However, even when bearings of the same size, structure, material and heat treatment are subjected to the same conditions, the bearing lives will show variation (See Fig. 1.). This results from the statistical nature of the fatigue phenomenon. In selecting a bearing, it is incorrect to take an average life for all bearings as the design standard. It is more practical to consider a bearing life that is reliable for the greater proportion of bearings used. Therefore, the basic rating life defined in the following is used.

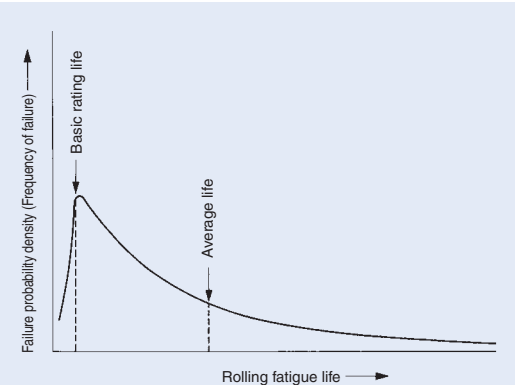


Fig. 1 Variation of rolling fatigue life

Basic rating life

The basic rating life is defined as the total number of revolutions that 90% of a group of identical bearings can be operated individually under the same conditions free from any material damage caused by rolling fatigue. For rotation at a constant rotational speed, the basic rating life can be represented by the total service hours.

Basic dynamic load rating

The basic dynamic load rating is defined as the constant radial load (in the case of radial bearings) or the constant axial load acting along the bearing central axis (in the case of thrust bearings) that allows a basic rating life of 1,000,000 revolutions.

Calculation of rating life

The relationship among the basic rating life, basic dynamic load rating and dynamic equivalent load (bearing load) of rolling bearings is as follows:

$$L_{10} = \left( \frac{C}{P} \right)^p \dots\dots\dots (1)$$

- where,  $L_{10}$  : Basic rating life,  $10^6$  rev.
- $C$  : Basic dynamic load rating, N
- $P$  : Dynamic equivalent load, N
- $p$  : Exponent, Roller bearing: 10/3
- Ball bearing: 3

Accordingly, when the rotational speed per minute is given, the basic rating life is represented as the total service hours according to the following equations:

$$L_h = \frac{10^6 L_{10}}{60n} = 500 f_h^p \dots\dots\dots (2)$$

$$f_h = f_n \frac{C}{P} \dots\dots\dots (3)$$

$$f_n = \left( \frac{33.3}{n} \right)^{1/p} \dots\dots\dots (4)$$

- where,  $L_h$  : Basic rating life represented by service hours, h
- $n$  : Rotational speed,  $\text{min}^{-1}$
- $f_h$  : Life factor
- $f_n$  : Velocity factor

In addition, the rating life can be calculated by obtaining  $f_h$  and  $f_n$  from the life calculation scales of Fig. 2.

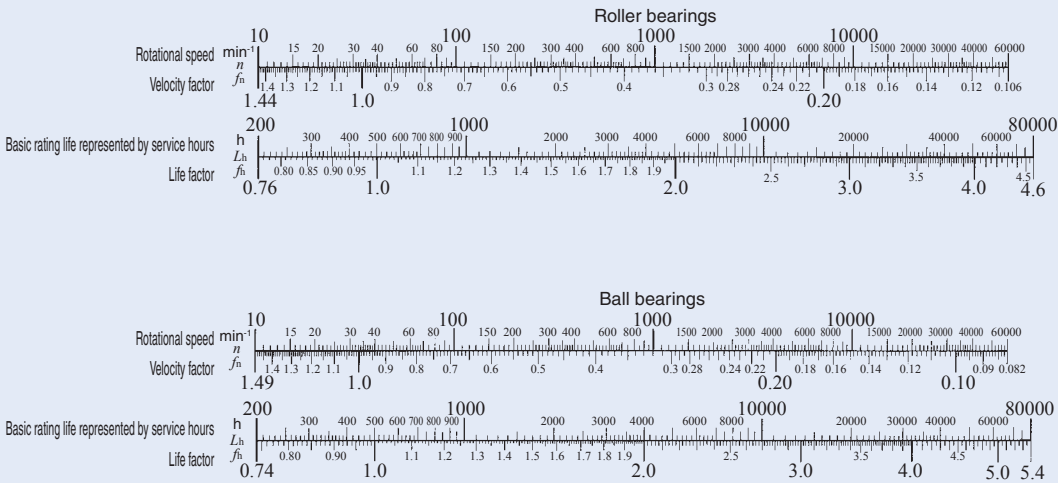


Fig. 2 Scales for rating life calculation

Bearing life factors for various machines

The required life of the bearing must be determined according to the machine in which the bearing is to be used and the operating conditions. Table 1 shows reference values of life factors for selecting a bearing for each machine.

Table 1 Life factor of bearings  $f_h$  for various machines

| Operating conditions                                                       | Machine and life factor $f_h$ |                                                                               |                                                                                                  |                                                            |                                                       |
|----------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------|
|                                                                            | ~ 3                           | 2 ~ 4                                                                         | 3 ~ 5                                                                                            | 4 ~ 7                                                      | 6 ~                                                   |
| Occasional or short term usage                                             | • Power tools                 | • Agricultural machines                                                       |                                                                                                  |                                                            |                                                       |
| Infrequent usage but requiring reliable operation                          |                               | • Construction machinery                                                      | • Conveyors<br>• Elevators                                                                       |                                                            |                                                       |
| Intermittent operation but for comparatively long periods                  | • Roll neck of rolling mills  | • Small motors<br>• Deck cranes<br>• General cargo cranes<br>• Passenger cars | • Factory motors<br>• Machine tools<br>• General gear units<br>• Printing machines               | • Crane sheaves<br>• Compressors<br>• Important gear units |                                                       |
| Operated in excess of 8 hours per day or continuously for an extended time |                               | • Escalators                                                                  | • Centrifugal separators<br>• Blowers<br>• Wood working machines<br>• Plastic extruding machines |                                                            | • Paper making machines                               |
| Continuous use for 24 hours and accidental stops not allowed               |                               |                                                                               |                                                                                                  |                                                            | • Water supply equipment<br>• Power station equipment |

Life of oscillating bearing

The life of an oscillating bearing can be obtained from equation (5).

L\_{OC} = \frac{90}{\theta} \left(\frac{C}{P}\right)^p \dots\dots\dots (5)

- where, L\_{OC}: Basic rating life of oscillating bearing, 10^6 cycles
- 2\theta : Oscillating angle, deg. (See Fig.3)
- P : Dynamic equivalent load, N

Therefore, when the oscillating frequency n\_1 min^{-1} is given, the basic rating life as represented by total oscillating hours can be obtained by substituting n\_1 for n in equation (2) on page A17. When 2\theta is small, an oil film cannot be formed easily between the contact surfaces of the raceway and the rolling elements. This may cause fretting corrosion. In this case, please consult IKO.

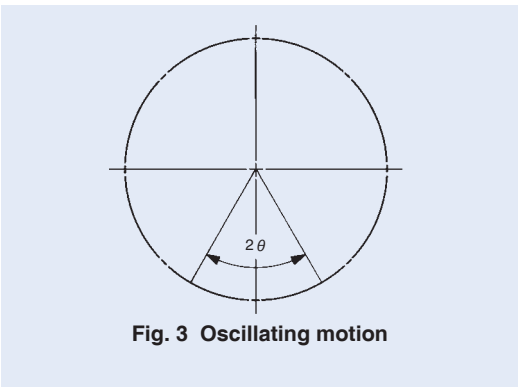


Fig. 3 Oscillating motion

Corrected rating life

When a rolling bearing is used in ordinary applications, the basic rating life can be calculated by equations (1) and (2) mentioned previously. This basic rating life applies to bearings which require a reliability of 90%, have ordinary bearing properties being made of materials of ordinary quality for rolling bearings, and are used under ordinary operating conditions. In some applications, however, it is necessary to obtain a rating life that applies to bearings which require high reliability, have special bearing properties or are used under special operating conditions. The corrected rating life for these special cases can be obtained from the following equation by using the

bearing life adjustment factors a\_1, a\_2 and a\_3, respectively.

L\_{na} = a\_1 a\_2 a\_3 L\_{10} \dots\dots\dots (6)

- where, L\_{na} : Corrected rating life, 10^6 rev.
- a\_1 : Life adjustment factor for reliability
- a\_2 : Life adjustment factor for special bearing properties
- a\_3 : Life adjustment factor for operating conditions

Life adjustment factor for reliability a\_1

The reliability of rolling bearings is defined as the proportion of bearings having a life equal to or greater than a certain specified value when a group of identical bearings are operated under identical conditions. With respect to individual bearings, it refers to the probability of the life of a bearing being equal to or greater than a certain specified value. The corrected rating life for a reliability of (100-n)% can be obtained using equation (6). Table 2 shows the values of the life adjustment factor a\_1 for various reliabilities.

Table 2 Life adjustment factor for reliability a\_1

| Reliability % | L_n    | a_1  |
|---------------|--------|------|
| 90            | L_{10} | 1    |
| 95            | L_5    | 0.62 |
| 96            | L_4    | 0.53 |
| 97            | L_3    | 0.44 |
| 98            | L_2    | 0.33 |
| 99            | L_1    | 0.21 |

Life adjustment factor for special bearing properties a\_2

The bearing life is extended or shortened according to the quality of the material, the manufacturing technology of the bearing and its internal design. For these special bearing life properties, the life is corrected by the life adjustment factor for special bearing properties a\_2. The table of dimensions for IKO Bearings shows the values of the basic dynamic load rating which are determined taking into consideration the fact that bearing life has been extended by improved quality of materials and advances in manufacturing technologies. Therefore, the bearing life is calculated using equation (6) usually assuming a\_2 = 1.

Life adjustment factor for operating conditions a\_3

This factor helps take into account the effects of operating conditions, especially lubrication on the bearing. The bearing life is limited by the phenomenon of fatigue which occurs, in general, beneath surfaces subjected to repeated stresses. Under good lubrication conditions where the rolling element and raceway surfaces are completely separated by an oil film and surface damage can be disregarded, a\_3 is set to be 1. However, when conditions of lubrication are not good, namely, when the viscosity of the lubricating oil is low or the peripheral speed of the rolling elements is especially low, and so on, a\_3 < 1 is used. On the other hand, when lubrication is especially good, a value of a\_3 > 1 can be used. When lubrication is not good and a\_3 < 1 is used, the life adjustment factor a\_2 cannot generally exceed 1.

When selecting a bearing according to the basic dynamic load rating, it is recommended that a suitable value for reliability factor a\_1 is chosen for each application. The selection should be made using the (C/P) or f\_h values determined by machine type and based upon the actual conditions of lubrication, temperature, mounting, etc., which have already been experienced and observed in the same type of machines.

Limiting conditions

These bearing life equations are applicable only when the bearing is mounted and lubricated normally without intrusion of foreign materials and not used under extreme operating conditions. Unless these conditions are satisfied, the life may be shortened. For example, it is necessary to separately consider the effects of bearing mounting errors, excessive deformation of housing and shaft, centrifugal force acting on rolling elements at high-speed revolution, excessive preload, especially large radial internal clearance of radial bearings, etc. When the dynamic equivalent load exceeds 1/2 of the basic dynamic load rating, the life equations may not be applicable.

Correction of basic dynamic load rating for temperature and hardness

Temperature factor

The operating temperature for each bearing is determined according to its material and structure. If special heat treatment is performed, bearings can be used at temperatures higher than +150°C. As the allowable contact stress gradually decreases when the bearing temperature exceeds 150°C, the basic dynamic load rating is lowered and can be obtained by the following equation:

C\_t = f\_t C \dots\dots\dots (7)

- where, C\_t : Basic dynamic load rating considering temperature rise, N
- f\_t : Temperature factor (See Fig. 4.)
- C : Basic dynamic load rating, N

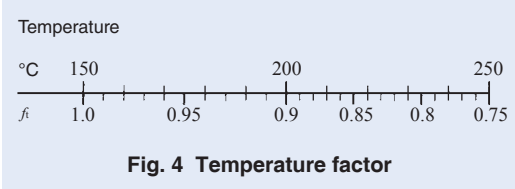


Fig. 4 Temperature factor

Further, if the bearing is used at high temperature, i.e. 120°C or above, the amount of dimensional displacement gets larger. So special heat treatment is necessary. If needed, please contact IKO.

Hardness factor

When the shaft or housing is used as the raceway surface instead of the inner or outer ring, the surface hardness of the part used as the raceway surface should be 58 ~ 64HRC. If it is less than 58HRC, the basic dynamic load rating is lowered and can be obtained by the following equation:

C\_H = f\_H C \dots\dots\dots (8)

- where, C\_H : Basic dynamic load rating considering hardness, N
- f\_H : Hardness factor (See Fig. 5.)
- C : Basic dynamic load rating N

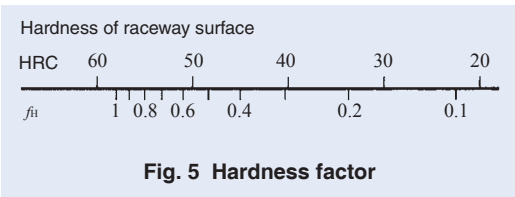


Fig. 5 Hardness factor

# Basic Static Load Rating and Static Safety Factor

## Basic static load rating

When a bearing at rest sustains a heavy load or a bearing rotating at a relatively low speed receives a heavy shock load, the contact stress may exceed a certain limiting value, producing a local permanent deformation in the raceways or the rolling elements, and subsequently causing noise or vibration or lowering the rotating performance. The basic static load rating is, therefore, determined as a guideline for the maximum allowable load for the bearing at rest, under which the permanent deformation will not exceed a certain limit value, and the lowering of the rotating performance will not occur. Its definition is given as follows.

The basic static load rating is the static load that gives the contact stress shown in Table 3 at the center of the contact area of the rolling element and the raceway receiving the maximum load. A radial load constant in direction and magnitude is used in the case of radial bearings, while an axial load constant in magnitude acting along the bearing central axis is used in the case of thrust bearings.

Table 3

| Type of bearing             | Contact stress MPa |
|-----------------------------|--------------------|
| Roller bearings             | 4 000              |
| Self-aligning ball bearings | 4 600              |
| Other ball bearings         | 4 200              |

## Static safety factor

The basic static load rating gives the theoretical allowable limit of the static equivalent load. Normally, this limit is corrected by considering the operating conditions and the requirements for the bearing. The correction factor, namely, the static safety factor  $f_s$  is defined as in the following equation and its general values are shown in Table 4.

$$f_s = \frac{C_0}{P_0} \dots\dots\dots(9)$$

where,  $C_0$  : Basic static load rating, N  
 $P_0$  : Static equivalent load, N

Table 4 Static safety factor

| Operating conditions of the bearing                                                                      | $f_s$      |
|----------------------------------------------------------------------------------------------------------|------------|
| When high rotational accuracy is required                                                                | $\geq 3$   |
| For ordinary operation conditions                                                                        | $\geq 1.5$ |
| For ordinary operation conditions not requiring very smooth rotation<br>When there is almost no rotation | $\geq 1$   |

In case of Shell Type Needle Roller Bearings of which outer ring is drawn from a thin steel plate and then carburized and quenched, it is necessary to use a static safety factor of 3 or more.

# Calculation of Bearing Loads

The loads acting on bearings include the weight of the machine parts supported by the bearings, the weight of the rotating body, loads produced when operating the machine, loads by belts or gears transmitting power, and various other loads.

These loads can be divided into radial loads perpendicular to the central axis of the bearings and axial loads parallel to the central axis, and they act independently or in combination with other loads. In addition, the magnitude of vibration or shocks on the bearings varies depending on the application of the machine. Thus, theoretically calculated loads may not always be accurate and have to be corrected by multiplying various empirical factors to obtain the actual bearing loads.

## Load distribution to bearings

Table 5 shows examples of calculations where static loads are acting in radial direction.

## Load factor

Although radial loads and axial loads can be obtained by calculation, it is not unusual for the actual bearing loads to exceed the calculated loads, due to vibration and shocks produced when operating the machine. The actual bearing load is obtained from the following equation, by multiplying the calculated load by the load factor:

$$F = f_w F_c \dots\dots\dots(10)$$

where,  $F$  : Bearing load, N  
 $f_w$  : Load factor (See Table 6.)  
 $F_c$  : Theoretically calculated load, N

Table 6 Load factor

| Operating conditions                        | Example                                                                           | $f_w$     |
|---------------------------------------------|-----------------------------------------------------------------------------------|-----------|
| Smooth operation without shocks             | Electric motors, Air conditioning equipment, Measuring instruments, Machine tools | 1 ~ 1.2   |
| Ordinary operation                          | Reduction gearboxes, Vehicles, Textile machinery, Paper making machinery          | 1.2 ~ 1.5 |
| Operation subjected to vibration and shocks | Rolling mills, Rock crushers, Construction machinery                              | 1.5 ~ 3   |

Table 5 Load distribution to bearings

| Example | Bearing load                                                                                      |
|---------|---------------------------------------------------------------------------------------------------|
|         | $F_{r1} = \frac{dK_{r1} + bK_{r2}}{f}$ $F_{r2} = \frac{cK_{r1} + aK_{r2}}{f}$                     |
|         | $F_{r1} = \frac{gK_{r1} + bK_{r2} - cK_{r3}}{f}$ $F_{r2} = \frac{aK_{r2} + dK_{r3} - eK_{r1}}{f}$ |

Bearing loads in case of belt or chain transmission

When power is transmitted by a belt or chain, the load acting on the pulley or sprocket wheel is obtained from the following equations:

T=9550000 \frac{H}{n} \dots\dots\dots(11)

K\_t = \frac{T}{R} \dots\dots\dots(12)

where, T : Torque acting on pulley or sprocket wheel, N-mm  
K\_t : Effective transmitting force of belt or chain, N  
H : Transmitting power, kW  
n : Rotational speed, min<sup>-1</sup>  
R : Effective radius of pulley or sprocket wheel, mm

For belt transmission, the load K\_r acting on the pulley shaft is obtained from the following equation, multiplying the effective transmitting force K\_t by the belt factor f\_b shown in Table 7.

K\_r = f\_b K\_t \dots\dots\dots(13)

Table 7 Belt factor

| Type of belt                      | f <sub>b</sub> |
|-----------------------------------|----------------|
| V-belts                           | 2 ~ 2.5        |
| Timing belts                      | 1.3 ~ 2        |
| Plain belts (with tension pulley) | 2.5 ~ 3        |
| Plain belts                       | 4 ~ 5          |

In the case of chain transmission, a value of 1.2 to 1.5 is taken as the chain factor corresponding to f\_b. The load acting on the sprocket wheel shaft is obtained from equation (13) in the same manner as the belt transmission.

Bearing loads in case of gear transmission

When power is transmitted by gears, the force acting on the gears varies according to the type of gear. Spur gears produce radial loads only, but helical gears, bevel gears and worm gears produce axial loads in addition to radial loads. Taking the simplest case of spur gears as an example, the bearing load is obtained from the following equations:

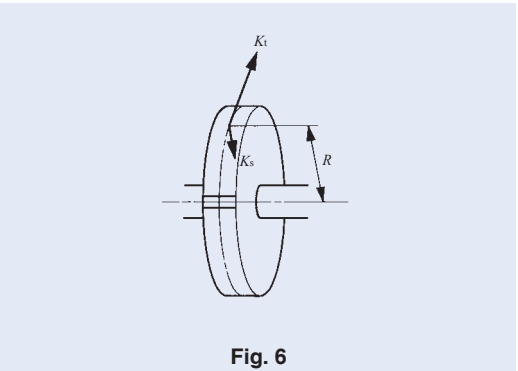
T=9550000 \frac{H}{n} \dots\dots\dots(14)

K\_t = \frac{T}{R} \dots\dots\dots(15)

K\_s = K\_t \tan \theta \dots\dots\dots(16)

K\_c = \sqrt{K\_t^2 + K\_s^2} = K\_t \sec \theta \dots\dots\dots(17)

where, T : Torque applied to gear, N-mm  
K\_t : Tangential force acting on gear, N  
K\_s : Radial force acting on gear, N  
K\_c : Resultant normal force on gear tooth surface, N  
H : Transmitting power, kW  
n : Rotational speed, min<sup>-1</sup>  
R : Pitch circle radius of drive gear, mm  
θ : Pressure angle of gear, deg.



In this case, the resultant normal force on the tooth surface acts as the radial force to the shaft and the magnitude of vibration or shocks varies depending on the accuracy and surface finish of the gear. Therefore, the radial load K\_r applied to the shaft is obtained from the following equation, multiplying the resultant normal force K\_c on gear tooth surface by the gear factor f\_z shown in Table 8.

K\_r = f\_z K\_c \dots\dots\dots(18)

Table 8 Gear factor

| Type of gear                                                          | f <sub>z</sub> |
|-----------------------------------------------------------------------|----------------|
| Precision gears<br>(Pitch error and form error: Less than 0.02mm)     | 1.05 ~ 1.1     |
| Ordinary machined gears<br>(Pitch error and form error: 0.02 ~ 0.1mm) | 1.1 ~ 1.3      |

Mean equivalent load corresponding to fluctuating load

When the load applied to the bearing fluctuates, the bearing life is calculated by using the mean equivalent load F\_m, which is a constant load that will give the bearing a life equal to that produced under the fluctuating load. The mean equivalent load is obtained from the following equation:

F\_m = \sqrt[p]{\frac{1}{N} \int\_0^N F\_n^p dN} \dots\dots\dots(19)

where, F\_m : Mean equivalent load, N  
N : Total number of revolutions, rev.  
F\_n : Fluctuating load, N  
p : Exponent, Roller bearing = 10/3  
Ball bearing = 3

Table 9 shows examples of the calculation of mean equivalent loads for various fluctuating loads.

Table 9 Mean equivalent load for the fluctuation load

| Type of fluctuating load           | Mean equivalent load F <sub>m</sub>                                                                                                                                                                                                                                                                                           |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step load                          | $F_m = \sqrt[p]{\frac{1}{N} (F_1^p N_1 + F_2^p N_2 + \dots + F_n^p N_n)}$<br>where, N <sub>1</sub> : Total number of revolutions under load F <sub>1</sub> rev.<br>N <sub>2</sub> : Total number of revolutions under load F <sub>2</sub> rev.<br>N <sub>n</sub> : Total number of revolutions under load F <sub>n</sub> rev. |
| Monotonously changing load         | $F_m = \frac{1}{3} (2F_{max} + F_{min})$<br>where, F <sub>max</sub> : Maximum value of fluctuating load, N<br>F <sub>min</sub> : Minimum value of fluctuating load, N                                                                                                                                                         |
| Sinusoidally fluctuating load      | <br>$F_m \doteq 0.65 F_{max}$                                                                                                                                                                                                                                                                                                 |
|                                    | <br>$F_m \doteq 0.75 F_{max}$                                                                                                                                                                                                                                                                                                 |
| Stationary load plus rotating load | $F_m = F_S + F_R - \frac{F_S F_R}{F_S + F_R}$<br>where, F <sub>S</sub> : Stationary load, N<br>F <sub>R</sub> : Rotating load, N                                                                                                                                                                                              |

Equivalent load

The loads applied to the bearing are divided into radial loads that are applied perpendicular to the central axis and axial loads that are applied in parallel to the central axis. These loads act independently or in combination with other loads.

Dynamic equivalent load

When both radial load and axial load are applied to the bearing simultaneously, the virtual load, acting on the center of the bearing, that will give a life equal to that under the radial load and the axial load is defined as a dynamic equivalent load.

In the case of needle roller bearings, radial bearings receive only radial loads and thrust bearings receive only axial loads. Accordingly, radial loads are directly used in the life calculation of the radial bearings, while axial loads are directly used for the thrust bearings.

[For radial bearings]

$$P_r = F_r \tag{20}$$

[For thrust bearings]

$$P_a = F_a \tag{21}$$

where,  $P_r$  : Dynamic equivalent radial load, N  
 $P_a$  : Dynamic equivalent axial load, N  
 $F_r$  : Radial load, N  
 $F_a$  : Axial load, N

Static equivalent load

When both radial load and axial load are applied to the bearing simultaneously, the virtual load, acting on the center of the bearing, that will produce a maximum contact stress on the contact surface between the rolling element and the raceway equal to that given by the radial load and the axial load is defined as a static equivalent load.

In the case of needle roller bearings, radial bearings receive only radial loads and thrust bearings receive only axial loads. Accordingly, radial loads are directly used for the radial bearings, while axial loads are directly used for the thrust bearings.

[For radial bearings]

$$P_{0r} = F_r \tag{22}$$

[For thrust bearings]

$$P_{0a} = F_a \tag{23}$$

where,  $P_{0r}$  : Static equivalent radial load, N  
 $P_{0a}$  : Static equivalent axial load, N  
 $F_r$  : Radial load, N  
 $F_a$  : Axial load, N

Boundary Dimensions and Identification Number

Boundary dimensions

Examples of symbols for quantities indicating the boundary dimensions of IKO Needle Roller Bearings are shown below. For details, see the table of dimensions for each model.

Machined Type Needle Roller Bearing

- $d$  : Nominal bearing bore diameter
- $D$  : Nominal bearing outside diameter
- $B$  : Nominal inner ring width
- $C$  : Nominal outer ring width
- $F_w$  : Nominal roller set bore diameter
- $r$  : Chamfer dimensions of inner and outer rings
- $r_{s\min}$  : Smallest permissible single chamfer dimensions of inner and outer rings

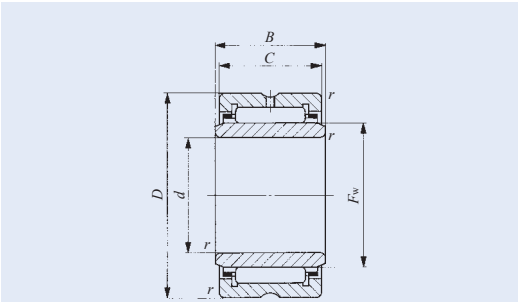


Fig. 7 Machined Type Needle Roller Bearing

Shell Type Needle Roller Bearing

- $D$  : Nominal bearing outside diameter
- $F_w$  : Nominal roller set bore diameter
- $C$  : Nominal outer ring width

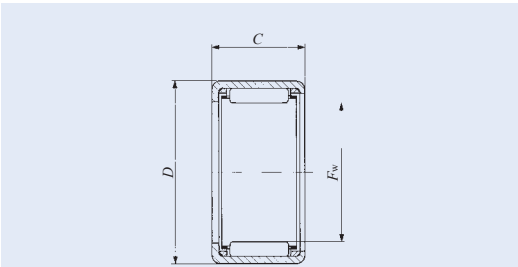


Fig. 8 Shell Type Needle Roller Bearing

Needle Roller Cage

- $E_w$  : Nominal roller set outside diameter
- $F_w$  : Nominal roller set bore diameter
- $B_c$  : Nominal cage width

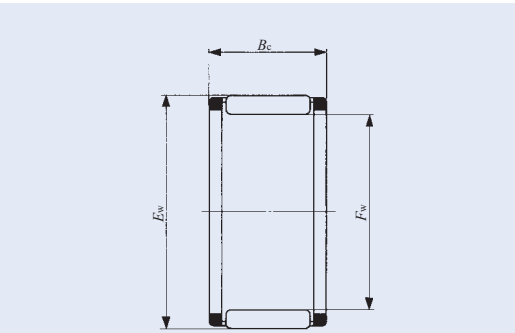


Fig. 9 Needle Roller Cage

Thrust Roller Bearing

- $D_c$  : Nominal cage outside diameter
- $d_c$  : Nominal cage bore diameter
- $D_w$  : Nominal roller diameter

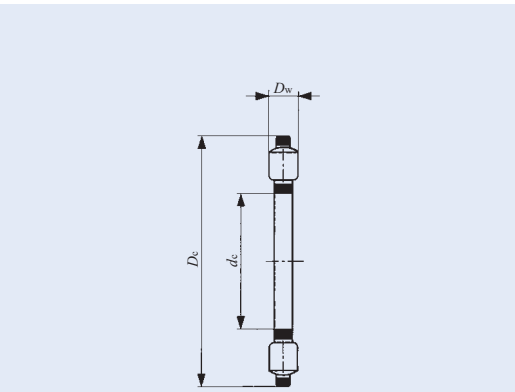


Fig. 10 Thrust Roller Bearing

|   |
|---|
| A |
| B |
| C |
| D |
| E |
| F |
| G |
| H |
| I |
| J |
| K |
| L |
| M |

Identification Number

The identification number of IKO Bearings consists of a model number and supplemental codes. The descriptions of typical codes and their arrangements are shown below. There are many codes other than those described. See the section of identification number of each bearing.

Table 10 Arrangement of identification number of bearing

|                   |                           |   |
|-------------------|---------------------------|---|
| Model number      | Model code                | ① |
|                   | Boundary dimensions       | ② |
| Supplemental code | Material symbol           | ③ |
|                   | Cage symbol               | ④ |
|                   | Shield symbol             | ⑤ |
|                   | Seal symbol,              | ⑥ |
|                   | Bearing ring shape symbol | ⑦ |
|                   | Clearance symbol          | ⑧ |
|                   | Classification symbol     | ⑨ |

①Model code

The model code represents the bearing series. The features of each bearing series are shown on pages A5 to A15.

②Boundary dimensions

One of the following four kinds of presentation methods is used for showing boundary dimensions in the identification number, which vary depending on the bearing series. Table 11 shows the presentation methods of boundary dimensions for each model code.

- (a)Dimension series + Bore diameter number
- (b)Bore diameter or roller set bore diameter + Outside diameter or roller set outside diameter + Width
- (c)Bore diameter or roller set bore diameter + Width
- (d)Basic diameter

③Material symbol

|        |                                                        |
|--------|--------------------------------------------------------|
| Symbol | Type of material                                       |
| F      | Stainless steel for bearing rings and rolling elements |

④Cage symbol

|        |                            |
|--------|----------------------------|
| Symbol | Descriptions               |
| N      | Made of synthetic resin    |
| V      | No cage or full complement |

⑤Seal or shield symbol

|                  |                            |
|------------------|----------------------------|
| Symbol           | Descriptions               |
| Z                | With dust cover            |
| ZZ               | With shields on both sides |
| U                | With a seal on one side    |
| UU               | With seals on both sides   |
| S <sup>(1)</sup> | With ThrustDisk Seals™     |
| 2RS              | With seals on both sides   |

Note<sup>(1)</sup> ThrustDisk Seals™ are embedded on both sides.

⑥Bearing ring shape symbol

|                   |                                               |
|-------------------|-----------------------------------------------|
| Symbol            | Descriptions                                  |
| NR                | With stop ring on outer surface of outer ring |
| OH <sup>(1)</sup> | With oil hole in bearing ring                 |
| J                 | No oil hole                                   |

Note<sup>(1)</sup> This differs depending on the type of bearing. See the section of each bearing.

⑦Clearance symbol

|        |                                                                     |
|--------|---------------------------------------------------------------------|
| Symbol | Descriptions                                                        |
| C2     | C2 clearance                                                        |
| (None) | CN clearance                                                        |
| C3     | C3 clearance                                                        |
| C4     | C4 clearance                                                        |
| C5     | C5 clearance                                                        |
| T1     | Special radial clearance<br>(Applicable to Crossed Roller Bearings) |
| C1     |                                                                     |
| C2     |                                                                     |

⑧Classification symbol

|        |              |
|--------|--------------|
| Symbol | Descriptions |
| (None) | JIS Class 0  |
| P6     | JIS Class 6  |
| P5     | JIS Class 5  |
| P4     | JIS Class 4  |

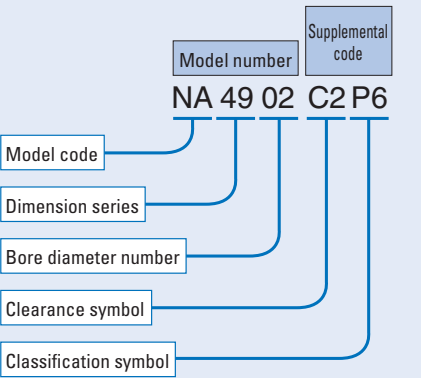
Table 11 Indication of boundary dimensions

| Bearing type                                   | Model number                               |                                                                                    |
|------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------|
|                                                | Model code                                 | Indication of boundary dimensions                                                  |
| Shell Type Needle Roller Bearings              | TA, TLA, YT, YTL                           | Roller set bore diameter + Outer ring width                                        |
|                                                | BA, BHA, YB, YBH                           | Roller set bore diameter + Outer ring width <sup>(1)</sup>                         |
| Needle Roller Cages for General Usage          | KT, KTW                                    | Roller set bore diameter + Roller set outside diameter + Cage width                |
| Needle Roller Cages for Engine Connecting Rods | KT···EG, KTV···EG                          | Roller set bore diameter + Roller set outside diameter + Cage width                |
| Machined Type Needle Roller Bearings           | NA, RNA                                    | Dimension series + Bore diameter number                                            |
|                                                | TR, TAF, GTR                               | Roller set bore diameter + Bearing outside diameter + Bearing width                |
|                                                | TRI, TAFI, GTRI                            | Bearing bore diameter + Bearing outside diameter + Outer ring width                |
|                                                | BR                                         | Roller set bore diameter + Bearing outside diameter + Bearing width <sup>(1)</sup> |
|                                                | BRI                                        | Bearing bore diameter + Bearing outside diameter + Outer ring width <sup>(1)</sup> |
| Needle Roller Bearings with Separable Cage     | RNAF, RNAFW                                | Roller set bore diameter + Bearing outside diameter + Bearing width                |
|                                                | NAF, NAFW                                  | Bearing bore diameter + Bearing outside diameter + Bearing width                   |
| Roller Bearings                                | NAU, NAG, NAS                              | Dimension series + Bore diameter number                                            |
|                                                | TRU                                        | Bearing bore diameter + Bearing outside diameter + Bearing width                   |
| Thrust Bearings                                | NTB, AS, WS, GS                            | Bearing bore diameter + Bearing outside diameter                                   |
|                                                | AZ                                         | Bearing bore diameter + Bearing outside diameter + Bearing height                  |
|                                                | AZK                                        | Bearing bore diameter + Bearing outside diameter + Roller diameter                 |
| Combined Type Needle Roller Bearings           | NAX, NBX                                   | Roller set bore diameter + Assembled bearing width                                 |
|                                                | NAXI, NBXI                                 | Inner ring bore diameter + Assembled bearing width                                 |
|                                                | NATA, NATB                                 | Dimensional series + Bore diameter number                                          |
| Cam Followers                                  | CF···B, CFS, NUCF···B                      | Stud diameter                                                                      |
|                                                | CFKR                                       | Bearing outside diameter                                                           |
|                                                | CR···B, CR, CRH···B                        | Bearing outside diameter <sup>(1)</sup>                                            |
| Roller Followers                               | NAST, NART, NURT                           | Bearing bore diameter                                                              |
|                                                | CRY                                        | Bearing outside diameter <sup>(1)</sup>                                            |
| Crossed Roller Bearings                        | CRBHV, CRBFV, CRBC, CRB, CRBT, CRBTF, CRBS | Bearing bore diameter + Bearing width                                              |
| Spherical Bushings                             | SB···A, GE                                 | Inner ring bore diameter                                                           |
|                                                | SBB                                        | Inner ring bore diameter <sup>(1)</sup>                                            |
| PILLOBALLs                                     | PB,PHS,POS,PHSB,POSB,PHSA                  | Inner ring bore diameter                                                           |
| L-Balls                                        | LHSA, LHS                                  | Screw size                                                                         |
| Seals for Needle Roller Bearings               | OS, DS                                     | Shaft diameter + Seal outside diameter + Seal width                                |
| Cir-clips for Needle Roller Bearings           | WR                                         | Shaft diameter                                                                     |
|                                                | AR                                         | Bore diameter                                                                      |

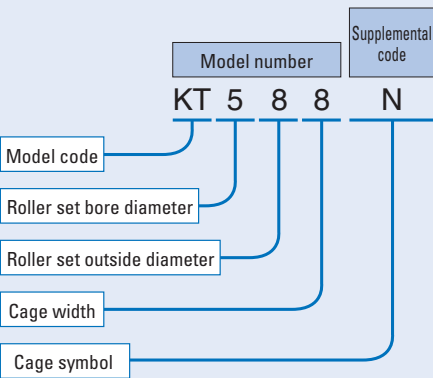
Note<sup>(1)</sup> The nominal dimensions of inch series bearings are indicated in units of 1/16 inch.

Example of identification number

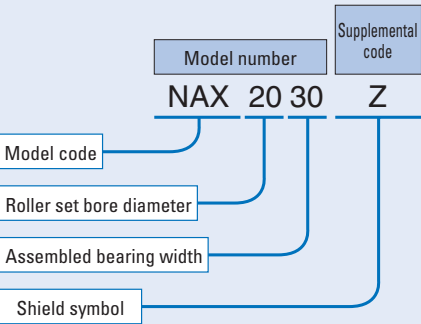
(a) Example of "Dimension series + Bore diameter number"



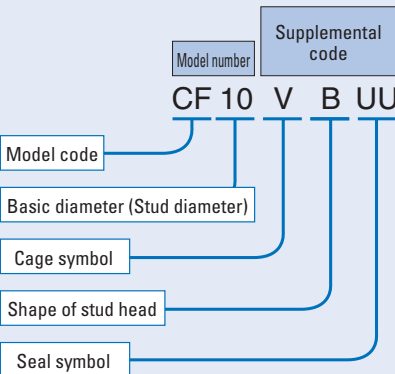
(b) Example of "Bore diameter or roller set bore diameter + Outside diameter or roller set outside diameter + width"



(c) Example of "Bore diameter or roller set bore diameter + width"



(d) Example of "Basic diameter"



Accuracy

The accuracy of IKO Needle Roller Bearings conforms to JIS B 1514-1~-3 (Rolling bearings - Tolerances of bearings), and the dimensional accuracy and rotational accuracy are specified. The specified items are shown in Fig. 11.

Needle Roller Bearings are classified into 4 classes of accuracy. These classes are represented by the numbers 0, 6, 5 and 4, written in order of increasing accuracy.

Table 12 shows the accuracy for the inner rings of radial bearings, Table 13 shows the accuracy for the outer rings of radial bearings, Table 14 shows the tolerances for the smallest single roller set bore diameter of radial bearings, and Table 15 shows the permissible limit values of chamfer dimensions of radial bearings. For thrust bearings, see the section on accuracy of Thrust Bearings. Note that the series of Shell Type Needle Roller Bearings, Roller Bearings, Cam Followers, Roller Followers, Combined Type Needle Roller Bearings, and Crossed Roller Bearings have special accuracy. For further details, see the section on accuracy of each bearing series.

Remarks

The meanings of the new symbols for quantities used for accuracy of radial bearings are as follows:

- ①  $\Delta$  represents the deviation of a dimension from the specified value.
- ②  $V$  represents the variation of a dimension.
- ③ Suffixes  $s$ ,  $m$ , and  $p$  represent a single (or actual) measurement, a mean measurement, and a measurement in a single radial plane, respectively.

[Example]  $V_{dsp}$  means the difference between the largest and the smallest of the bore diameters in a single radial plane (circularity).  $V_{dmp}$  means the difference between the largest and the smallest of the single plane mean bore diameters (cylindricity).

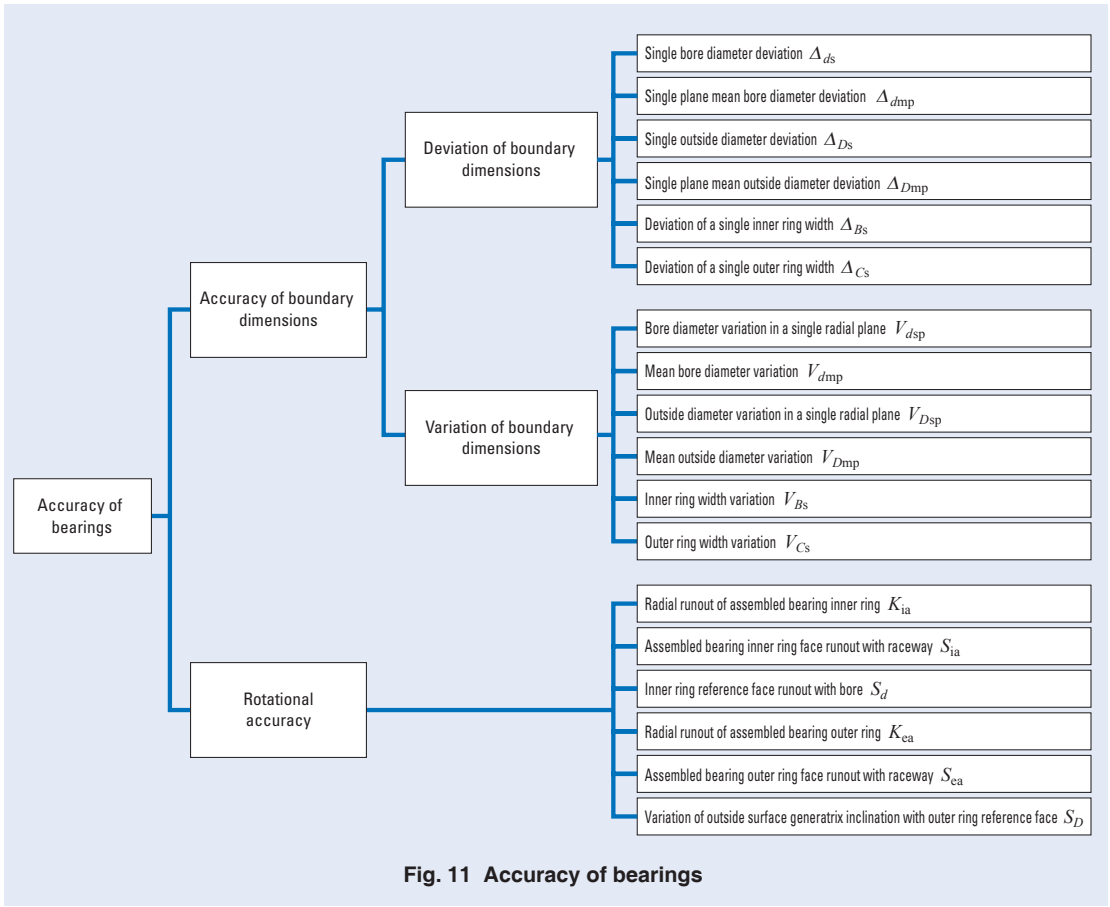


Fig. 11 Accuracy of bearings



Table 14 Tolerances for smallest single roller set bore diameter  $F_{ws\ min}^{(1)}$  unit:  $\mu m$

| $F_w$<br>Nominal roller set bore diameter<br>mm |       | $\Delta F_{ws\ min}$<br>Deviation of smallest single roller set bore diameter |      |
|-------------------------------------------------|-------|-------------------------------------------------------------------------------|------|
| Over                                            | Incl. | High                                                                          | Low  |
| 3                                               | 6     | + 18                                                                          | + 10 |
| 6                                               | 10    | + 22                                                                          | + 13 |
| 10                                              | 18    | + 27                                                                          | + 16 |
| 18                                              | 30    | + 33                                                                          | + 20 |
| 30                                              | 50    | + 41                                                                          | + 25 |
| 50                                              | 80    | + 49                                                                          | + 30 |
| 80                                              | 120   | + 58                                                                          | + 36 |
| 120                                             | 180   | + 68                                                                          | + 43 |
| 180                                             | 250   | + 79                                                                          | + 50 |
| 250                                             | 315   | + 88                                                                          | + 56 |
| 315                                             | 400   | + 98                                                                          | + 62 |
| 400                                             | 500   | + 108                                                                         | + 68 |

Note(1) This is the diameter of the cylinder used instead of the inner ring, where the radial clearance becomes 0 at least in one radial direction.

Table 15 Permissible limit values for chamfer dimensions of radial bearings unit: mm

| $r_{s\ min}$<br>Smallest<br>permissible single<br>chamfer dimension | $d$<br>Nominal bore diameter |       | $r_{s\ max}$<br>Largest permissible single chamfer dimension |                 |
|---------------------------------------------------------------------|------------------------------|-------|--------------------------------------------------------------|-----------------|
|                                                                     | Over                         | Incl. | Radial direction                                             | Axial direction |
| 0.1                                                                 | —                            | —     | 0.55 (2)                                                     | 0.55 (2)        |
| 0.15                                                                | —                            | —     | 0.6 (2)                                                      | 0.6             |
| 0.2                                                                 | —                            | —     | 0.7 (2)                                                      | 0.8             |
| 0.3                                                                 | —                            | 40    | 0.8 (2)                                                      | 1               |
|                                                                     | 40                           | —     | 0.8                                                          | 1               |
| 0.4 (1)                                                             | —                            | —     | 0.8                                                          | 1.2             |
| 0.6                                                                 | —                            | 40    | 1.1 (2)                                                      | 2               |
|                                                                     | 40                           | —     | 1.3                                                          | 2               |
| 1                                                                   | —                            | 50    | 1.5                                                          | 3               |
|                                                                     | 50                           | —     | 1.9                                                          | 3               |
| 1.1                                                                 | —                            | 120   | 2                                                            | 3.5             |
|                                                                     | 120                          | —     | 2.5                                                          | 4               |
| 1.5                                                                 | —                            | 120   | 2.3                                                          | 4               |
|                                                                     | 120                          | —     | 3                                                            | 5               |
| 2                                                                   | —                            | 80    | 3                                                            | 4.5             |
|                                                                     | 80                           | 220   | 3.5                                                          | 5               |
|                                                                     | 220                          | —     | 3.8                                                          | 6               |
| 2.1                                                                 | —                            | 280   | 4                                                            | 6.5             |
|                                                                     | 280                          | —     | 4.5                                                          | 7               |
| 2.5 (1)                                                             | —                            | 100   | 3.8                                                          | 6               |
|                                                                     | 100                          | 280   | 4.5                                                          | 6               |
|                                                                     | 280                          | —     | 5                                                            | 7               |
| 3                                                                   | —                            | 280   | 5                                                            | 8               |
|                                                                     | 280                          | —     | 5.5                                                          | 8               |
| 4                                                                   | —                            | —     | 6.5                                                          | 9               |
| 5                                                                   | —                            | —     | 8                                                            | 10              |
| 6                                                                   | —                            | —     | 10                                                           | 13              |

Note(1) Not specified in JIS.  
(2) The numeric value differs from JIS.  
Remark Although the exact shape of the chamfer is not specified, its profile in the axial plane must not extend beyond the imaginary circular arc of radius  $r_{s\ min}$  which is tangential to the inner ring side surface and bearing bore surface or to the outer ring side surface and bearing outside surface. (See Fig. 12.)

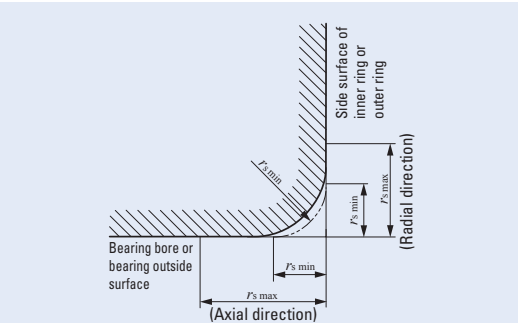


Fig. 12 Permissible values for chamfer dimensions

Methods of Measurement

Measurement of IKO Needle Roller Bearings is based on JIS B 1515-1, -2 (Rolling bearings-Tolerances). Tables 16 and 17 show some examples of the methods.  
Special methods are used to measure Shell Type Needle Roller Bearings. Therefore, refer to the section on accuracy for these bearings on page B3.

Table 16 Measurement methods of accuracy of boundary dimensions

| Measurement methods     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Accuracy and definitions                                                                                                                                                                                                                                 |                                                                                                                                                                              |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Single bore diameter    | Zero the gauge indicator to the appropriate size using gauge blocks or a master ring.<br>In several angular directions and in a single radial plane, measure and record the largest and the smallest single bore diameters, $d_{sp\ max}$ and $d_{sp\ min}$ , within the measuring zone (excluding the zone 1.2 times the respective maximum allowable chamfer dimensions of the inner ring face). Repeat angular measurements and recordings in several radial planes to determine the largest and the smallest single bore diameter, $d_{s\ max}$ and $d_{s\ min}$ . | $d_{mp}$<br>Mean bore diameter in a single plane<br>$d_{mp} = \frac{d_{sp\ max} + d_{sp\ min}}{2}$<br>$d_{sp}$ : Single bore diameter in a single plane                                                                                                  | Calculated mean value of the maximum and minimum values of the single bore diameter within a radial plane.                                                                   |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\Delta d_{mp}$<br>Deviation of mean bore diameter in a single plane<br>$\Delta d_{mp} = d_{mp} - d$<br>$d$ : Nominal bearing bore diameter                                                                                                              | Deviation of mean bore diameter in a single plane and nominal bore diameter.                                                                                                 |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V_{dsp}$<br>Variation of bore diameter in a single plane<br>$V_{dsp} = d_{sp\ max} - d_{sp\ min}$                                                                                                                                                       | Deviation of the maximum and minimum values of the single bore diameter within a radial plane.                                                                               |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V_{dmp}$<br>Variation of mean bore diameter<br>$V_{dmp} = d_{mp\ max} - d_{mp\ min}$                                                                                                                                                                    | Deviation of the maximum and minimum values of mean bore diameter in a single plane, for individual raceway rings with essentially cylindrical bore diameter surfaces.       |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\Delta d_s$<br>Deviation of a single bore diameter<br>$\Delta d_s = d_s - d$<br>$d_s$ : Single bore diameter (distance between two parallel straight lines touching the intersection of the single bore diameter surface and the radial plane)          | Deviation of single bore diameter and nominal bore diameter.                                                                                                                 |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                          |                                                                                                                                                                              |
| Single outside diameter | Zero the gauge indicator to the appropriate size using gauge blocks or a master. In several angular directions and in a single radial plane, measure and record the largest and the smallest single outside diameters, $D_{sp\ max}$ and $D_{sp\ min}$ , within the measuring zone (excluding the zone 1.2 times the respective maximum allowable chamfer dimensions of the outer ring face). Repeat and record measurements in several radial planes to determine the largest and the smallest single outside diameter, $D_{s\ max}$ and $D_{s\ min}$ .               | $D_{mp}$<br>Mean outside diameter in a single plane<br>$D_{mp} = \frac{D_{sp\ max} + D_{sp\ min}}{2}$<br>$D_{sp}$ : Single outside diameter in a single plane                                                                                            | Calculated mean value of the maximum and minimum values of the single outside diameter within a radial plane.                                                                |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\Delta D_{mp}$<br>Deviation of mean outside diameter in a single plane<br>$\Delta D_{mp} = D_{mp} - D$<br>$D$ : Nominal bearing outside diameter                                                                                                        | Deviation of mean outside diameter in a single plane and nominal outside diameter.                                                                                           |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V_{Dsp}$<br>Variation of outside diameter in a single plane<br>$V_{Dsp} = D_{sp\ max} - D_{sp\ min}$                                                                                                                                                    | Deviation of the maximum and minimum values of the single outside diameter within a radial plane.                                                                            |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V_{Dmp}$<br>Variation of mean outside diameter<br>$V_{Dmp} = D_{mp\ max} - D_{mp\ min}$                                                                                                                                                                 | Deviation of the maximum and minimum values of mean outside diameter in a single plane, for individual raceway rings with essentially cylindrical outside diameter surfaces. |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\Delta D_s$<br>Deviation of a single outside diameter<br>$\Delta D_s = D_s - D$<br>$D_s$ : Single outside diameter (distance between two parallel straight lines touching the intersection of the single outside diameter surface and the radial plane) | Deviation of single outside diameter and nominal outside diameter.                                                                                                           |

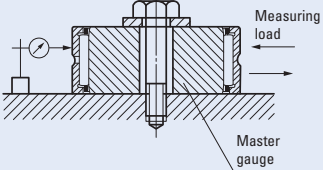
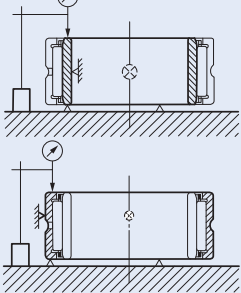
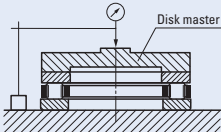
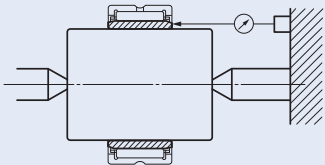
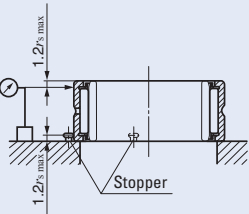
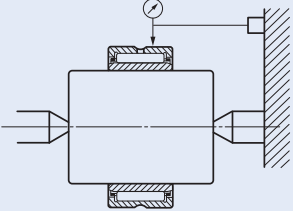
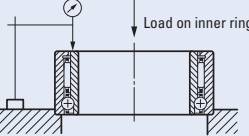
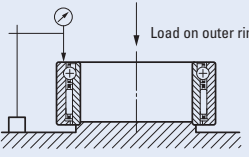
| Measurement methods                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Accuracy and definitions                                            |                                                                                                                                                                                                                                                                               |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Single bore diameter of rolling element complement | Fasten the master gauge to a surface plate. Position the bearing on the master gauge and apply the indicator in the radial direction near the middle of the width on the ring outside surface. Measure the amount of movement of the outer ring in the radial direction by applying sufficient load on the outer ring in the same radial direction as that of the indicator and in the opposite radial direction. Record indicator readings at the extreme radial positions of the outer ring. Rotate the bearing and repeat the measurement in several different angular positions to determine the largest and the smallest readings, $F_{ws\ max}$ and $F_{ws\ min}$ . | $F_{ws}$<br>Single bore diameter of roller complement               | In radial bearings without inner rings, the distance between two parallel straight lines touching the intersection of the inscribed circle of roller complement and the radial plane.                                                                                         |
|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $F_{ws\ min}$<br>Smallest single bore diameter of roller complement | In radial bearings without inner rings, the minimum value of the single bore diameter of roller complement.<br><br>Remark     Diameter of a cylinder where the smallest single bore diameter of roller complement has zero radial clearance in at least one radial direction. |
| Inner ring width                                   | Zero the gauge indicator to the appropriate height from the reference surface using gauge blocks or a master. Support one face of the inner or outer ring on three equally spaced fixed supports of equal height and provide two suitable radial supports on the bore or outside surface set at 90° to each other to centre the inner or outer ring. Position the indicator against the other face of the ring opposite one fixed support. Rotate the inner or outer ring one revolution and measure and record the largest and the smallest single inner (outer) ring width, $B_{s\ max}$ and $B_{s\ min}$ , ( $C_{s\ max}$ and $C_{s\ min}$ ).                          | $\Delta_{Bs}$<br>Deviation of a single inner ring width             | Deviation of single inner ring width and nominal inner ring width.<br><br>$\Delta_{Bs} = B_s - B$                                                                                                                                                                             |
|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $V_{Bs}$<br>Variation of inner ring width                           | Deviation of the maximum and minimum values of the single inner ring width for individual inner rings.<br><br>$V_{Bs} = B_{s\ max} - B_{s\ min}$                                                                                                                              |
| Outer ring width                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\Delta_{Cs}$<br>Deviation of a single outer ring width             | Deviation of single outer ring width and nominal outer ring width.<br><br>$\Delta_{Cs} = C_s - C$                                                                                                                                                                             |
|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $V_{Cs}$<br>Variation of outer ring width                           | Deviation of the maximum and minimum values of the single outer ring width for individual outer rings.<br><br>$V_{Cs} = C_{s\ max} - C_{s\ min}$                                                                                                                              |
| Bearing height                                     | Support the bearing on a surface plate. Zero the gauge indicator to an appropriate height from the surface plate using gauge blocks or a master. Place a plate of known thickness on the bearing assembly, apply a dynamically stable coaxial load, and position the indicator over the centre of the plate. Rotate the housing washer several times, to be sure to reach the smallest height, and take indicator readings.<br><br>                                                                                                                                                    | $\Delta_{Ts}$<br>Deviation of the actual bearing height             | Deviation of actual bearing height and nominal bearing height of the thrust bearing.<br><br>$\Delta_{Ts} = T_s - T$<br><br>$T_s$ : Actual bearing height<br>$T$ : Nominal bearing height                                                                                      |

Table 17 Measurement methods for rotational accuracy

| Accuracy                                                                         | Measurement methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| $S_d$<br>Perpendicularity of inner ring face with respect to the bore            | Use a precision arbor having a taper of approximately 1 : 5 000 on diameter. Mount the bearing assembly on the tapered arbor and place the arbor between two centres so that it can be accurately rotated. Position the indicator against the reference face of the inner ring at a radial distance from the arbor axis of half the mean diameter of the face. Take indicator readings while rotating the inner ring one revolution.                                                                                                                                       |    |
| $S_D$<br>Perpendicularity of outer ring outside surface with respect to the face | Support the reference face of the outer ring on a surface plate leaving the inner ring, if an assembled bearing, free. Locate the outer ring cylindrical outside surface against two supports set at 90° to each other to centre the outer ring. Position the indicator directly above one support. The indicator and the two supports are axially located at the extremes of the measurement zone (positions 1.2 times the respective maximum allowable chamfer dimensions of the outer ring face). Take indicator readings while rotating the outer ring one revolution. |    |
| $K_{ia}$<br>Radial runout of inner ring of assembled bearing                     | Use a precision arbor having a taper of approximately 1 : 5 000 on diameter. Mount the bearing assembly on the tapered arbor and place the arbor between two centres so that it can be accurately rotated. Position the indicator against the outside surface of the outer ring as close as possible to the middle of the outer ring raceway. Hold the outer ring to prevent rotation but ensure its weight is supported by the rolling elements. Take indicator readings while rotating the arbor one revolution.                                                         |   |
| $K_{ea}$<br>Radial runout of outer ring of assembled bearing                     | Use a precision arbor having a taper of approximately 1 : 5 000 on diameter. Mount the bearing assembly on the tapered arbor and place the arbor between two centres so that it can be accurately rotated. Position the indicator against the outside surface of the outer ring as close as possible to the middle of the outer ring raceway. Hold the inner ring stationary. Take indicator readings while rotating the outer ring one revolution.                                                                                                                        |                                                                                       |
| $S_{ia}$<br>Axial runout of inner ring of assembled bearing                      | Support the reference face of the outer ring on a surface plate with a pilot for centering the outside diameter of the ring. Apply a dynamically stable coaxial load to the reference face of the inner ring in order to ensure contact between rolling elements and raceways. Position the indicator against the reference face of the inner ring and take indicator readings while rotating the inner ring one revolution.                                                                                                                                               |  |
| $S_{ea}$<br>Axial runout of outer ring of assembled bearing                      | Support the reference face of the inner ring on a surface plate with a pilot for centering in the bore of the inner ring. Apply a dynamically stable coaxial load to the reference face of the outer ring in order to ensure contact between rolling elements and raceways. Position the indicator against the reference face of the outer ring and take indicator readings while rotating the outer ring one revolution.                                                                                                                                                  |  |

The clearances between the bearing rings and rolling elements are known as bearing clearances. When either the inner or outer ring is fixed and a specified measuring load is applied to the free bearing ring inward and outward alternately in the radial direction, the displacement of the free bearing is referred to as the radial internal clearance. The amount of measuring load in this case is extremely small, and its values are specified in JIS B 1515-2 (Rolling bearings-Tolerances-Part2:Measuring and gauging principles and methods).

❶ Table 18 shows the radial internal clearances of Needle Roller Bearings with Inner Ring based on JIS B 1520 (Rolling bearings-Radial internal clearance). The radial internal clearances are classified into C2, CN, C3, C4, and C5, with clearances increasing in this order. CN is used under normal operating conditions. When a smaller range in radial internal clearance than the values shown in Table 18 is required, please consult IKO.

❷ In the case of Shell Type Needle Roller Bearings, the correct dimensional accuracy is achieved only after the bearings are press-fitted into the specified housing bore. Therefore, the clearances shown in Table 18 are not applicable. See page B5.

❸ For the radial internal clearances of Cam Followers, Roller Followers and Crossed Roller Bearings, see the relevant section for each bearing.

Table 18 Radial internal clearances of Needle Roller Bearings

unit: μm

| d<br>Nominal bore diameter<br>mm |       | Classification of clearances |      |      |      |      |      |      |      |      |      |
|----------------------------------|-------|------------------------------|------|------|------|------|------|------|------|------|------|
|                                  |       | C2                           |      | CN   |      | C3   |      | C4   |      | C5   |      |
| Over                             | Incl. | Min.                         | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| —                                | 10    | 0                            | 25   | 20   | 45   | 35   | 60   | 50   | 75   | —    | —    |
| 10                               | 24    | 0                            | 25   | 20   | 45   | 35   | 60   | 50   | 75   | 65   | 90   |
| 24                               | 30    | 0                            | 25   | 20   | 45   | 35   | 60   | 50   | 75   | 70   | 95   |
| 30                               | 40    | 5                            | 30   | 25   | 50   | 45   | 70   | 60   | 85   | 80   | 105  |
| 40                               | 50    | 5                            | 35   | 30   | 60   | 50   | 80   | 70   | 100  | 95   | 125  |
| 50                               | 65    | 10                           | 40   | 40   | 70   | 60   | 90   | 80   | 110  | 110  | 140  |
| 65                               | 80    | 10                           | 45   | 40   | 75   | 65   | 100  | 90   | 125  | 130  | 165  |
| 80                               | 100   | 15                           | 50   | 50   | 85   | 75   | 110  | 105  | 140  | 155  | 190  |
| 100                              | 120   | 15                           | 55   | 50   | 90   | 85   | 125  | 125  | 165  | 180  | 220  |
| 120                              | 140   | 15                           | 60   | 60   | 105  | 100  | 145  | 145  | 190  | 200  | 245  |
| 140                              | 160   | 20                           | 70   | 70   | 120  | 115  | 165  | 165  | 215  | 225  | 275  |
| 160                              | 180   | 25                           | 75   | 75   | 125  | 120  | 170  | 170  | 220  | 250  | 300  |
| 180                              | 200   | 35                           | 90   | 90   | 145  | 140  | 195  | 195  | 250  | 275  | 330  |
| 200                              | 225   | 45                           | 105  | 105  | 165  | 160  | 220  | 220  | 280  | 305  | 365  |
| 225                              | 250   | 45                           | 110  | 110  | 175  | 170  | 235  | 235  | 300  | 330  | 395  |
| 250                              | 280   | 55                           | 125  | 125  | 195  | 190  | 260  | 260  | 330  | 370  | 440  |
| 280                              | 315   | 55                           | 130  | 130  | 205  | 200  | 275  | 275  | 350  | 410  | 485  |
| 315                              | 355   | 65                           | 145  | 145  | 225  | 225  | 305  | 305  | 385  | 455  | 535  |
| 355                              | 400   | 100                          | 190  | 190  | 280  | 280  | 370  | 370  | 460  | 510  | 600  |
| 400                              | 450   | 110                          | 210  | 210  | 310  | 310  | 410  | 410  | 510  | 565  | 665  |
| 450                              | 500   | 110                          | 220  | 220  | 330  | 330  | 440  | 440  | 550  | 625  | 735  |

Remark For bearings with CN clearance, no symbol is attached to the identification number. In the case of bearings with C2, C3, C4 and C5 clearances, these symbols are attached to the identification number.  
Example NA 4905 C2

Selection of clearance

Radial clearances of needle roller bearings change according to bearing fit, temperature difference between bearing rings and rolling elements, loads, etc., and these factors greatly influence bearing life, accuracy, noise, generation of heat, etc. If radial clearances are too large, noise and vibration will increase, and if they are too small, abnormally great forces are exerted on the contact areas between raceways and rolling elements, resulting in abnormally high heat generation and a decrease in bearing life. Therefore, in the ideal case, the clearance provided before mounting should be such that it will become zero or slightly larger when the bearing has reached steady-state operation and the temperature has become constant (saturation temperature). However, it is difficult to achieve this ideal state for all bearings. Under general operating conditions, bearings with CN clearance are most widely used, and are manufactured to provide satisfactory performance when fitted according to Tables 21 and 22. When radial internal clearances other than CN are used, refer to Table 19.

Table 19 Examples of selecting radial internal clearances other than CN clearance

| Operating conditions                                                                                                                     | Selection of clearance  |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| When heavy loads and shock loads are applied, and amount of interference is great.                                                       | C3 or larger clearance  |
| When directionally indeterminate loads are applied, and a tight fit is required for both inner and outer rings.                          |                         |
| When temperature of inner ring is much higher than that of outer ring.                                                                   |                         |
| When shaft deflection and/or mounting error to the housing are great.                                                                    |                         |
| When less noise and vibration are required.<br>When a loose fit is required for both inner and outer rings.<br>When preload is required. | C2 or smaller clearance |

Reduction of radial clearances by fit

When the inner or outer rings are interference fitted onto shafts and into housings, respectively, they expand or shrink due to elastic deformation. As the result, the radial clearances are reduced. These reduced radial clearances are called residual (internal) clearances. The amount of reduction is obtained by the following equation, and it is generally 70 to 90% of the interference amount.

ΔC = ΔF + ΔE .....(24)

where, ΔC : Amount of reduction of the radial clearance, mm  
ΔF : Amount of expansion of the outside diameter of inner ring, mm  
ΔE : Amount of shrinkage of the bore diameter of outer ring, mm

❶ Amount of expansion of the outside diameter of inner ring

· With solid shaft

ΔF = Δde · d / F .....(25)

· With hollow shaft

ΔF = Δde · d / F · 1 - (di/d)² / 1 - (d/F)² (di/d)² .....(26)

where, Δde : Effective interference of inner ring, mm  
d : Bore diameter of inner ring, mm  
F : Outside diameter of inner ring, mm  
di : Bore diameter of hollow shaft, mm

❷ Amount of shrinkage of the bore diameter of outer ring

· With steel housing (D0 = ∞)

ΔE = ΔDe · E / D .....(27)

· With steel housing (D0 ≠ ∞)

ΔE = ΔDe · E / D · 1 - (D/D0)² / 1 - (E/D)² (D/D0)² .....(28)

where, ΔDe : Effective interference of outer ring, mm  
D : Outside diameter of outer ring, mm  
E : Bore diameter of outer ring, mm  
D0 : Outside diameter of housing, mm

Reduction of radial clearances due to temperature differences between inner and outer rings

Frictional heat generated by rotation is dissipated through the shafts and housings as well as through oil and air. Under general operating conditions, heat dissipation is larger on the housing side compared with that on the shaft side, and the temperature of the outer ring is usually lower than that of the inner ring. During operation, the temperature of the rolling elements is the highest, followed by that of the inner ring and that of the outer ring. The amount of thermal expansion, therefore, varies, and the radial clearances are reduced. This reduced radial clearance is called the effective (internal) clearance, and the amount of reduction is obtained by the following equation:

$$\Delta \delta = \alpha \Delta_t E \cdots \cdots (29)$$

where,  $\Delta \delta$  : Reduction of radial clearance, mm  
 $\alpha$  : Coefficient of linear expansion for bearing steel  
 $\quad \quad \quad \doteq 12.5 \times 10^{-6} \text{ 1/}^\circ\text{C}$   
 $\Delta_t$  : Temperature difference between the outer ring and the inner ring plus rolling elements considered as one unit,  $^\circ\text{C}$   
 $E$  : Bore diameter of outer ring, mm

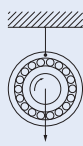
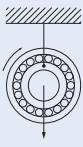
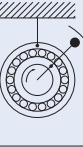
The temperature difference  $\Delta_t$  is considered to be 5 ~ 10 $^\circ\text{C}$  under normal operating conditions and 15 ~ 20 $^\circ\text{C}$  at high rotational speeds. Therefore, when the temperature difference is great, a correspondingly larger radial internal clearance must be selected.

Fit

Purpose of fit

To achieve the best performance of needle roller bearings, it is important that the bearing rings are correctly fitted onto the shaft and into the housing. The purpose of fit is to provide the appropriate amount of interference required between the inner ring and the shaft or between the outer ring and the housing, to prevent harmful mutual slippage. If the interference is insufficient, it will cause a harmful relative displacement, known as creep, between the fitted surfaces in the circumferential direction. This may lead to abnormal wear of fitted surfaces, intrusion of wear particles into the bearing, generation of abnormal heat, vibration, etc. Therefore, a suitable fit must be selected.

Table 20 Nature of radial load and fit

| Nature of the load                                           |                                                                                                                          | Fit                                                                                                      |                                          |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------|
|                                                              |                                                                                                                          | Inner ring                                                                                               | Outer ring                               |
| Rotating load on inner ring<br>Stationary load on outer ring |                                         | Inner ring : Rotating<br>Outer ring : Stationary<br>Load direction : Fixed                               | Interference fit<br><br>Clearance fit    |
|                                                              |                                       | Inner ring : Stationary<br>Outer ring : Rotating<br>Load direction : Rotating with outer ring            |                                          |
| Rotating load on outer ring<br>Stationary load on inner ring |                                       | Inner ring : Stationary<br>Outer ring : Rotating<br>Load direction : Fixed                               | Clearance fit<br><br>Interference fit    |
|                                                              |                                       | Inner ring : Rotating<br>Outer ring : Stationary<br>Load direction : Rotating with inner ring            |                                          |
| Directionally indeterminate load                             | The load direction is not fixed, including cases where the load direction is fluctuating or there is an unbalanced load. | Inner ring : Rotating or stationary<br>Outer ring : Rotating or stationary<br>Load direction : Not fixed | Interference fit<br><br>Interference fit |

Conditions for determination of fit

When determining a suitable fit for a bearing, it is necessary to consider various conditions such as nature and magnitude of the load, temperature, required rotational accuracy, material/finish grade/thickness of the shaft and housing, ease of mounting and dismounting, etc.

① Nature of load and fit

Basically, the appropriate fit depends on whether the load direction is rotational or stationary in relation to the inner and outer rings. The relationship between the nature of radial loads and the fit is, in general, based on Table 20.

② Load amount and interference

The greater the load, the larger the interference must be. When selecting an interference between the inner ring and the shaft, it is necessary to estimate the reduction of interference due to the radial load. The amount of reduction of interference is obtained by the following equations.

· When  $F_r \leq 0.2C_0$

$$\Delta_{dF} = 0.08 \sqrt{\frac{d}{B}} F_r \times 10^{-3} \cdots \cdots (30)$$

· When  $F_r > 0.2C_0$

$$\Delta_{dF} = 0.02 \frac{F_r}{B} \times 10^{-3} \cdots \cdots (31)$$

where,  $F_r$  : Radial load applied to bearing, N  
 $C_0$  : Basic static load rating, N  
 $\Delta_{dF}$  : Amount of reduction of inner ring interference, mm  
 $d$  : Bore diameter of inner ring, mm  
 $B$  : Width of inner ring, mm

③ Temperature conditions and change of interference

The interference of fitted surfaces is also influenced by the temperature difference between the bearing and the shaft and housing. For example, when steam is flowing through a hollow shaft, or when the housing is made of light metal, it is necessary to take into consideration the differences in temperature, the coefficient of linear expansion and other such factors. Usually, the interference of the inner ring decreases as the bearing temperature increases during operation. If the temperature difference between the inside of the bearing and the outside of the housing is taken

as  $\Delta_T$ , the temperature difference between the inner ring and the shaft can be estimated to be (0.1 ~ 0.15)  $\Delta_T$ . Accordingly, the amount of reduction of the inner ring interference is obtained by the following equation.

$$\Delta_{dT} = (0.1 \sim 0.15) \Delta_T \alpha d \doteq 0.0015 \Delta_T d \times 10^{-3} \cdots (32)$$

where,  $\Delta_{dT}$  : Reduction amount of inner ring interference due to temperature difference, mm  
 $\Delta_T$  : Temperature difference between the inside of the bearing and the outside of the housing,  $^\circ\text{C}$   
 $\alpha$  : Coefficient of linear expansion for bearing steel  
 $\quad \quad \quad \doteq 12.5 \times 10^{-6} \text{ 1/}^\circ\text{C}$   
 $d$  : Bore diameter of inner ring, mm

④ Shaft finish grade and interference

Since peaks of surface roughness of the fitted surface are crushed down when fitting the bearing, the effective interference becomes smaller than the apparent interference obtained by measurements, and it is generally obtained by the following equations.

· For ground shaft

$$\Delta_{de} = \frac{d}{d+2} \Delta_{df} \cdots \cdots (33)$$

· For machined shaft

$$\Delta_{de} = \frac{d}{d+3} \Delta_{df} \cdots \cdots (34)$$

where,  $\Delta_{de}$  : Effective interference of inner ring, mm  
 $d$  : Bore diameter of inner ring, mm  
 $\Delta_{df}$  : Apparent interference, mm

⑤ Minimum interference and maximum interference

When the load direction is rotating in relation to the inner ring, the inner ring is fitted with interference to the shaft. For solid ground steel shafts, the minimum interference (required apparent interference)  $\Delta_{df}$  is expressed by the following equation which is deduced from equations (30) or (31), (32) and (33).

$$\Delta_{df} \geq \frac{d+2}{d} (\Delta_{dF} + 0.0015 \Delta_T d \times 10^{-3}) \cdots (35)$$

It is desired that the maximum interference should be less than 1/1000 of the shaft diameter. In the case of the outer ring, the effective interference varies according to the housing material, thickness, shape, etc., so it is determined empirically.

Selection of fit

When selecting a suitable fit, in addition to the various conditions mentioned above, it is necessary to draw on experience and practical results.

Tables 21 and 22 show the most general fit data.

When a thin housing or a hollow shaft is used, the interference is made larger than an ordinary fit.

The fit between needle roller bearings without inner ring and shafts is based on Table 23.

For the fit between Shell Type Needle Roller Bearings and housing bores, see page B5.

For the fit between inner rings for Shell Type Needle Roller Bearings and shafts, see Table 22.

Table 21 Fit between needle roller bearings and housing bores (Not applicable to Shell Type Needle Roller Bearings)

| Operating conditions                                                               |                                              | Tolerance class of housing bore <sup>(1)</sup> | Application examples (Reference)          |
|------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------|-------------------------------------------|
| Rotating load on outer ring                                                        | Heavy load on thin housing, large shock load | P7 <sup>(2)</sup>                              | Flywheels                                 |
|                                                                                    | Heavy load, normal load                      | N7 <sup>(2)</sup>                              | Wheel bosses, transmission gears          |
|                                                                                    | Light load, fluctuating load                 | M7                                             | Pulleys, tension pulleys                  |
| Directionally indeterminate load                                                   | Large shock load                             | M7                                             | Eccentric wheels, pumps                   |
|                                                                                    | Heavy load, normal load                      | K7                                             | Compressors                               |
|                                                                                    | Normal load, light load                      | J7                                             | Crankshafts, compressors                  |
| Stationary load on outer ring                                                      | Shock load, heavy load                       | J7                                             | General bearing applications, gear shafts |
|                                                                                    | Normal load, light load                      | H7                                             | General bearing applications              |
|                                                                                    | With heat conduction through shaft           | G7                                             | Paper dryers                              |
| Light load, normal load, requirements of high-precision rotation and high rigidity |                                              | K6                                             | Main spindles of machine tools            |

Notes<sup>(1)</sup> This table applies to steel or cast iron housings. For lighter metal, a tighter fit should be selected.  
For split housings, do not use a fit tighter than J7.

<sup>(2)</sup> Care should be taken so that the radial internal clearance is not too small.

Remark Light load, normal load and heavy load represent  $P \leq 0.06C$ ,  $0.06C < P \leq 0.12C$ , and  $0.12C < P$ , respectively, where  $P$  is the dynamic equivalent radial load and  $C$  is the basic dynamic load rating of the bearing to be used.

Table 22 Fit between needle roller bearings with inner ring and shafts

| Operating conditions                                            |                                                        | Shaft dia. mm       |       | Tolerance class of shaft <sup>(1)</sup> | Application examples (Reference)                                                                                      |
|-----------------------------------------------------------------|--------------------------------------------------------|---------------------|-------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|                                                                 |                                                        | Over                | Incl. |                                         |                                                                                                                       |
| Stationary load on inner ring                                   | Light load, normal load, low or medium rotating speed  | All shaft diameters |       | g6                                      | Wheels on dead axles                                                                                                  |
|                                                                 | Heavy load, medium rotating speed                      |                     |       | h6                                      | Control lever gears                                                                                                   |
|                                                                 | Especially smooth operation and accuracy are required. |                     |       | h5                                      | Rope sheaves<br>Tension pulleys                                                                                       |
| Rotating load on inner ring or Directionally indeterminate load | Light load                                             | —                   | 50    | j5                                      | Electric appliances, Precision machinery<br>Machine tools, Pumps<br>Blowers, Transportation vehicles                  |
|                                                                 |                                                        | 50                  | 100   | k5                                      |                                                                                                                       |
|                                                                 |                                                        | 100                 | 200   | m6 <sup>(2)</sup>                       |                                                                                                                       |
|                                                                 |                                                        | 200                 | —     | n6 <sup>(3)</sup>                       |                                                                                                                       |
|                                                                 | Normal load                                            | —                   | 50    | k5 <sup>(4)</sup>                       | General bearing applications<br>Pumps, Transmission gearboxes,<br>Wood working machinery, Internal combustion engines |
|                                                                 |                                                        | 50                  | 150   | m5, m6 <sup>(2)</sup>                   |                                                                                                                       |
|                                                                 |                                                        | 150                 | 200   | n6 <sup>(3)</sup>                       |                                                                                                                       |
|                                                                 | Heavy load<br>Shock load                               | 200                 | —     | p6 <sup>(3)</sup>                       |                                                                                                                       |
|                                                                 |                                                        | —                   | 150   | n6 <sup>(3)</sup><br>p6 <sup>(3)</sup>  | Industrial vehicles, Construction machinery<br>Crushers                                                               |

Notes<sup>(1)</sup> This table applies to solid steel shafts.

<sup>(2)</sup> It is necessary to examine the reduction of radial internal clearances caused by the expansion of inner rings after mounting.

<sup>(3)</sup> It is necessary to use bearings with radial internal clearances greater than CN clearance.

<sup>(4)</sup> For NATA and NATB, do not use a tighter fit than k5.

Table 23 Tolerance class of shafts assembled with needle roller bearings without inner ring

| $F_w$<br>Nominal roller set bore diameter<br>mm |       | Radial internal clearance               |              |                          |
|-------------------------------------------------|-------|-----------------------------------------|--------------|--------------------------|
|                                                 |       | Smaller than CN clearance               | CN clearance | Larger than CN clearance |
| Over                                            | Incl. | Tolerance class of shaft <sup>(1)</sup> |              |                          |
| —                                               | 65    | k5                                      | h5           | g6                       |
| 65                                              | 80    | k5                                      | h5           | f6                       |
| 80                                              | 160   | k5                                      | g5           | f6                       |
| 160                                             | 180   | k5                                      | g5           | e6                       |
| 180                                             | 200   | j5                                      | g5           | e6                       |
| 200                                             | 250   | j5                                      | f6           | e6                       |
| 250                                             | 315   | h5                                      | f6           | e6                       |
| 315                                             | —     | g5                                      | f6           | d6                       |

Note<sup>(1)</sup> When the housing bore fit is tighter than K7, the shaft diameter is made smaller by considering shrinkage of roller set bore diameter after mounting.

Table 24 Fit values for radial bearings (JIS Class 0) (Fit with housing bore) unit: μm

| D                        |       | Δ <sub>Dmp</sub>                             |     | G7                                                                                | H7                                                                                | J7                                                                                | K6                                                                                | K7                                                                                | M7                                                                                | N7                                                                                  | P7                                                                                  |
|--------------------------|-------|----------------------------------------------|-----|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Nominal outside diameter |       | Single plane mean outside diameter deviation |     |  |  |  |  |  |  |  |  |
| Over                     | Incl. | High                                         | Low |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 3                        | 6     | 0                                            | - 8 | - 24 ~ - 4                                                                        | - 20 ~ 0                                                                          | -14 ~ 6                                                                           | -10 ~ 6                                                                           | -11 ~ 9                                                                           | - 8 ~ 12                                                                          | - 4 ~ 16                                                                            | 0 ~ 20                                                                              |
| 6                        | 10    | 0                                            | - 8 | - 28 ~ - 5                                                                        | - 23 ~ 0                                                                          | -16 ~ 7                                                                           | -10 ~ 7                                                                           | -13 ~ 10                                                                          | - 8 ~ 15                                                                          | - 4 ~ 19                                                                            | 1 ~ 24                                                                              |
| 10                       | 18    | 0                                            | - 8 | - 32 ~ - 6                                                                        | - 26 ~ 0                                                                          | -18 ~ 8                                                                           | -10 ~ 9                                                                           | -14 ~ 12                                                                          | - 8 ~ 18                                                                          | - 3 ~ 23                                                                            | 3 ~ 29                                                                              |
| 18                       | 30    | 0                                            | - 9 | - 37 ~ - 7                                                                        | - 30 ~ 0                                                                          | -21 ~ 9                                                                           | -11 ~ 11                                                                          | -15 ~ 15                                                                          | - 9 ~ 21                                                                          | - 2 ~ 28                                                                            | 5 ~ 35                                                                              |
| 30                       | 50    | 0                                            | -11 | - 45 ~ - 9                                                                        | - 36 ~ 0                                                                          | -25 ~ 11                                                                          | -14 ~ 13                                                                          | -18 ~ 18                                                                          | -11 ~ 25                                                                          | - 3 ~ 33                                                                            | 6 ~ 42                                                                              |
| 50                       | 80    | 0                                            | -13 | - 53 ~ -10                                                                        | - 43 ~ 0                                                                          | -31 ~ 12                                                                          | -17 ~ 15                                                                          | -22 ~ 21                                                                          | -13 ~ 30                                                                          | - 4 ~ 39                                                                            | 8 ~ 51                                                                              |
| 80                       | 120   | 0                                            | -15 | - 62 ~ -12                                                                        | - 50 ~ 0                                                                          | -37 ~ 13                                                                          | -19 ~ 18                                                                          | -25 ~ 25                                                                          | -15 ~ 35                                                                          | - 5 ~ 45                                                                            | 9 ~ 59                                                                              |
| 120                      | 150   | 0                                            | -18 | - 72 ~ -14                                                                        | - 58 ~ 0                                                                          | -44 ~ 14                                                                          | -22 ~ 21                                                                          | -30 ~ 28                                                                          | -18 ~ 40                                                                          | - 6 ~ 52                                                                            | 10 ~ 68                                                                             |
| 150                      | 180   | 0                                            | -25 | - 79 ~ -14                                                                        | - 65 ~ 0                                                                          | -51 ~ 14                                                                          | -29 ~ 21                                                                          | -37 ~ 28                                                                          | -25 ~ 40                                                                          | -13 ~ 52                                                                            | 3 ~ 68                                                                              |
| 180                      | 250   | 0                                            | -30 | - 91 ~ -15                                                                        | - 76 ~ 0                                                                          | -60 ~ 16                                                                          | -35 ~ 24                                                                          | -43 ~ 33                                                                          | -30 ~ 46                                                                          | -16 ~ 60                                                                            | 3 ~ 79                                                                              |
| 250                      | 315   | 0                                            | -35 | -104 ~ -17                                                                        | - 87 ~ 0                                                                          | -71 ~ 16                                                                          | -40 ~ 27                                                                          | -51 ~ 36                                                                          | -35 ~ 52                                                                          | -21 ~ 66                                                                            | 1 ~ 88                                                                              |
| 315                      | 400   | 0                                            | -40 | -115 ~ -18                                                                        | - 97 ~ 0                                                                          | -79 ~ 18                                                                          | -47 ~ 29                                                                          | -57 ~ 40                                                                          | -40 ~ 57                                                                          | -24 ~ 73                                                                            | 1 ~ 98                                                                              |
| 400                      | 500   | 0                                            | -45 | -128 ~ -20                                                                        | -108 ~ 0                                                                          | -88 ~ 20                                                                          | -53 ~ 32                                                                          | -63 ~ 45                                                                          | -45 ~ 63                                                                          | -28 ~ 80                                                                            | 0 ~ 108                                                                             |

Remark The negative value denotes a clearance and the positive value denotes an interference.

Table 25 Fit values for radial bearings (JIS Class 0) (Fit with shaft) unit: μm

| d                     |       | Δ <sub>dmp</sub>                          |     | g6                                                                                | h5                                                                                | h6                                                                                | j5                                                                                | k5                                                                                | m5                                                                                | m6                                                                                 | n6                                                                                  | p6                                                                                  |
|-----------------------|-------|-------------------------------------------|-----|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Nominal bore diameter |       | Single plane mean bore diameter deviation |     |  |  |  |  |  |  |  |  |  |
| Over                  | Incl. | High                                      | Low |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 3                     | 6     | 0                                         | - 8 | -12 ~ 4                                                                           | - 5 ~ 8                                                                           | - 8 ~ 8                                                                           | - 2 ~ 11                                                                          | 1 ~ 14                                                                            | 4 ~ 17                                                                            | 4 ~ 20                                                                             | 8 ~ 24                                                                              | 12 ~ 28                                                                             |
| 6                     | 10    | 0                                         | - 8 | -14 ~ 3                                                                           | - 6 ~ 8                                                                           | - 9 ~ 8                                                                           | - 2 ~ 12                                                                          | 1 ~ 15                                                                            | 6 ~ 20                                                                            | 6 ~ 23                                                                             | 10 ~ 27                                                                             | 15 ~ 32                                                                             |
| 10                    | 18    | 0                                         | - 8 | -17 ~ 2                                                                           | - 8 ~ 8                                                                           | -11 ~ 8                                                                           | - 3 ~ 13                                                                          | 1 ~ 17                                                                            | 7 ~ 23                                                                            | 7 ~ 26                                                                             | 12 ~ 31                                                                             | 18 ~ 37                                                                             |
| 18                    | 30    | 0                                         | -10 | -20 ~ 3                                                                           | - 9 ~ 10                                                                          | -13 ~ 10                                                                          | - 4 ~ 15                                                                          | 2 ~ 21                                                                            | 8 ~ 27                                                                            | 8 ~ 31                                                                             | 15 ~ 38                                                                             | 22 ~ 45                                                                             |
| 30                    | 50    | 0                                         | -12 | -25 ~ 3                                                                           | -11 ~ 12                                                                          | -16 ~ 12                                                                          | - 5 ~ 18                                                                          | 2 ~ 25                                                                            | 9 ~ 32                                                                            | 9 ~ 37                                                                             | 17 ~ 45                                                                             | 26 ~ 54                                                                             |
| 50                    | 80    | 0                                         | -15 | -29 ~ 5                                                                           | -13 ~ 15                                                                          | -19 ~ 15                                                                          | - 7 ~ 21                                                                          | 2 ~ 30                                                                            | 11 ~ 39                                                                           | 11 ~ 45                                                                            | 20 ~ 54                                                                             | 32 ~ 66                                                                             |
| 80                    | 120   | 0                                         | -20 | -34 ~ 8                                                                           | -15 ~ 20                                                                          | -22 ~ 20                                                                          | - 9 ~ 26                                                                          | 3 ~ 38                                                                            | 13 ~ 48                                                                           | 13 ~ 55                                                                            | 23 ~ 65                                                                             | 37 ~ 79                                                                             |
| 120                   | 140   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 140                   | 160   | 0                                         | -25 | -39 ~ 11                                                                          | -18 ~ 25                                                                          | -25 ~ 25                                                                          | -11 ~ 32                                                                          | 3 ~ 46                                                                            | 15 ~ 58                                                                           | 15 ~ 65                                                                            | 27 ~ 77                                                                             | 43 ~ 93                                                                             |
| 160                   | 180   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 180                   | 200   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 200                   | 225   | 0                                         | -30 | -44 ~ 15                                                                          | -20 ~ 30                                                                          | -29 ~ 30                                                                          | -13 ~ 37                                                                          | 4 ~ 54                                                                            | 17 ~ 67                                                                           | 17 ~ 76                                                                            | 31 ~ 90                                                                             | 50 ~ 109                                                                            |
| 225                   | 250   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 250                   | 280   | 0                                         | -35 | -49 ~ 18                                                                          | -23 ~ 35                                                                          | -32 ~ 35                                                                          | -16 ~ 42                                                                          | 4 ~ 62                                                                            | 20 ~ 78                                                                           | 20 ~ 87                                                                            | 34 ~ 101                                                                            | 56 ~ 123                                                                            |
| 280                   | 315   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 315                   | 355   | 0                                         | -40 | -54 ~ 22                                                                          | -25 ~ 40                                                                          | -36 ~ 40                                                                          | -18 ~ 47                                                                          | 4 ~ 69                                                                            | 21 ~ 86                                                                           | 21 ~ 97                                                                            | 37 ~ 113                                                                            | 62 ~ 138                                                                            |
| 355                   | 400   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| 400                   | 450   | 0                                         | -45 | -60 ~ 25                                                                          | -27 ~ 45                                                                          | -40 ~ 45                                                                          | -20 ~ 52                                                                          | 5 ~ 77                                                                            | 23 ~ 95                                                                           | 23 ~ 108                                                                           | 40 ~ 125                                                                            | 68 ~ 153                                                                            |
| 450                   | 500   |                                           |     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |

Remark The negative value denotes a clearance and the positive value denotes an interference.

Design of Shaft and Housing

Accuracy and roughness of shaft and housing

Accuracy and roughness of fitting surface

Since the bearing rings of needle roller bearings are thin, their performance is easily affected by poor accuracy of shafts or housings. Under general operating conditions, the fitting surfaces of shafts and housings can be finished by lathe turning. However, when the load is great and high accuracy and low noise are required, a grinding finish is required. Table 26 shows the accuracy and roughness of fitting surfaces for general use.

Accuracy and roughness of raceway surface

In case of needle roller bearings unlike other bearings, mating surfaces such as shaft and housing bore surfaces can be used directly as the raceway surfaces. For such use, accuracy and roughness of the raceway surfaces are important because they will influence bearing life, noise and accuracy. In general, accuracy and roughness of raceway surfaces are based on Table 26.

Inclination of shaft

Shafts and outer rings may have some inclination between them due to deflection of the shaft, machining accuracy of shafts and housings, errors in mounting, etc. In this case, the use of two or more bearings in tandem arrangement on a single shaft should be avoided. Instead, a bearing with large load ratings should be used. It is recommended that inclination of shafts be less than 1/1000.

Table 27 Tolerance class IT values for basic dimensions

| Basic dimension |       | Tolerance class <sup>(1)</sup> |     |     |
|-----------------|-------|--------------------------------|-----|-----|
| mm              |       | IT5                            | IT6 | IT7 |
| Over            | Incl. | Tolerance μm                   |     |     |
| —               | 3     | 4                              | 6   | 10  |
| 3               | 6     | 5                              | 8   | 12  |
| 6               | 10    | 6                              | 9   | 15  |
| 10              | 18    | 8                              | 11  | 18  |
| 18              | 30    | 9                              | 13  | 21  |
| 30              | 50    | 11                             | 16  | 25  |
| 50              | 80    | 13                             | 19  | 30  |
| 80              | 120   | 15                             | 22  | 35  |
| 120             | 180   | 18                             | 25  | 40  |
| 180             | 250   | 20                             | 29  | 46  |
| 250             | 315   | 23                             | 32  | 52  |
| 315             | 400   | 25                             | 36  | 57  |
| 400             | 500   | 27                             | 40  | 63  |
| 500             | 630   | 30                             | 44  | 70  |

Note<sup>(1)</sup> Based on JIS B 0401.

Table 26 Specifications of shafts and housings for radial needle roller bearings

| Item                                                        | Shaft                                                      |                                                            | Housing bore                                               |                                                            |
|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
|                                                             | Fitting surface                                            | Raceway surface                                            | Fitting surface                                            | Raceway surface                                            |
| Circularity                                                 | 0.3 × IT6 <sup>(1)</sup><br>or<br>0.3 × IT5 <sup>(1)</sup> | 0.3 × IT6 <sup>(1)</sup><br>or<br>0.3 × IT5 <sup>(1)</sup> | 0.3 × IT7 <sup>(1)</sup><br>or<br>0.3 × IT6 <sup>(1)</sup> | 0.3 × IT7 <sup>(1)</sup><br>or<br>0.3 × IT6 <sup>(1)</sup> |
| Cylindricity                                                | 0.5 × IT6 <sup>(2)</sup><br>or<br>0.5 × IT5 <sup>(2)</sup> | 0.3 × IT6 <sup>(1)</sup><br>or<br>0.3 × IT5 <sup>(1)</sup> | 0.5 × IT7 <sup>(2)</sup><br>or<br>0.5 × IT6 <sup>(2)</sup> | 0.3 × IT7 <sup>(1)</sup><br>or<br>0.3 × IT6 <sup>(1)</sup> |
| Surface roughness μ mR <sub>a</sub><br>(μ mR <sub>y</sub> ) | 0.8<br>(3.2)                                               | 0.2 <sup>(3)</sup><br>(0.8)                                | 1.6<br>(6.3)                                               | 0.2 <sup>(3)</sup><br>(0.8)                                |
| Hardness                                                    | —                                                          | 58 ~ 64HRC <sup>(4)</sup>                                  | —                                                          | 58 ~ 64HRC <sup>(4)</sup>                                  |

Notes<sup>(1)</sup> 30% or less of the dimensional tolerance for shafts or housing bores is recommended.

<sup>(2)</sup> 50% or less of the dimensional tolerance for shafts or housing bores is recommended.

<sup>(3)</sup> When required accuracy is not critical, a surface roughness within 0.8 μ mR<sub>a</sub> (3.2 μ mR<sub>y</sub>) is allowable.

<sup>(4)</sup> An appropriate thickness of the hardened layer is required.

Remark For tolerance class IT, see Table 27.

Raceway materials and heat treatment

When using shafts and housings as raceways, the following materials are generally used.

|                                    |              |            |
|------------------------------------|--------------|------------|
| High-carbon chromium bearing steel | SUJ2         | JIS G 4805 |
| Carburizing steel                  | SCM415 ~ 421 | JIS G 4053 |
| Carburizing steel                  | SNCM 220     | JIS G 4053 |
| Carburizing steel                  | SCr 420      | JIS G 4053 |
| Carburizing steel                  | SNC 415, 815 | JIS G 4053 |
| Carburizing steel                  | S 15 CK      | JIS G 4051 |

In addition, S50C and S55C (JIS G 4051) can be used after through hardening or induction hardening. The hardened layer produced by tempering at +160 ~ +180°C after hardening must have a fine uniform martensite microstructure.

When hardening the raceway surface by case hardening or induction hardening, a surface hardness of 58 ~ 64HRC and an appropriate thickness of the hardened layer must be ensured. The minimum effective thickness of the hardened layer after heat treatment and grinding is defined as the distance from the surface to the depth where the hardness is 550HV, and it is obtained by the following equation.

$E_{ht} \geq 0.8D_w(0.1 + 0.002D_w)$  .....(36)

where,  $E_{ht}$  : Minimum effective thickness of the hardened layer, mm  
 $D_w$  : Roller diameter, mm  
Generally, the required effective thickness of the hardened layer is at least 0.3 mm.

Dimensions related to mounting of bearings

The dimensions of shaft and housing related to mounting of the needle roller bearings are shown in the table of dimensions for each bearing. (See Fig. 13.)

The minimum value of the shaft shoulder diameter  $d_a$  which receives the inner ring, and the maximum value of the housing shoulder diameter  $D_a$  which receives the outer ring, represent the effective shoulder diameters (excluding the chamfered part) which make proper contact with the side faces of the inner and outer rings respectively.

Also, the maximum value of the shaft shoulder (or inner ring retaining piece) diameter  $d_a$  is the dimension related to the ease of mounting/dismounting of the shaft and inner ring to/from the housing and outer ring.

The largest permissible single corner radius  $r_{as\ max}$  of the shaft and housing must be smaller than the smallest permissible single chamfer dimension  $r_{s\ min}$  of the bearing so that the side surface of the bearing can make proper contact with the shoulder. Table 28 shows the related dimensions.

For dimensions of the fillet relief when finishing the shaft or housing by grinding, the values shown in Table 29 are recommended.

For other dimensions related to mounting, see the related section for each bearing as required. In addition, for ease in dismounting of bearings, it is convenient to make notches in the shoulder of the shaft or housing to allow the insertion of dismounting hooks.

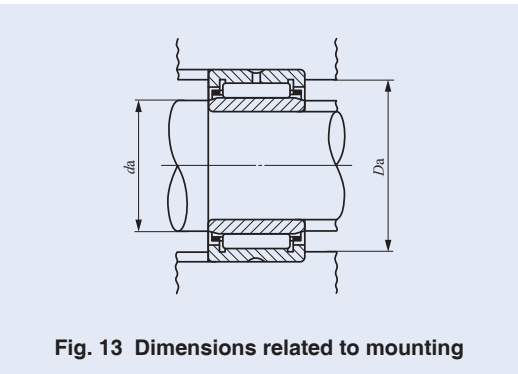


Fig. 13 Dimensions related to mounting

Table 28 Largest permissible single corner radius of shafts and housings  $r_{as\ max}$

| $r_{s\ min}$<br>Smallest permissible<br>single chamfer<br>dimension | $r_{as\ max}$<br>Largest permissible single<br>corner radius of shafts and<br>housings | unit: mm |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------|
| 0.1                                                                 | 0.1                                                                                    |          |
| 0.15                                                                | 0.15                                                                                   |          |
| 0.2                                                                 | 0.2                                                                                    |          |
| 0.3                                                                 | 0.3                                                                                    |          |
| 0.4                                                                 | 0.4                                                                                    |          |
| 0.6                                                                 | 0.6                                                                                    |          |
| 1                                                                   | 1                                                                                      |          |
| 1.1                                                                 | 1                                                                                      |          |
| 1.5                                                                 | 1.5                                                                                    |          |
| 2                                                                   | 2                                                                                      |          |
| 2.1                                                                 | 2                                                                                      |          |
| 2.5                                                                 | 2                                                                                      |          |
| 3                                                                   | 2.5                                                                                    |          |
| 4                                                                   | 3                                                                                      |          |
| 5                                                                   | 4                                                                                      |          |

Table 29 Fillet relief dimensions for ground shafts and housings

| $r_{s\ min}$<br>Smallest permissible<br>single chamfer<br>dimension | Fillet relief dimensions |          |     | unit: mm |
|---------------------------------------------------------------------|--------------------------|----------|-----|----------|
|                                                                     | $t$                      | $r_{gs}$ | $b$ |          |
| 1                                                                   | 0.2                      | 1.3      | 2   |          |
| 1.1                                                                 | 0.3                      | 1.5      | 2.4 |          |
| 1.5                                                                 | 0.4                      | 2        | 3.2 |          |
| 2                                                                   | 0.5                      | 2.5      | 4   |          |
| 2.1                                                                 | 0.5                      | 2.5      | 4   |          |
| 3                                                                   | 0.5                      | 3        | 4.7 |          |
| 4                                                                   | 0.5                      | 4        | 5.9 |          |
| 5                                                                   | 0.6                      | 5        | 7.4 |          |
| 6                                                                   | 0.6                      | 6        | 8.6 |          |
| 7.5                                                                 | 0.6                      | 7        | 10  |          |

Sealing

To obtain the best performance of rolling bearings, it is necessary to prevent leakage of lubricant and the

entry of harmful foreign substances, such as dirt, dust and water. For this reason, sealing devices must always work effectively to seal and prevent against dust penetration under all operating conditions. Also, when selecting a suitable sealing method, it is necessary to consider such factors as the type of lubricant, peripheral speed of the seal, operating temperature, shaft eccentricity, seal friction, etc. as well as ease of assembly and disassembly.

Sealing methods are of the non-contact and contact types, and it is necessary to select the appropriate type depending on the application.

Non-contact type sealing method

There are many methods of non-contact type sealing, including the use of oil grooves, flingers and labyrinths, which utilize the centrifugal force and narrow gaps.

Since they do not make direct contact with the shaft or housing, it is unnecessary to consider friction and wear, and the non-contact sealing method is suitable for high speed rotation and high operating temperatures. However, because of gaps, this method is not always sufficient in preventing oil leakage and dust entry when the machine is not in operation.

① Oil groove

Oil grooves are provided on either the shaft or housing bore, or on both for more effective sealing (See Fig. 14.). The clearance between the shaft and the housing bore should be as small as possible, and the values shown in Table 30 are generally used, taking into consideration errors in machining and assembly, shaft deformation, etc. Three or more grooves are made with a width of 3 ~ 5 mm and a depth of 4 ~ 5 mm. If the grooves are filled with grease, it will be more effective for dust prevention.

As shown in Fig. 15, helical grooves are suitable for horizontal shafts which have a fixed direction of rotation. Right or left handed grooves are used according to the direction of rotation, and they are used for oil lubrication normally in conjunction with a suitable anti-dust device.

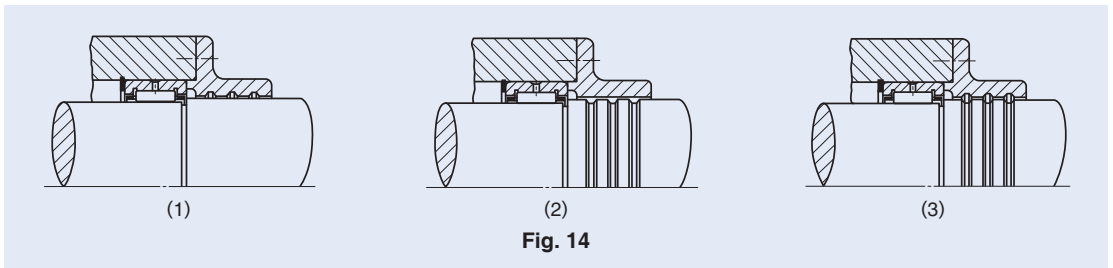
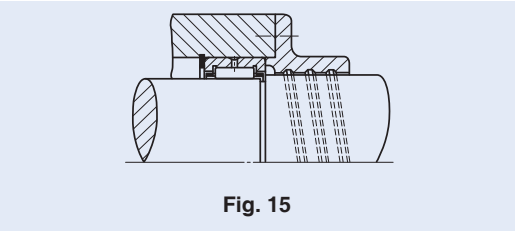


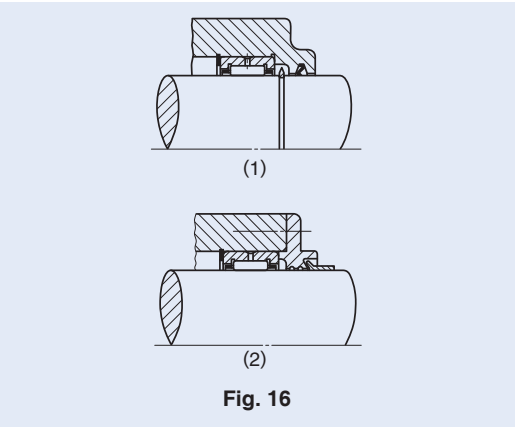
Fig. 14

Table 30 Clearance between grooved shaft and housing bore unit: mm

| Shaft dia.  | Clearance  |
|-------------|------------|
| Incl. 50 mm | 0.25 ~ 0.4 |
| Over 50 mm  | 0.5 ~ 1    |



**② Flinger**  
The oil flinger is a disk attached to the shaft which throws off oil due to the centrifugal force of rotation and thus prevents oil leakage and the entry of foreign particles. Fig. 16 (1) shows an example in which the flinger is located inside the housing, mainly to prevent oil leakage. Since it sucks in dust and dirt, it should be used in a dust free environment. Fig. 16 (2) shows an example in which the flinger is located outside the housing, and is used in combination with another sealing device, to prevent entry of foreign particles.



**③ Labyrinth**  
Although it is a little difficult to make, the labyrinth is very effective in preventing oil leakage especially at high speeds. At low speeds, filling the labyrinth with grease is effective in preventing the entry of dust. In Fig. 17, it is necessary to split the housing or cover plate into two. In Fig. 18, it is easy to assemble, and if combined with an oil seal, it improves the sealing effect. Table 31 shows the labyrinth clearances generally used.

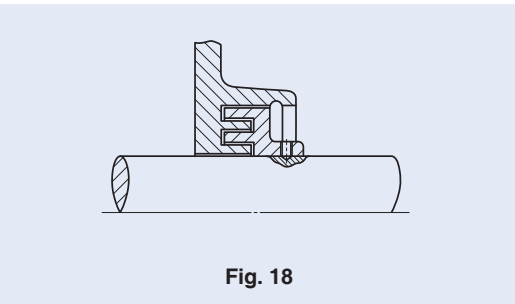
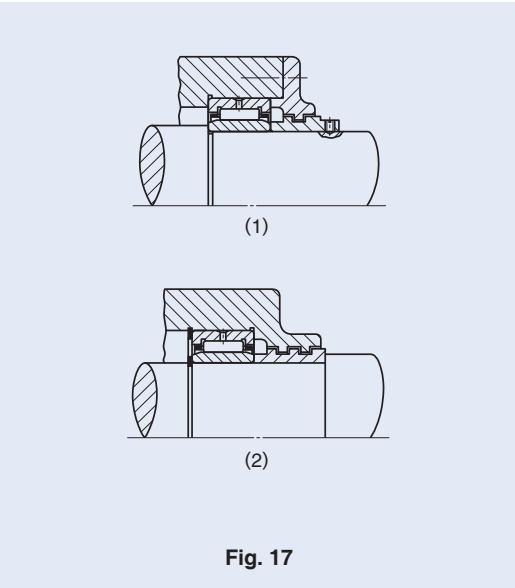


Table 31 Labyrinth clearance unit: mm

| Shaft dia.  | Clearance        |                 |
|-------------|------------------|-----------------|
|             | Radial direction | Axial direction |
| Incl. 50 mm | 0.25 ~ 0.4       | 1 ~ 2           |
| Over 50 mm  | 0.5 ~ 1          | 3 ~ 5           |

Contact type sealing method

In this type of sealing, the shaft is sealed by the application of pressure resulting from the elasticity of the seal material to the sealing surface of the shaft, which rotates, reciprocates or oscillates. Synthetic rubber, synthetic resin and felt are generally used as sealing materials.

**① Oil seal**  
Synthetic rubber oil seals are the most general type of sealing used. The sealing effect is obtained when the elastic lip comes into contact with the shaft. Some lips are spring-loaded to maintain adequate pressing force. The sliding surfaces of the lip and the shaft always show frictional behavior such that the boundary lubrication and fluid lubrication are mixed. If there is an insufficient amount of oil between the contact surfaces, it will cause heat generation, wear and seizure. Conversely, if the oil film is too thick, it may cause oil leakage. General oil seals are specified in JIS B 2402-1~5. IKO Oil Seals for Needle Roller Bearings (See page L1.) have a low sectional height to match the Needle Roller Bearings. Nitrile rubber is generally used as the material for oil seal lips. Table 32 shows the materials and their operating temperature ranges. The finished surface of the shaft where the seal lip makes contact must have an appropriate surface roughness, as shown in Table 33, according to the peripheral speed. It must also have accurate circularity, and the shaft eccentricity should be less than 0.05 mm. To increase wear resistance, the hardness of the sliding part of the shaft must be more than 40HRC. This can be achieved by hard-chrome plating or heat treatment.

Table 32 Seal materials and operating temperatures

| Seal material             |                | Operating temperature range °C |
|---------------------------|----------------|--------------------------------|
| Synthetic rubber          | Nitrile rubber | - 25 ~ + 120                   |
|                           | Acrylic rubber | - 15 ~ + 130                   |
|                           | Silicon rubber | - 50 ~ + 180                   |
|                           | Fluoro rubber  | - 10 ~ + 180                   |
| Tetrafluoroethylene resin |                | - 50 ~ + 220                   |

Table 33 Peripheral speed and surface roughness of shaft

| Peripheral speed m / s |       | Surface roughness $\mu mR_a$ ( $\mu mR_y$ ) |
|------------------------|-------|---------------------------------------------|
| Over                   | Incl. |                                             |
| —                      | 5     | 0.8(3.2)                                    |
| 5                      | 10    | 0.4(1.6)                                    |
| 10                     | —     | 0.2(0.8)                                    |

**② Felt seal**  
Because of their simple structure, felt seals have long been used to protect grease lubrication from dust. Since felt absorbs some grease during operation, it hardly causes heat generation and seizure, but it cannot be used when the peripheral speed of the shaft is high (more than 4 m/s). Where there is a high concentration of dirt and dust, they may become attached to the contact surface of felt, sometimes scratching the shaft surface. To prevent this, two felt seals are placed apart from each other, or a felt seal is used together with a synthetic rubber seal.

Purpose of lubrication

The main purpose of bearing lubrication is to reduce friction and wear and to prevent heat generation and seizure. The lubricant and the lubricating method have a big influence on the operating performance of the bearing, and it is therefore necessary to select them suitably for the operating conditions. The effects of lubrication are as follows.

- 1 Reduction of friction and wear
At the contact surfaces between the race rings, rolling elements and cage of the bearing, lubrication prevents metal-to-metal contact, and reduces friction and wear due to sliding and rolling, in the latter of which micro-slips occur by differential slip, skew, spin, or elastic deformation.
- 2 Elimination of frictional heat
The lubricant removes the heat generated by friction or transferred from outside, and prevents overheating of the bearing. Circulating lubrication is generally used for this purpose.
- 3 Influence on bearing life
The bearing life is extended if the rolling contact surfaces between the race rings and rolling elements are separated by an oil film of adequate thickness, and is shortened if the oil film is inadequate due to low oil viscosity, etc.
- 4 Rust prevention
The lubricant prevents rust formation on the inside and outside surfaces of the bearing.

- 5 Dust prevention
Grease lubrication is particularly effective for dust prevention. Oil circulating or jet lubrication is effective in washing foreign particles away from the area around the bearing.

Methods of lubrication

Grease lubrication and oil lubrication are generally used for rolling bearings. In special cases, solid lubricants are also used. In general, grease lubrication requires the simplest sealing structure. It is therefore economical and widely used. Also, once filled with grease, the bearing can be used for a long period without replenishing the grease. However, compared with oil, its heat removal properties and cooling capacity are inferior, since grease has high flow resistance, which causes high churning heat. Oil has greater fluidity and superior heat removal properties. It is therefore suitable for high-speed operations. In addition, it is simple to filter out dust and dirt from oil. Thus it can prevent the generation of noise and vibration and increase bearing life. Another advantage of oil lubrication is that it offers the possibility for selecting the appropriate method for particular operating conditions from among various available lubrication methods. However, measures to prevent oil leakage are required. As a guideline for selection, Table 34 compares grease and oil lubrication. For the lubricants used for IKO Spherical Bushings, see page K8.

Table 34 Comparison between grease lubrication and oil lubrication

Table with 3 columns: Item, Grease lubrication (1), Oil lubrication. Rows include Sealing structure, Temperature, Rotational speed, Load, Maintenance, Lubricant replacement, Lubrication performance, Dust filtration, and Entry of dust and dirt.

Note(1) This represents bearing grease for general use.

Grease lubrication

1 Amount of grease to be filled
The amount of grease to be filled depends on the housing structure, dimensions, type of grease used and atmosphere. Generally, filling about 1/3 to 1/2 of the free space inside of the bearing and the housing is considered to be appropriate. Too much will cause a rise in temperature, and care should be taken especially at high speed rotations. In Fig. 19, several grease pockets are provided by the grease sectors on one side of the bearing. Even if the filled grease is dispersed by the centrifugal force at high rotational speeds, it is trapped by the grease pockets and diverted back into the bearing again. Old grease accumulates in the space on the opposite side of the bearing, and this can be removed periodically by taking off the cover.

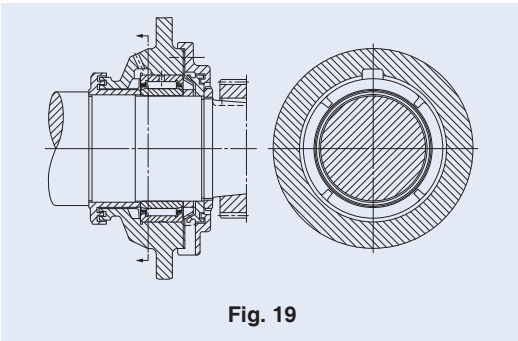
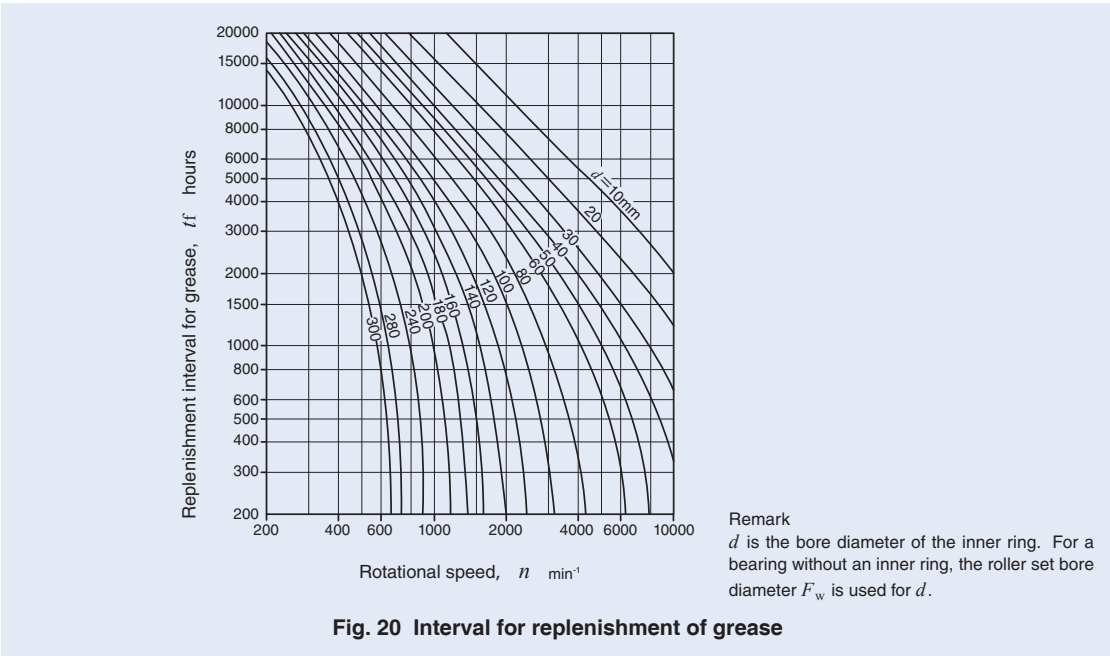


Fig. 19

2 Replenishment of grease
The life of grease depends on its type and quality, the type and dimensions of the bearing, operating conditions, temperature, amount of wear, penetration of foreign particles and water, etc. Fig. 20 shows the replenishment intervals for grease, and is used as a general guideline. The values obtained from this diagram apply to cases in which the load condition is normal, the machine body is stationary, and the operating temperature on the outer surface of bearing outer ring is less than +70°C. If the temperature exceeds +70°C, as a general rule, the replenishment interval is halved for every 15°C increase.



Remark
d is the bore diameter of the inner ring. For a bearing without an inner ring, the roller set bore diameter Fw is used for d.

Fig. 20 Interval for replenishment of grease

Oil lubrication

1 Oil bath lubrication

This is the most commonly used oil lubrication method, and is used for medium and low speeds. If the amount of oil is too large, heat will be generated by churning, and if the amount is too small, seizure will occur. Therefore, the correct amount of oil must be maintained. When the machine is stationary, the correct oil level in the case of a bearing mounted on a horizontal shaft, is near the center of the lowest rolling element. In the case of a vertical shaft, about 50% of the surfaces of the rolling elements should be submerged in oil. It is desirable to provide an oil gauge so that the oil level can be easily checked while the machine is stationary or running.

2 Oil drip lubrication

Oil drips, which are fed down from a sight-feed oiler or along a fiber string, become an oil spray due to wind pressure generated by the rotating cage, shaft, nut, etc., or they strike the rotating parts and form an oil spray, which fills up the housing and every required part. Because oil spray removes frictional heat, this method has a more effective cooling effect than the oil bath method, and is widely used for high-speed rotation and medium load conditions. In the case of the sight-feed oiler (Fig. 21), the number of drips can be adjusted. However, this is difficult using the string-feed method. The number of drips depends on the bearing type, rotational speed, etc., but 5 ~ 6 drips per minute is generally used.

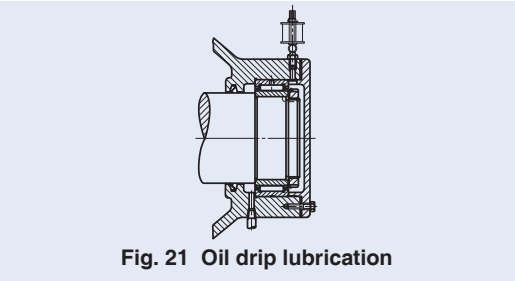


Fig. 21 Oil drip lubrication

3 Oil splash lubrication

In this method, oil is splashed in all directions by the rotation of the gear or disk. This can be used for considerably high-speed rotations without soaking the bearing directly in oil. In the gear case where shafts and bearings are lubricated with the same oil, wear particles may be introduced into the bearing as they might get mixed with the oil. In this case, a permanent magnet is provided at the bottom of the gear case to collect metal particles, or a shield plate is installed next to the bearing. Fig. 22 shows another method in which the splashed

oil flows along the grooves in the case and accumulates in the oil pockets, keeping the oil level constant. So the oil is steadily supplied to the bearing.

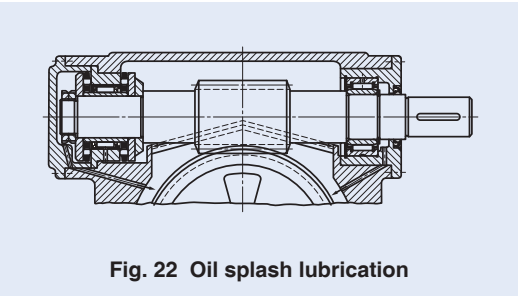


Fig. 22 Oil splash lubrication

4 Oil circulating lubrication

When automatic lubrication is more economical because lubrication is required at many points, or when cooling is required for high rotational speed, this method is used. The oil is supplied with a pump, which can control the oil pressure, and a filter or cooler, etc. can be set up in the circulation system, making this an ideal method of lubrication. As shown in Fig. 23, the oil supply and discharge ports are located opposite to each other, and the discharge port is made large to prevent the accumulation of oil.

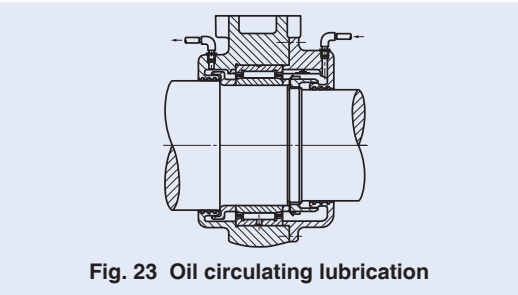


Fig. 23 Oil circulating lubrication

5 Oil mist lubrication

After dirt and dust are removed by a filter, the oil is turned into a spray by dry compressed air, and this lubricates the bearing. When the air and oil pass through the bearing, the air cools the bearing and the oil lubricates it. In addition, because the air inside the housing is at a higher pressure than the outside air, the entry of water and foreign particles is prevented. There are many other advantages of this method, and it is suitable for high rotational speed applications such as high speed internal grinding spindles.

6 Oil jet lubrication

This is a highly reliable lubrication method and is used under severe conditions such as ultra-high rotational speeds and high temperatures. The speed of the oil jet should be more than 20% of the peripheral speed of the inner ring raceway surface, since the air around

the bearing rotates together with the bearing forming an air wall. As shown in Fig. 24, the jet from the nozzle blows directly into the space between the inner ring and the cage. Due to the large amount of oil being used, it is more effective to make the discharge port larger, and use the forced discharge. When the  $d_m n$  value (mean value of the bearing outside and bore diameters in millimeter x rotational speed in min<sup>-1</sup>) is more than 1,000,000, the speed of the jet should be 10 ~ 20 m/s, the nozzle diameter should be about 1 mm, oil supply pressure should be 0.1 ~ 0.5 MPa, and the oil supply amount should be about 500 cc/min or greater. When the rotational speed is higher, the oil supply pressure and the oil amount should be higher.

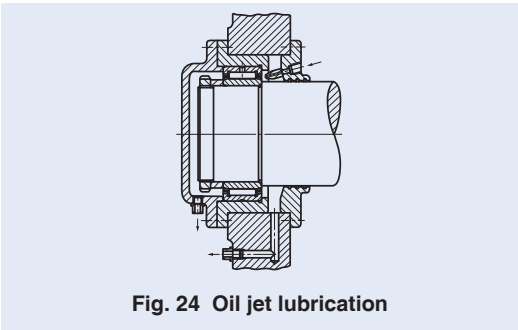


Fig. 24 Oil jet lubrication

Lubricants

For rolling bearings, lubricating grease or oil is generally used. For special applications, solid lubricants are used.

Lubricating grease

Grease is a semi-solid lubricant made by mixing base oil (liquid lubricant) and a thickener under heat and adding additives as required. There are many types of grease according to various combinations of base oil, thickeners and additives. Grease is usually classified by thickeners and base oil. Table 35 shows the general properties of each type of grease. Reference examples of the lubricant greece brand and performance are shown on page M46.

Table 35 Properties of various types of grease

| Name (Common name)             | Calcium grease                                                                                                                                                          | Sodium grease                                                                                                                                              | Aluminum grease                                                                  | Mixed base grease                 | Barium grease                                                              | Lithium grease                                                |                                                                                                                                               |                                                                               | Non-soap base grease (Non-soap grease)                                                                                                                                                                                   |                            |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                | (Cup grease)                                                                                                                                                            | (Fiber grease)                                                                                                                                             | (Mobile grease)                                                                  |                                   |                                                                            |                                                               | (Diester grease)                                                                                                                              | (Silicon grease)                                                              | (Bentone grease)                                                                                                                                                                                                         |                            |
| Base oil                       | Mineral oil                                                                                                                                                             | Mineral oil                                                                                                                                                | Mineral oil                                                                      | Mineral oil                       | Mineral oil                                                                | Mineral oil                                                   | Diester oil                                                                                                                                   | Silicon oil                                                                   | Mineral oil                                                                                                                                                                                                              | Synthetic oil              |
| Thickener                      | Ca soap                                                                                                                                                                 | Na soap                                                                                                                                                    | Al soap                                                                          | Na + Ca soap, Li + Ca soap        | Ba soap                                                                    | Li soap                                                       | Li soap                                                                                                                                       | Li soap                                                                       | Bentone                                                                                                                                                                                                                  | Silica gel, Polyurea, etc. |
| Appearance                     | Buttery                                                                                                                                                                 | Fibrous and buttery                                                                                                                                        | Stringy and buttery                                                              | Fibrous and buttery               | Fibrous and buttery                                                        | Buttery                                                       | Buttery                                                                                                                                       | Buttery                                                                       | Buttery                                                                                                                                                                                                                  | Buttery                    |
| Pour point °C                  | 80 ~ 90                                                                                                                                                                 | 150 ~ 180                                                                                                                                                  | 70 ~ 90                                                                          | 160 ~ 190                         | 150 ~ 180                                                                  | 170 ~ 190                                                     | 170 ~ 190                                                                                                                                     | 200 ~ 250                                                                     | 200 ~                                                                                                                                                                                                                    | None                       |
| Operating temperature range °C | - 10 ~ + 70                                                                                                                                                             | - 20 ~ + 120                                                                                                                                               | - 10 ~ + 80                                                                      | - 10 ~ + 100                      | - 10 ~ + 135                                                               | - 20 ~ + 120                                                  | - 50 ~ + 120                                                                                                                                  | - 50 ~ + 180                                                                  | - 10 ~ + 150                                                                                                                                                                                                             | ~ + 200                    |
| Pressure resistance            | Strong to weak                                                                                                                                                          | Strong to medium                                                                                                                                           | Strong                                                                           | Strong                            | Strong to medium                                                           | Medium                                                        | Medium                                                                                                                                        | Weak                                                                          | Medium to weak                                                                                                                                                                                                           | Medium                     |
| Water resistance               | Good                                                                                                                                                                    | Poor                                                                                                                                                       | Good                                                                             | Good, poor for Na+ Ca soap grease | Good                                                                       | Good                                                          | Good                                                                                                                                          | Good                                                                          | Good                                                                                                                                                                                                                     | Good                       |
| Mechanical stability           | Fair                                                                                                                                                                    | Good                                                                                                                                                       | Poor                                                                             | Good                              | Poor                                                                       | Excellent                                                     | Excellent                                                                                                                                     | Excellent                                                                     | Good                                                                                                                                                                                                                     | Good to poor               |
| Features and application       | Contains about 1% water. When the temperature rises to more than +80°C, the water evaporates and the grease separates into oil and soap. This is used for medium loads. | Long fibrous grease cannot withstand high speeds, but has good pressure resistance properties. Short fibrous grease is comparatively good for high speeds. | It has water and rust resistant properties, and adheres easily to metal surface. | Usable at fairly high speeds.     | It has water and heat resistant properties. This is an all-purpose grease. | This is the best all-purpose grease among soap based greases. | Excellent under low temperature conditions and has superior frictional properties. Suitable for small bearings used in measuring instruments. | Mainly used for high temperatures. Not suited to high speeds and heavy loads. | Generally good heat resistance. Grease having a mineral base oil is for general use. Grease having a synthetic base oil is suitable for special use where superior heat and chemical resistance properties are required. |                            |

1 Base oil

Petroleum lubricating oil is usually used as the base oil.

As the lubricating performance of grease depends mainly on that of base oil, the viscosity of the base oil is an important property. In general, low viscosity is suitable for light-load and high-speed rotations, and high viscosity for heavy-load and low-speed rotations. Synthetic lubricants of the diester or silicon series are used instead of lubricants of the petroleum series in consideration of the pour point and high temperature stability.

2 Thickener

As shown in Table 35, metal soap bases are mostly used as thickeners. In particular, Na-soap is water-soluble and emulsifies easily, and it cannot be used in damp or wet areas. The type of thickener and the pour point of grease have a close relationship. In general, the higher the pour point, the higher the maximum usable temperature of grease. However, even when the grease uses a thickener having a high pour point, its upper operating temperature limit is low if its base oil has low heat resistance.

3 Consistency

This represents the hardness grade of grease. Grease becomes harder in proportion to the amount of thickener if the same thickener is used. Immediately after grease has been stirred (usually 60 times), a depression is formed in the grease in a specified time using a specified cone. The consistency (combined consistency) is expressed by the value of depth of depression (mm) multiplied by 10. This value gives an estimate of the fluidity during operation with a greater value for softer grease. Table 36 shows the consistency number of grease and the relationship between the consistency and operating conditions.

Table 36 Consistency and operating conditions of grease

| NLGI consistency number | Combined consistency | Application                           |
|-------------------------|----------------------|---------------------------------------|
| 0                       | 385 ~ 355            | For centralized lubrication,          |
| 1                       | 340 ~ 310            | For oscillating motion                |
| 2                       | 295 ~ 265            | For general use                       |
| 3                       | 250 ~ 220            | For general use, For high temperature |
| 4                       | 205 ~ 175            | For sealing with grease               |

4 Additives

Additives include various types of substances, which are added to grease in small quantities to improve its characteristics. For example, when a bearing is kept

running for long periods of time, its temperature rises. This results in oxidation of the lubricant and formation of oxides, which lead to corrosion of the bearing. Thus, when a bearing is to be operated for long periods of time without regreasing, antioxidants are added. In addition, grease containing extreme pressure additives is suitable for use in places that are subjected to heavy loads.

5 Miscibility of different greases

In principle, it is desirable to use grease of the same brand. However, when the mixing of different greases is unavoidable, greases with the same type of thickener and with a similar type of base oil should be used. It should be noted that if different types of grease are mixed, they may interact with each other and the consistency will become softer than that for the individual greases.

Lubricating oil

For rolling bearings, refined mineral oil or synthetic oil is used. To improve its properties, antioxidant additives, extreme pressure additives and detergent additives are added as required. When selecting lubricating oil, it is important to select oil which has adequate viscosity under operating temperatures. If the viscosity is too low, the formation of the oil film will be insufficient, causing abnormal wear and seizure. On the other hand, if the viscosity is too high, it will generate excessive heat or increase power loss due to viscous resistance. As a general standard, oil having higher viscosity should be used for heavier loads and oil having lower viscosity should be used for higher rotational speeds. Under conditions of normal use for various bearings, the values of viscosity shown in Table 37 will be a guideline. The relationship between viscosity and temperature can be obtained from Fig. 25. Also, Table 38 shows examples of selecting lubricating oil according to the conditions of bearing use.

Table 37 Bearing series and required viscosity of lubricating oil

| Bearing series                                          | Kinematic viscosity at operating temperatures |
|---------------------------------------------------------|-----------------------------------------------|
| Needle roller bearings<br>Roller bearings               | 13 mm <sup>2</sup> /s or more                 |
| Crossed roller bearings                                 | 20 mm <sup>2</sup> /s or more                 |
| Thrust needle roller bearings<br>Thrust roller bearings | 32 mm <sup>2</sup> /s or more                 |

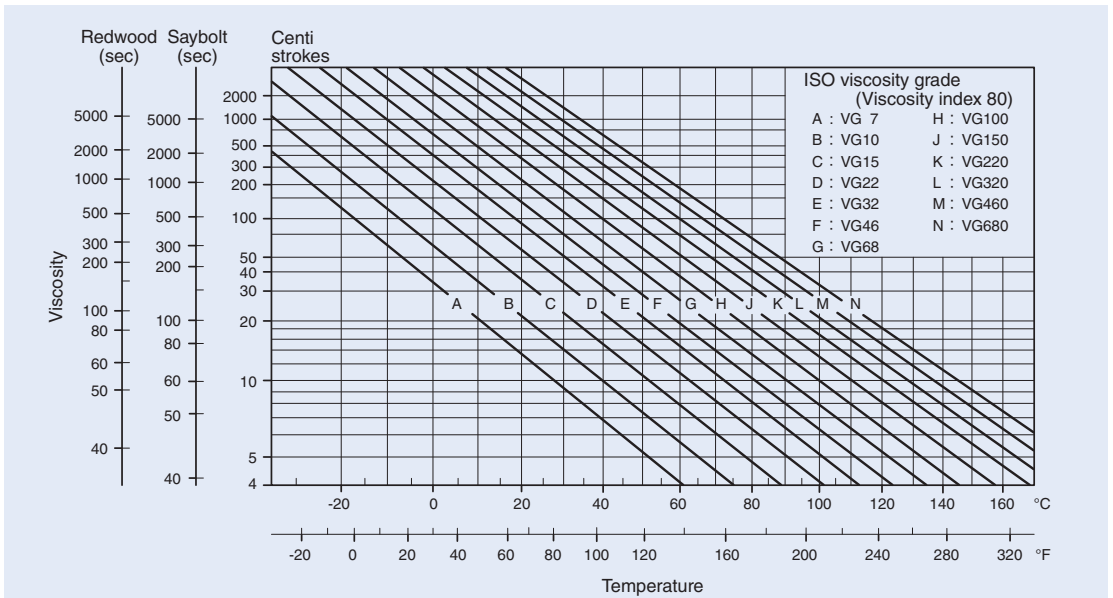


Fig. 25 Relationship between viscosity and temperature of lubricating oil

Table 38 Conditions of bearing use and examples of lubricating oil selection

| Conditions            |            | ISO viscosity grade(VG) |    |    |    |    |    |     |     |     |     |     |     |
|-----------------------|------------|-------------------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
|                       |            | 10                      | 15 | 22 | 32 | 46 | 68 | 100 | 150 | 220 | 320 | 460 | 680 |
| Operating temperature | - 30 ~ 0°C | Refrigerator oil        |    |    |    |    |    |     |     |     |     |     |     |
|                       | 0 ~ 50°C   | Bearing oil             |    |    |    |    |    |     |     |     |     |     |     |
|                       | 50 ~ 80°C  | Bearing oil             |    |    |    |    |    |     |     |     |     |     |     |
|                       | 80 ~ 110°C | Bearing oil             |    |    |    |    |    |     |     |     |     |     |     |
| $d_m n$ value         |            | Large                   |    |    |    |    |    |     |     |     |     |     |     |
| Load                  |            | Small                   |    |    |    |    |    |     |     |     |     |     |     |

Remarks · Lubricating oils are based on JIS K 2211 (Refrigerating machine oils), JIS K 2239 (Bearing Oil), JIS K 2213 (Turbine Oil), and JIS K 2219 (Gear Oil).  
· The method of lubrication in these cases is mainly oil bath lubrication or circulating lubrication.  
· When the temperature is on the high side within the operating temperature range, oils of high viscosity are used.  
·  $d_m n$  represents the mean value of the bore and outside diameters (mm) of the bearing multiplied by the rotational speed (min<sup>-1</sup>).

C-Lube Bearing

IKO C-Lube Bearing is a bearing that is lubricated with a newly developed thermosetting solid-type lubricant. A large amount of lubricating oil and fine particles of ultra high molecular weight polyolefin resin are solidified by heat treatment to fill the inner space of the bearing. As the bearing rotates, the lubricating oil oozes out onto the raceway in proper quantities, maintaining the lubrication performance for a long period of time.

The dimension tables for C-Lube Machined Type Needle Roller Bearings, C-Lube Cam Followers, and C-Lube Roller Followers are shown on pages D77, I55, and I99.

C-Lube Bearing is available in all Needle Roller Bearing series. Also C-Lube Bearings for food processing are available, using NSF H1-certified lubrication oil and resin compliant with FDA standards to mitigate any effect on human health. If needed, please contact IKO.

Features of C-Lube Bearing

- Most suitable for preventing grease dry-up in applications where lubrication is difficult.
- Great reduction of maintenance work by extending the lubrication interval.
- Elimination of oil contamination, making this bearing most suitable for applications that would be adversely affected by oil.

Cautions for using C-Lube Bearing

- Never wash C-Lube Bearing with organic solvent and/or white kerosene which have the ability to remove fat, or leave the bearing in contact with these agents.
- The operating temperature range is -15 ~ +80°C. For continuous operation, the recommended operating temperature is +60°C or less.

- To ensure normal rotation of the bearing, apply a load of 1% or more of the basic dynamic load rating at use.
- The allowable rotational speed is different from that of the general needle roller bearings. For  $d_m n$ ,  $d_1 n$ , and  $dn$ , use the values in Table 39 or less as guidelines.

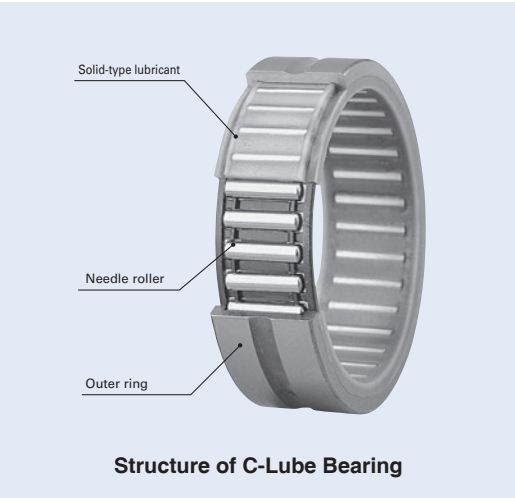


Table 39 C-Lube Bearing  $d_m n$ ,  $d_1 n$ ,  $dn$

| Representative model                        |                 | Allowable rotational speed                                            |
|---------------------------------------------|-----------------|-----------------------------------------------------------------------|
|                                             | Main model code | $d_m n$ <sup>(1)</sup> , $d_1 n$ <sup>(2)</sup> , $dn$ <sup>(3)</sup> |
| C-Lube Machined Type Needle Roller Bearings | TAF···/SG       | $d_m n=20\ 000$                                                       |
| C-Lube Cam Followers                        | CF···/SG        | $d_1 n=10\ 000$                                                       |
| C-Lube Roller Followers <sup>(4)</sup>      | NART···/SG      | $dn = 8\ 000$                                                         |

Notes<sup>(1)</sup>  $d_m n = (\text{bore diameter of bearing} \text{ [mm]} + \text{outside diameter of bearing} \text{ [mm]}) / 2 \times \text{rotational speed} \text{ [min}^{-1}\text{]}$

<sup>(2)</sup>  $d_1 n = \text{stud diameter} \text{ [mm]} \times \text{rotational speed} \text{ [min}^{-1}\text{]}$

<sup>(3)</sup>  $dn = \text{inner ring bore diameter} \text{ [mm]} \times \text{rotational speed} \text{ [min}^{-1}\text{]}$

<sup>(4)</sup> The allowable rotational speed of C-Lube Roller Followers is applicable to use with oscillating rotation. For use with one-way or continuous rotation, please consult IKO.

Friction and Allowable Rotational Speed

Friction

Compared with sliding bearings, the starting (static) friction for rolling bearings is small, and the difference between the starting (static) friction and the kinetic friction is also small. The loss of power and temperature rise in machines are thus reduced, improving the mechanical efficiency.

Frictional torque is influenced by the bearing type, bearing load, rotational speed, lubricant characteristics, etc. It varies according to the lubricant when operated under light-loads and high-speed conditions, and according to the load when operated under heavy-loads and low-speed conditions.

Frictional torque of rolling bearings is complicated because it is influenced by various factors, but for convenience, it can be expressed approximately by the following equations.

· Radial bearings  $M = \mu P \frac{d}{2} \dots\dots\dots(37)$

· Thrust bearings  $M = \mu P \frac{d_m}{2} \dots\dots\dots(38)$

where,  $M$  : Frictional torque, N-mm  
 $\mu$  : Coefficient of friction  
 $P$  : Bearing load, N  
 $d$  : Bearing bore diameter, mm  
 $d_m$  : Mean value of bearing bore and outside diameters, mm

The approximate coefficients of friction of IKO Bearings under operating conditions, in which lubrication and mounting are correct and where loads are relatively large and stable, are shown in Table 40.

Table 40 Coefficient of friction

| Bearing series                         | $\mu$           |
|----------------------------------------|-----------------|
| Needle roller bearings with cage       | 0.0010 ~ 0.0030 |
| Full complement needle roller bearings | 0.0030 ~ 0.0050 |
| Thrust needle roller bearings          | 0.0030 ~ 0.0040 |
| Thrust roller bearings                 | 0.0030 ~ 0.0040 |

Allowable rotational speed

As the rotational speed of rolling bearings is increased, the bearing temperature also increases due to the heat generated at the contact surfaces between the cage, raceways and rolling elements, until it finally leads to bearing seizure. It is therefore necessary to maintain the rotational speed of a bearing below a certain limit value to ensure safe operation for long periods. This limit value is called the allowable rotational speed.

Since the amount of heat generated is approximately proportional to the sliding speed at the contact area, this sliding speed is an approximate guide indicating the limit of the bearing rotational speed.

The allowable rotational speed of bearings thus varies according to the bearing type, size, bearing load, method of lubrication, radial clearance, and other such factors.

The allowable rotational speeds shown in the table of dimensions are empirical values. They are not absolute values and can be changed according to the bearing use conditions. Depending on the structure and accuracy around the bearing, the lubricant and the lubrication method, it is possible for some bearings to be operated at more than twice the allowable rotational speed given in the table without trouble.

|   |
|---|
| A |
| B |
| C |
| D |
| E |
| F |
| G |
| H |
| I |
| J |
| K |
| L |
| M |

## Operating Temperature Range

The allowable operating temperature range for needle roller bearings is generally  $-20 \sim +120^{\circ}\text{C}$ .

When operating at temperatures outside this range, the operation may be limited by the allowable temperature range of prepacked grease, seal, cage material, etc. Further, if the bearing is used at high temperature, i.e.  $120^{\circ}\text{C}$  or above, the amount of dimensional displacement gets larger. So special heat treatment is necessary.

The operating temperature range for some types of bearings is different from the above. See the section for each bearing.

## Handling of Bearings

### Precautions in handling

Since the bearing is a high-accuracy mechanical element, special attention must be paid to its handling. The following precautions should be noted when handling the bearings.

**① Bearings and their surrounding parts should be kept clean.** Bearings and their surrounding parts must be kept clean paying special attention to dust and dirt. Tools and the working environment should also be cleaned.

**② Bearings should be handled carefully.** A shock load during handling may cause scratches, indentations and even cracks or chips on the raceway surfaces and rolling elements.

**③ Bearings should be mounted or dismounted with proper tools.** When mounting and dismounting, tools suitable for the bearing type should be used.

**④ Bearings should be protected against corrosion.** Bearings are treated with anti-corrosive oil. However, when handling them with bare hands, sweat from the hands may result in future rust formation. Gloves should be worn, or hands should be dipped in mineral oil.

### Storage

Store bearings laid flat indoors, placed in the packing/ packaging provided by IKO. Avoid storing in high temperatures, low temperatures, and high humidity. In products pre-packed with lubricant, the lubricant will deteriorate with age if products are stored for a long time. Be sure to reapply lubricant before use.

### Mounting

#### Preparation

Before mounting the bearing, the dimensions and fillets of the shaft and housing should be checked to ensure that they conform to specifications.

Bearings should be unwrapped just before mounting. In case of grease lubrication, bearings should be filled with grease without cleaning the bearings. Even in the case of oil lubrication, it is normally unnecessary to clean the bearings. However, when high accuracy is required or when using at high speeds, the bearings should be cleaned using cleaning oil to remove thoroughly oily contents. The cleaned bearings should not be left alone without anti-corrosive precautions, because bearings can easily be corroded after anti-corrosive agents are removed.

Lubricating grease is prepacked in some types of

bearings. Therefore, refer to the relevant section for each bearing.

### Methods of mounting

Mounting methods of bearings are different according to the type of bearing and the fit. In general, mounting of needle roller bearings is comparatively easy. However, non-separable bearings with large interferences should be handled with great care.

#### ① Mounting by press fit

Small and medium bearings with small interferences require a small pressing-in force for mounting, and they are mounted using a press at room temperature. The bearing should be pressed in carefully, applying a force evenly to the bearing with a fitting tool as shown in Fig. 26. For separable bearings, the inner and outer rings can be mounted separately, and the mounting work is simple. However, when installing the shaft and inner ring assembly into the outer ring, care should be taken not to damage the raceway surfaces and rolling elements.

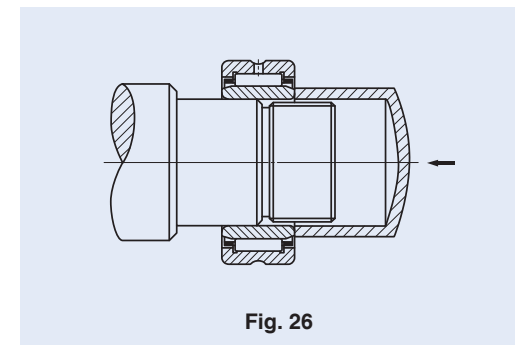


Fig. 26

When mounting non-separable bearings, the inner and outer rings are pressed in simultaneously by applying a cover plate as shown in Fig. 27. It must never happen that the inner ring is press-fitted to the shaft by striking the outer ring, or the outer ring by striking the inner ring, because the raceway surfaces and rolling elements will be scratched or indented.

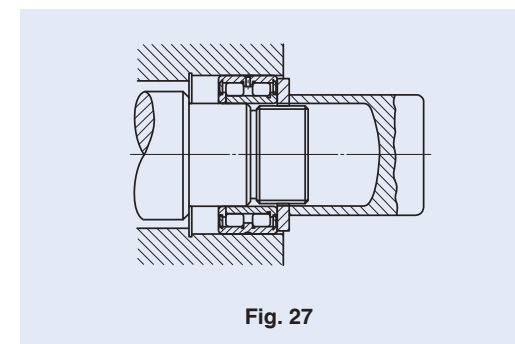


Fig. 27

When press fitting, the friction of the fitting surfaces can be reduced by applying high viscosity oil over the fitting surfaces.

The pressing-in or pulling-out force to be applied to the bearing is given on page A59.

#### ② Mounting by shrink fitting

This method is used when the interference is great or when a large bearing is to be fitted. The housing is heated and thermally expanded when fitting the outer ring to the housing and the inner ring is heated and expanded when fitting it to the shaft allowing the bearing to be set easily within a short time. The maximum allowable temperature for the shrink fit is  $+120^{\circ}\text{C}$ , and heating should be performed appropriately. Pure non-corrosive mineral oil is recommended as the heating oil for shrink fit, and insulation oil for transformers is considered to be the best. During cooling, the bearing also shrinks in the axial direction. Therefore, to ensure that there is no clearance between the bearing and the shoulder, an axial force must be applied continuously to the bearing until it has cooled.

When the interference between the outer ring and the housing is great, an expansion fit method in which the bearing is cooled using dry ice or other cooling agent before fitting can be used. Immediately after fitting, however, moisture from the air easily condenses on the bearing. Therefore, it is necessary to take preventive measures against corrosion.

## Pressing force and pulling force

Guidelines for the pressing force when pressing in the inner ring to the shaft and the pulling force when pulling it out are obtained from the following equation.

$$K = f_k \frac{d}{d + 2} \Delta_{df} B \left\{ 1 - \left( \frac{d}{F} \right)^2 \right\} \dots\dots\dots (39)$$

where,  $K$  : Pressing or pulling force, N  
 $f_k$  : Resistance factor determined by the coefficient of friction  
 When pressing in inner ring to shaft,  $f_k = 4 \times 10^{-4}$   
 When pulling out inner ring from shaft,  $f_k = 6 \times 10^{-4}$   
 $d$  : Bore diameter of inner ring, mm  
 $\Delta_{df}$  : Apparent interference, mm  
 $B$  : Width of inner ring, mm  
 $F$  : Outside diameter of inner ring, mm

The actual pressing force or pulling force may be greater than the calculated value due to mounting errors. When designing a puller, it is necessary that the puller has the strength (rigidity) to withstand more than 5 times the calculated value.

## Running test

After mounting the bearing, a running test is carried out to check whether the mounting is normal. Usually, it is first checked by manual turning. Then, it is operated by power gradually from no-load and low-speed up to normal operating conditions to check for abnormalities.

Noise can be checked by using a soundscope or similar instrument. In this test, checks are carried out for the following abnormalities.

### ① Manual turning

- (a) Uneven torque ..... Improper mounting
- (b) Sticking and rattling ... Scratches or indentations on the raceway surface
- (c) Irregular noise ... Penetration of dust or foreign particles

### ② Power running

- (a) Abnormal noise or vibration ... Indentations on the raceway surface, too great clearance
- (b) Abnormal temperature ... Unsuitable lubricant, improper mounting, too small clearance

## Dismounting

Dismounting of the bearings is carried out for the periodic inspection or repairs of machines. By inspecting the bearing, related parts or mechanisms, lubrication, etc., important data is obtained. In the same manner as in mounting, care should be taken to prevent damage to the bearing or other parts.

A suitable dismounting method should be selected according to the type of the bearing, fit, etc. Bearings mounted by interference fit are especially difficult to dismount, and it is necessary to give due consideration to the structure around the bearing during the design stage.

### Dismounting of outer ring

Outer rings mounted by interference fit are dismounted as shown in Fig. 28, by screwing in the push-out bolts evenly through several screw holes provided at places corresponding to the side face of the outer ring.

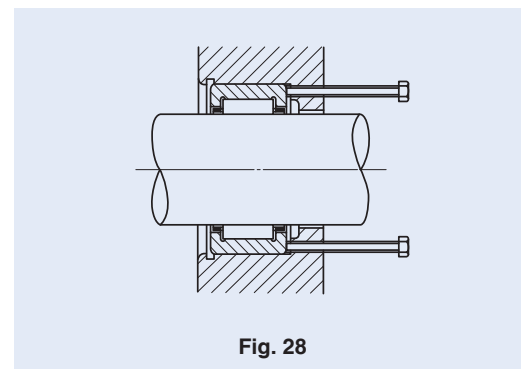


Fig. 28

### Dismounting of inner ring

In the case of bearings such as needle roller bearings in which the inner and outer rings are separable, the simplest way to press out the inner ring is by using a press as shown in Fig. 29.

The puller shown in Fig. 30 is also generally used. This is designed according to the bearing size. In addition, there are a 3-hook puller (Fig. 31) and a 2-hook puller for wide-range use.

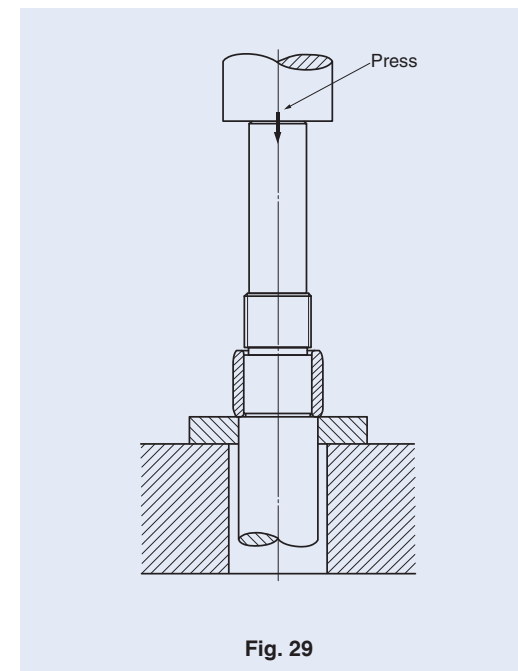


Fig. 29

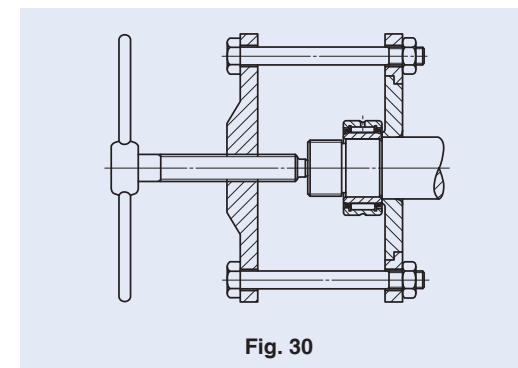


Fig. 30

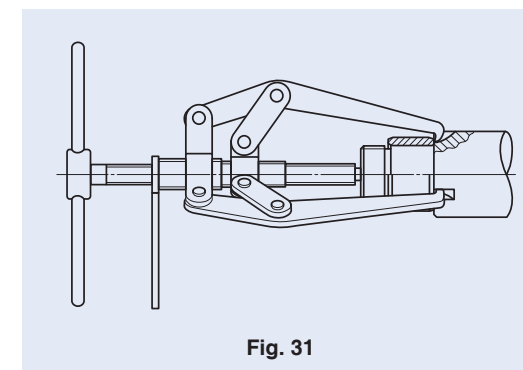


Fig. 31

In addition to these, when it is difficult to remove the inner ring due to high shoulders, several holes for removal pins are made through the shoulder, or several hook grooves are cut in the shoulder as shown in Fig. 32 and Fig. 33.

When a bearing is not to be used again after removal, it may be removed by heating with a torch lamp.

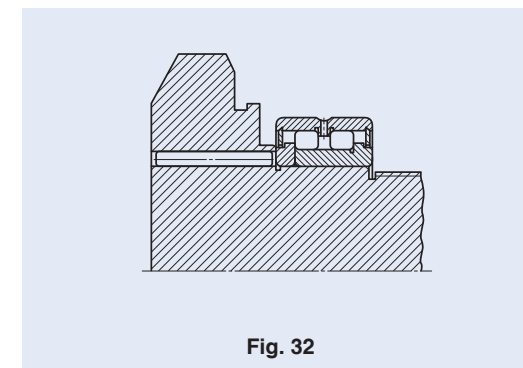


Fig. 32

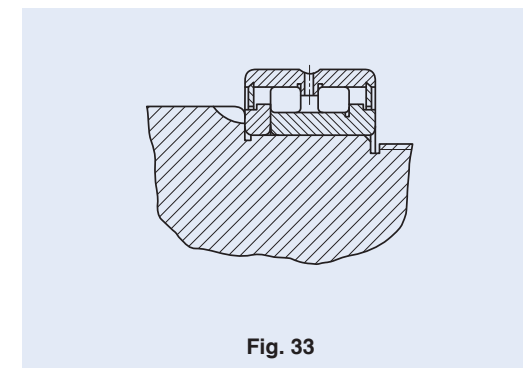


Fig. 33

Inspection of bearing

Cleaning of bearing

When inspecting a bearing after removal, the appearance of the bearing should be recorded first. Then, after the residual amount of lubricant is checked and a sample of lubricant is collected, the bearing should be cleaned.

For cleaning, light oil or kerosene is commonly used. Cleaning is divided into rough cleaning and final cleaning, and wire gauze is set as a raised bottom in a container to prevent the bearing from touching the bottom of the container.

Lubricating grease and adhering substances such as foreign particles are removed with a brush, etc., using oil for rough cleaning. Care should be taken during this process, because if the bearing is turned with foreign particles attached, the raceway surfaces may be scratched.

Final cleaning is carried out by turning the bearing in cleaning oil. It is desirable that the cleaning oil is kept clean by filtering. Immediately after cleaning, the bearing must be protected against corrosion.

Inspection and evaluation of bearing

The judgement as to whether the removed bearing is reusable depends on the inspection after cleaning. Conditions of the raceway surfaces, rolling elements and fitting surfaces, wear condition of the cage, increase of bearing clearance, dimensions, rotational accuracy, etc. should be checked for damage and abnormalities.

The evaluation is performed based on the experience taking into consideration the degree of damage, machine performance, importance of the machine, operating conditions, period until the next inspection, and other such factors.

Maintenance and inspection

Maintenance and inspection

Maintenance and inspection are carried out to maintain good performance of bearings installed in the machine.

Maintenance is performed by checking the machine operating conditions, checking and replenishing or replacing the lubricant, checking the bearing and related parts by periodic disassembly and other such procedures.

Items for inspection of a running bearing in a machine include the bearing temperature, noise, vibration and condition of lubricant.

When any abnormality is found during operation, the cause should be investigated and measures taken by referring to the section on running test on page A59. When removing a bearing, refer to the section on dismounting on page A59.

Damage, causes and corrective action

Rolling bearings can generally be used fully up to their rolling fatigue life if they are properly selected, mounted, operated and maintained. However, they may actually be damaged earlier than their expected lifetimes creating problems or accidents. Common causes of damage include improper mounting or handling, insufficient lubrication and penetration of foreign particles.

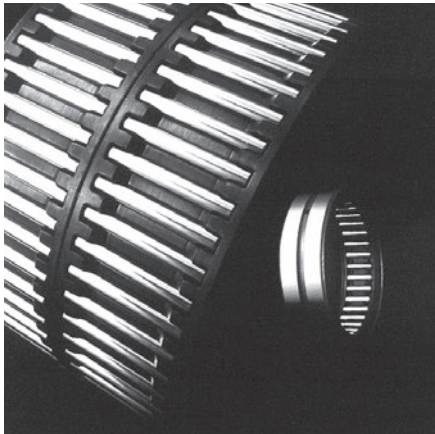
It may be difficult to determine the exact cause of a problem by checking only the damaged bearing. The conditions of the machine before and after the occurrence of the damage, the location and the operating and ambient conditions of the bearing, the structure around the bearing, etc. should also be examined. It then becomes possible to assess the cause of the damage by linking the conditions of the damaged bearing to the probable causes arising from the machine operation, and to prevent the recurrence of similar problems.

Common types of damage, causes and corrective action are listed in Table 41.

Table 41 Damage, causes and corrective action

| Condition of bearing damage |                                                                                                                               | Cause                                                                                                                                                            | Corrective action                                                                                                                                                              |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flaking                     | Flakings at opposite circumferential positions on raceway surfaces                                                            | Improper roundness of housing bore                                                                                                                               | Correction of housing bore accuracy                                                                                                                                            |
|                             | Flakings in the vicinity of raceway surface edges and roller ends                                                             | Improper mounting, Shaft deflection, Poor centering, Poor accuracy of shaft or housing                                                                           | Careful mounting, Careful centering, Correction of shoulders of shaft and housing for right angles                                                                             |
|                             | Flakings on raceway surfaces with an interval corresponding to roller pitch                                                   | Great shock load when mounting, Rusting during machine stoppage                                                                                                  | Careful mounting, Protection against rust for long periods of machine stoppage                                                                                                 |
|                             | Early flaking on raceway surfaces and rolling elements                                                                        | Too small clearance, Too great load, Poor lubrication, Rusting, etc.                                                                                             | Correct selection of fit and clearance<br>Correct selection of lubricant                                                                                                       |
| Galling                     | Galling on raceway surfaces and rolling surfaces of rollers                                                                   | Poor lubrication in early stage<br>Grease consistency too hard<br>High acceleration at start                                                                     | Selection of softer grease,<br>Avoiding quick acceleration                                                                                                                     |
|                             | Galling between roller end faces and collar guide surfaces                                                                    | Poor lubrication, Poor mounting,<br>Large axial load                                                                                                             | Correct selection of lubricant<br>Correct mounting                                                                                                                             |
| Breakage                    | Cracks in outer or inner ring                                                                                                 | Excessive shock load, Too much interference.<br>Poor cylindricity of shaft. Too large fillet radius,<br>Development of thermal cracks,<br>Development of flaking | Reevaluation of load conditions, Correction of fit,<br>Correction of machining accuracy of shaft or sleeve, Making fillet radius smaller than the chamfer dimension of bearing |
|                             | Cracked rolling elements, broken collar                                                                                       | Development of flaking<br>Shock to collar when mounting,<br>Dropped by careless handling                                                                         | Careful handling and mounting                                                                                                                                                  |
|                             | Broken cage                                                                                                                   | Abnormal load to cage by poor mounting,<br>Poor lubrication                                                                                                      | Minimizing mounting errors,<br>Study of lubricating method and lubricant                                                                                                       |
| Dent                        | Indentations on raceway surfaces at an interval corresponding to the pitch between rolling elements (brinelling)              | Shock load applied when mounting,<br>Excessive load while stopping                                                                                               | Careful handling                                                                                                                                                               |
|                             | Indentation on raceway surfaces and rolling surfaces of rollers                                                               | Biting of foreign substances such as metal chips and sands                                                                                                       | Cleaning of housing, Improvement of sealing,<br>Use of clean lubricant                                                                                                         |
| Abnormal wear               | False brinelling<br>(Phenomenon like brinelling)                                                                              | Vibration when the bearing is stationary such as during transportation,<br>Oscillating motion with small amplitude                                               | Fixing of shaft and housing,<br>Use of lubricating oil,<br>Application of preload to reduce vibration                                                                          |
|                             | Fretting<br>Localized wear of fitted surfaces accompanied by red-brown wear particles                                         | Sliding between fitted surfaces                                                                                                                                  | Increase of interference,<br>Application of oil                                                                                                                                |
|                             | Wear on raceway surfaces, collar surfaces, rolling surfaces of rollers, cages, etc.                                           | Penetration of foreign particles, Poor lubrication, Rust                                                                                                         | Improvement of sealing, Cleaning of housing<br>Use of clean lubricant                                                                                                          |
|                             | Creep<br>Wear on fitted surfaces                                                                                              | Sliding between fitted surfaces,<br>Insufficient tightening of sleeve                                                                                            | Increase of interference,<br>Correct tightening of sleeve                                                                                                                      |
| Seizure                     | Discoloration of rolling elements and/or raceway surfaces and/or flange surfaces, Adhesion and welding, Discoloration of cage | Poor lubrication, Too small clearance, Poor mounting                                                                                                             | Supply of proper amount of proper lubricant,<br>Rechecking of fit and bearing clearance<br>Rechecking of mounting dimensions and related parts                                 |
| Electric corrosion          | Ripples on raceway surfaces                                                                                                   | Melting by sparks due to electric current                                                                                                                        | Insulation of bearing,<br>Grounding to avoid electric current                                                                                                                  |
| Rust, corrosion             | Rust or corrosion on bearing inside surfaces or on fitted surfaces                                                            | Condensation of vapor in air,<br>Penetration of corrosive substances                                                                                             | Careful storage if under high temperature and high humidity, Protection against rust,<br>Improvement of sealing                                                                |

Description of Each Series  
&  
Table of Dimensions



|                                                |                                      |     |
|------------------------------------------------|--------------------------------------|-----|
| Shell Type Needle Roller Bearings              | TA·TLA·BA·BHA                        | B1  |
| Needle Roller Cages for general usage          | KT                                   | C1  |
| Needle Roller Cages for engine connecting rods | KT···EG·KTV···EG                     | C17 |
| Machined Type Needle Roller Bearings           | NA·TAFI·TRI·BRI                      | D1  |
| C-Lube Machined Type Needle Roller Bearings    | TAF···/SG                            | D75 |
| Needle Roller Bearings with separable cage     | NAF                                  | D79 |
| Roller Bearings                                | NAG·NAU·TRU·NAS                      | E1  |
| Thrust Bearings                                | NTB·AS·AZK·WS·GS                     | F1  |
| Combined Type Needle Roller Bearings           | NAX·NBX·NATA·NATB                    | G1  |
| Inner Rings                                    | IRT·IRB·LRT·LRB                      | H1  |
| Cam Followers                                  | CF···B·CFKR·CFS·NUCF···B·CR          | I1  |
| C-Lube Cam Followers                           | CF···/SG                             | I55 |
| Roller Followers                               | NAST·NART·NURT·CRY                   | I81 |
| C-Lube Roller Followers                        | NART···/SG                           | I99 |
| Crossed Roller Bearings                        | CRBHV·CRBFV·CRBC·CRB·CRBT·CRBTF·CRBS | J1  |
| Spherical Bushings                             | SB·GE·SBB                            | K1  |
| Pilloballs                                     | PB·PHS·POS·PHSA                      | K29 |
| L-balls                                        | LHSA·LHS                             | K45 |
| Super Flexible Nozzles                         | SNA·SNM·SNPT                         | K55 |
| Parts For Needle Roller Bearings               | OS·DS·WR·AR·Needle Roller            | L1  |

# SHELL TYPE NEEDLE ROLLER BEARINGS

- Shell Type Caged Needle Roller Bearings
- Shell Type Grease Retained Full Complement Needle Roller Bearings



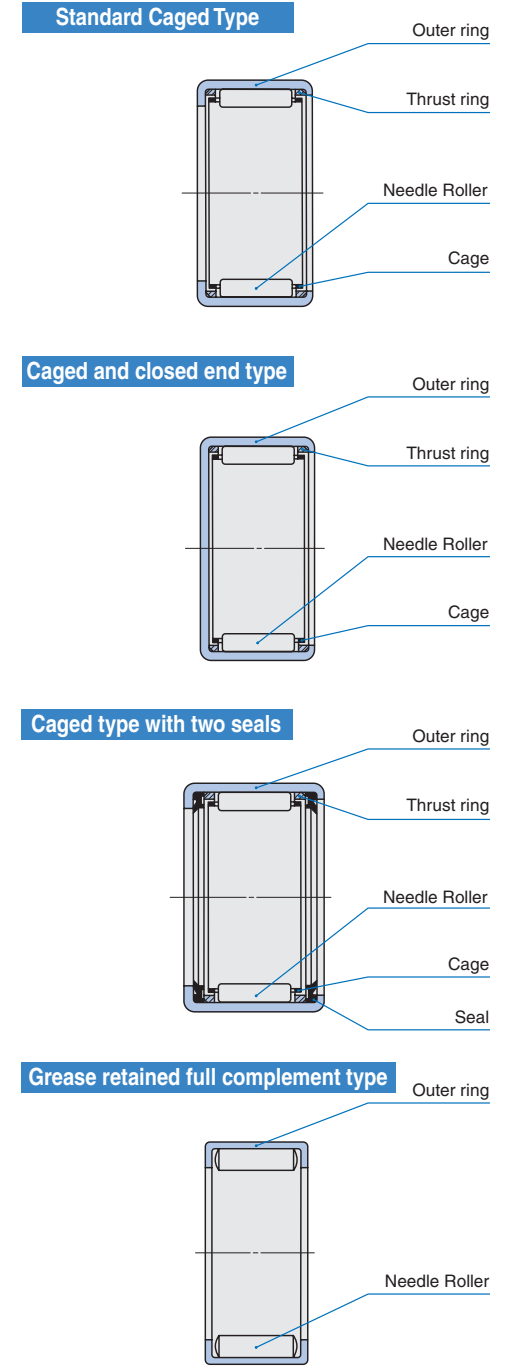
## Structure and features

IKO Shell Type Needle Roller Bearings are light-weight bearings with large load ratings. They employ a shell type outer ring made from a thin special-steel plate which is accurately drawn, carburized and quenched, thus providing the lowest sectional height among the needle roller bearings.

There are two types of bearings available in this series; the caged type and the full complement type. The appropriate type can be selected according to the operating conditions. The caged type has a structure in which the needle rollers are accurately guided by the cage and thrust rings. It is useful for applications at high-speed rotation. The full complement type needle roller bearing, on the other hand, is suitable for heavy-load applications at low-speed rotation.

Since these bearings are press-fitted into the housing, no fixtures for axial positioning are needed. They are ideal for use in mass-produced articles that require economy, and have a wide variety of applications.

### Structures of Shell Type Needle Roller Bearings



Types

Numerous varieties of Shell Type Needle Roller Bearings are available as shown in Table 1.

Table 1 Type of bearing

| Type          |            | Caged     |            |                           | Full complement |
|---------------|------------|-----------|------------|---------------------------|-----------------|
|               |            | Standard  | Closed end | With seals <sup>(1)</sup> |                 |
| Series        |            |           |            |                           |                 |
| Metric series | —          | TLA ... Z | TLAM       | TLA ... UU                | YTL             |
|               | Heavy duty | TA ... Z  | TAM        | —                         | YT              |
| Inch series   | —          | BA ... Z  | BAM        | —                         | YB              |
|               | Heavy duty | BHA ... Z | BHAM       | —                         | YBH             |

Note<sup>(1)</sup> When the heavy duty type with seals or the closed end type with one seal is required, please consult IKO.  
Remark A "W" is added to the model code to indicate that the rolling elements are of the double-row type.  
Example TAW 5045 Z

Shell Type Caged Needle Roller Bearings

Standard type

This type has a narrow gap between the bore of the marked-side flange of the outer ring (brand, bearing number, etc. are marked) and the shaft, which prevents grease leaks and the entry of foreign particles. This type has wide applications.

Closed end type

This type is completely closed on one side of the outer ring, and is ideal for use when perfect closing of shaft ends is desired.  
The shape of the closed end surface of the outer ring is divided into two types, and the dimensions  $t_1$  and  $t_2$  in the illustrations shown in the dimension tables apply to the bearings with the roller set bore diameters,  $F_w > 22$  and  $F_w \leq 22$ , respectively.

Type with seals at both sides

This type has a wider outer ring than the standard type and is installed with seals consisting of a reinforcing ring and special synthetic rubber to prevent grease leaks and the entry of foreign particles.

Shell Type Grease Retained Full Complement Needle Roller Bearings

This type has full complement rollers which extend to the full width of the outer ring raceway. It can, therefore, withstand heavy bearing loads and is most suitable for low and medium rotational speeds as well as rocking motions. As lubricating grease is prepacked with the rollers, the bearing can be operated immediately after being fitted.

Identification Number

The identification number of Shell Type Needle Roller Bearings consists of a model code and dimensions. Examples of the arrangement are shown below. When using with inner rings, the assembled inner rings shown in the dimension tables are used. An example in this case is also shown below. Inner rings are delivered separately.

Examples of identification number

Example 1

Model code

Dimensions

TA 18 20 Z

Type of bearing

Roller set bore diameter (18mm)

Outer ring width (20mm)

Example 2 (With inner ring)

Identification number of Shell Type Needle Roller Bearing

Identification number of Inner Ring

TA 1820 Z + IRT 1520

Accuracy

The outer rings of Shell Type Needle Roller Bearings are thin and therefore cannot avoid deformation due to heat treatment. It is thus not appropriate to take direct measurements of the bearing. The roller set bore diameter is measured using a plug gauge or tapered gauge after press-fitting the bearing to a suitable ring gauge. The gauge specifications are shown in Tables 2.1 and 2.2.  
Tolerances of outer ring width  $C$  are shown in Table 3.

Table 2.1 Measuring gauges for metric series bearings unit: mm

| $F_w$<br>Nominal roller set bore diameter | Ring gauge                                     |                                                | Plug gauge |        |
|-------------------------------------------|------------------------------------------------|------------------------------------------------|------------|--------|
|                                           | TA...Z <sup>(1)</sup>                          | TLA...Z <sup>(2)</sup>                         | Go         | No-go  |
| 4                                         | —                                              | 7.981                                          | 4.004      | 4.016  |
| 5                                         | —                                              | 8.981                                          | 5.004      | 5.016  |
| 6                                         | —                                              | 9.981                                          | 6.004      | 6.016  |
| 7                                         | —                                              | 10.977                                         | 7.005      | 7.020  |
| 8                                         | 14.992                                         | 11.977                                         | 8.005      | 8.020  |
| 9                                         | 15.992                                         | 12.977                                         | 9.005      | 9.020  |
| 10                                        | 16.992                                         | 13.977                                         | 10.005     | 10.020 |
| 12                                        | 18.991                                         | 15.977 <sup>(3)</sup><br>17.977 <sup>(3)</sup> | 12.006     | 12.024 |
| 13                                        | —                                              | 18.972                                         | 13.006     | 13.024 |
| 14                                        | 21.991                                         | 19.972                                         | 14.006     | 14.024 |
| 15                                        | 21.991                                         | 20.972                                         | 15.006     | 15.024 |
| 16                                        | 23.991                                         | 21.972                                         | 16.006     | 16.024 |
| 17                                        | 23.991                                         | 22.972                                         | 17.006     | 17.024 |
| 18                                        | 24.991                                         | 23.972                                         | 18.006     | 18.024 |
| 19                                        | 26.991                                         | —                                              | 19.007     | 19.028 |
| 20                                        | 26.991 <sup>(4)</sup><br>27.991 <sup>(4)</sup> | 25.972                                         | 20.007     | 20.028 |
| 21                                        | 28.991                                         | —                                              | 21.007     | 21.028 |
| 22                                        | 28.991 <sup>(5)</sup><br>29.991 <sup>(5)</sup> | 27.972                                         | 22.007     | 22.028 |
| 24                                        | 30.989 <sup>(6)</sup><br>31.989 <sup>(6)</sup> | —                                              | 24.007     | 24.028 |
| 25                                        | 32.989                                         | 31.967                                         | 25.007     | 25.028 |
| 26                                        | 33.989                                         | —                                              | 26.007     | 26.028 |
| 28                                        | 36.989                                         | 34.967                                         | 28.007     | 28.028 |
| 29                                        | 37.989                                         | —                                              | 29.007     | 29.028 |
| 30                                        | 39.989                                         | 36.967                                         | 30.007     | 30.028 |
| 32                                        | 41.989                                         | —                                              | 32.009     | 32.034 |
| 35                                        | 44.989                                         | 41.967                                         | 35.009     | 35.034 |
| 37                                        | 46.989                                         | —                                              | 37.009     | 37.034 |
| 38                                        | 47.989                                         | —                                              | 38.009     | 38.034 |
| 40                                        | 49.989                                         | 46.967                                         | 40.009     | 40.034 |
| 45                                        | 54.988                                         | 51.961                                         | 45.009     | 45.034 |
| 50                                        | 61.988                                         | 57.961                                         | 50.009     | 50.034 |
| 55                                        | 66.988                                         | 62.961                                         | 55.010     | 55.040 |
| 60                                        | 71.988                                         | —                                              | 60.010     | 60.040 |
| 62                                        | 73.988                                         | —                                              | 62.010     | 62.040 |
| 65                                        | 76.988                                         | —                                              | 65.010     | 65.040 |
| 70                                        | 81.987                                         | —                                              | 70.010     | 70.040 |

Notes<sup>(1)</sup> Also applicable to TAM and YT  
<sup>(2)</sup> Also applicable to TLAM, YTL, TLA...UU  
<sup>(3)</sup> The upper value is for TLA 1210Z model, and the lower value is for TLA 1212Z model.  
<sup>(4)</sup> The lower value is for TA 202820Z model, and the upper value is for models other than TA 202820Z model.  
<sup>(5)</sup> The lower value is for TA 223016Z and TA 223020Z models, and the upper value is for models other than those models.  
<sup>(6)</sup> The lower value is for TA 243216Z and TA 243220Z models, and the upper value is for models other than those models.

Table 2.2 Measuring gauges for inch series bearings unit: mm

| $F_w$<br>Nominal roller set bore diameter | Ring gauge            |                        | Plug gauge |        |
|-------------------------------------------|-----------------------|------------------------|------------|--------|
|                                           | BA...Z <sup>(1)</sup> | BHA...Z <sup>(2)</sup> | Go         | No-go  |
| 3.969                                     | 7.155                 | —                      | 3.990      | 4.016  |
| 4.762                                     | 8.730                 | —                      | 4.783      | 4.808  |
| 6.350                                     | 11.125                | —                      | 6.388      | 6.414  |
| 7.938                                     | 12.713                | 14.300                 | 7.976      | 8.001  |
| 9.525                                     | 14.300                | 15.888                 | 9.563      | 9.588  |
| 11.112                                    | 15.888                | 17.475                 | 11.151     | 11.176 |
| 12.700                                    | 17.475                | 19.063                 | 12.738     | 12.764 |
| 14.288                                    | 19.063                | 20.650                 | 14.326     | 14.351 |
| 15.875                                    | 20.650                | 22.238                 | 15.913     | 15.938 |
| 17.462                                    | 22.238                | 23.825                 | 17.501     | 17.526 |
| 19.050                                    | 25.387                | 26.975                 | 19.063     | 19.088 |
| 20.638                                    | 26.975                | 28.562                 | 20.650     | 20.676 |
| 22.225                                    | 28.562                | 30.150                 | 22.238     | 22.263 |
| 23.812                                    | 30.150                | —                      | 23.825     | 23.851 |
| 25.400                                    | 31.737                | 33.325                 | 25.413     | 25.438 |
| 26.988                                    | 33.325                | —                      | 27.000     | 27.026 |
| 28.575                                    | 34.912                | 38.087                 | 28.588     | 28.613 |
| 30.162                                    | 38.087                | —                      | 30.175     | 30.201 |
| 31.750                                    | 38.087                | 41.262                 | 31.763     | 31.788 |
| 33.338                                    | 41.262                | —                      | 33.350     | 33.378 |
| 34.925                                    | 41.262                | 44.437                 | 34.938     | 34.966 |
| 38.100                                    | 47.612                | —                      | 38.113     | 38.143 |
| 41.275                                    | 50.787                | —                      | 41.288     | 41.318 |
| 44.450                                    | 53.962                | 57.137                 | 44.463     | 44.496 |
| 47.625                                    | 57.137                | —                      | 47.638     | 47.671 |
| 50.800                                    | 60.312                | —                      | 50.815     | 50.848 |
| 52.388                                    | —                     | 64.280                 | 52.413     | 52.451 |
| 53.975                                    | 63.487                | —                      | 53.990     | 54.028 |
| 57.150                                    | 66.662                | —                      | 57.165     | 57.203 |
| 66.675                                    | 76.187                | —                      | 66.700     | 66.738 |
| 69.850                                    | 79.362                | —                      | 69.875     | 69.914 |

Notes<sup>(1)</sup> Also applicable to BAM and YB  
<sup>(2)</sup> Also applicable to BHAM and YBH

Table 3 Tolerances of outer ring width C unit: mm

| Series | Tolerance  |
|--------|------------|
| Metric | 0 ~ - 0.20 |
| Inch   | 0 ~ - 0.25 |

Fit

As the outer ring is thin, the correct dimensions and accuracy of Shell Type Needle Roller Bearings are obtained only after they have been press-fitted into the housing bore. Bearing accuracy is directly affected by housing dimensions, shape and rigidity. This should be taken into account when considering fit and accuracy. The radial clearance after fitting the bearing to the shaft and the housing bore varies with their tolerances.

Table 4 Recommended fit

| Type of bearing                                            | Housing material                 | Tolerance class      |                 |              |
|------------------------------------------------------------|----------------------------------|----------------------|-----------------|--------------|
|                                                            |                                  | Shaft <sup>(1)</sup> |                 | Housing bore |
|                                                            |                                  | Without inner ring   | With inner ring |              |
| TA ... Z, BA ... Z, BHA ... Z, TAM, BAM, BHAM, YT, YB, YBH | Steel<br>Cast iron               | h6                   | k5(j5)          | J7           |
|                                                            | Light alloy<br>(Thin steel pipe) | h6                   | k5(j5)          | M7(N7)       |
| TLA ... Z, TLAM, YTL, TLA ... UU                           | Steel<br>Cast iron               | h6                   | k5(j5)          | N7           |
|                                                            | Light alloy<br>(Thin steel pipe) | h6                   | k5(j5)          | R7(S7)       |

Note<sup>(1)</sup> When housings are made of light alloy or a thin steel pipe, the roller set bore diameter is greatly affected by the housing thickness and shape. Therefore, before mass-production assembly, assembly tests should be carried out to confirm the amount of dimensional change and to determine the tolerance of the shaft which will give normal clearances.

Table 5 Calculation example of radial clearance after fitting

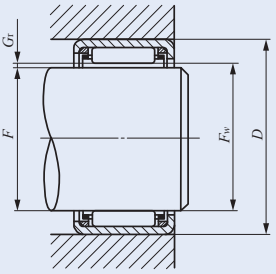
|  | Calculation procedure                                                                                                                                                                                                                                                                                                                                                      | Example of TLA 2020 Z                                                                                                                          |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | ① Dimension of roller set bore diameter of bearing after it has been press-fitted into the ring gauge.<br>Dimension of ring gauge (D <sub>0</sub> ): See Tables 2.1 and 2.2 on page B4.<br>Max. value of roller set bore dia. (F <sub>w max</sub> ): No-go dimension of plug gauge<br>Min. value of roller set bore dia. (F <sub>w min</sub> ): Go dimension of plug gauge | From Table 2.1 on page B4<br>D <sub>0</sub> = 25.972<br>F <sub>w max</sub> = 20.028<br>F <sub>w min</sub> = 20.007                             |
|                                                                                     | ② Dimension of housing bore<br>Max. value of housing bore (D <sub>max</sub> ): See the dimension table.<br>Min. value of housing bore (D <sub>min</sub> ): See the dimension table.                                                                                                                                                                                        | From the dimension table on page B14,<br>D <sub>max</sub> = 25.993<br>D <sub>min</sub> = 25.972                                                |
|                                                                                     | ③ Dimension of roller set bore diameter of bearing after it has been press-fitted into the housing bore<br>Max. value of roller set bore dia.(F <sub>we max</sub> )=(D <sub>max</sub> -D <sub>0</sub> ) + F <sub>w max</sub><br>Min. value of roller set bore dia.(F <sub>we min</sub> )=(D <sub>min</sub> -D <sub>0</sub> ) + F <sub>w min</sub>                          | From the equations,<br>F <sub>we max</sub> = 20.049<br>F <sub>we min</sub> = 20.007                                                            |
|                                                                                     | ④ Dimension of shaft<br>Max. value of shaft dia. (F <sub>max</sub> ): See the dimension table.<br>Min. value of shaft dia. (F <sub>min</sub> ): See the dimension table.                                                                                                                                                                                                   | From the dimension table on page B14,<br>F <sub>max</sub> = 20.000<br>F <sub>min</sub> = 19.987                                                |
|                                                                                     | ⑤ Radial clearance after mounting<br>Max. value of radial clearance(G <sub>r max</sub> )=F <sub>we max</sub> - F <sub>min</sub><br>Min. value of radial clearance(G <sub>r min</sub> )=F <sub>we min</sub> - F <sub>max</sub>                                                                                                                                              | From the equations,<br>G <sub>r max</sub> = 0.062<br>G <sub>r min</sub> = 0.007<br>The radial clearance after mounting becomes 0.007~0.062 mm. |

Table 4 shows the recommended fit for Shell Type Needle Roller Bearings.  
Table 5 shows a calculation example of radial clearance after fitting. This calculation applies to bearings without inner ring to be fitted into rigid steel or cast iron housings. When the housing is made of light alloy or a thin steel pipe, it is necessary to check dimensions by actual measurement.  
Generally, when making the radial clearance smaller, it is recommended that the shaft diameter be increased, without decreasing the housing bore diameter.

Lubrication

Bearings with prepacked grease are shown in Table 6. ALVANIA GREASE S2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease.  
In the case of bearings without prepacked grease, perform proper lubrication for use. If the bearings are operated without lubrication, the wear of the roller contact surfaces will increase and the bearing life will be shortened.

Table 6 Bearings with prepacked grease

| Bearing type  |                | Caged    |            |            | Full complement |
|---------------|----------------|----------|------------|------------|-----------------|
|               |                | Standard | Closed end | With seals | Grease retained |
| Metric series | TLA, TLAM, YTL | ×        | ×          | ○          | ○               |
|               | TA, TAM, YT    | ×        | ×          | —          | ○               |
| Inch series   | BA, BAM, YB    | ×        | ×          | —          | ○               |
|               | BHA, BHAM, YBH | ×        | ×          | —          | ○               |

○ : With prepacked grease    × : Without prepacked grease

Static Safety Factor

Since Shell Type Needle Roller Bearings employ an outer ring made from a thin steel plate which is drawn, carburized and quenched, excessively large loads must be avoided. The required static safety factor is usually more than 3.

Specifications of shaft and housing

Shell Type Needle Roller Bearings are commonly used without an inner ring. In such cases, the surface hardness of the raceway surface should be 58 ~ 64HRC and the surface roughness should not exceed 0.2 μ mR<sub>a</sub>. However, when the operating condition is not severe, a surface roughness 0.8 μ mR<sub>a</sub> or less can be used.

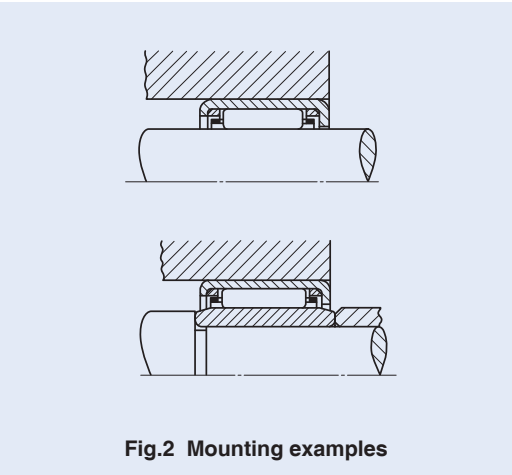
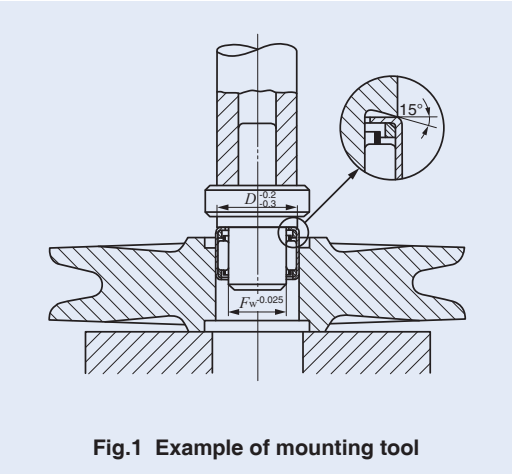
If the surface hardness is low, the load rating must be corrected by the hardness factor shown on page A20. When the shaft cannot be heat treated and finished by grinding, the use of IKO Inner Rings for Shell Type Needle Roller Bearings (See page H1.) is recommended.

Mounting

Shell Type Needle Roller Bearings should be pressed into the housings gently using the appropriate tool as shown in Fig. 1, with their marked end surface up. As the outer ring is thin, it must never be struck directly with a hammer.  
Since the outer rings of Shell Type Needle Roller Bearings are firmly fitted to housing bores with interference, it is unnecessary to fix them axially. Fig. 2 shows mounting examples.

Oil Hole

For Shell Type Needle Roller Bearings with an oil hole, "OH" is appended to the end of the identification number.  
**Example** TA 2525 Z OH  
The symbol "OH" is not marked on the bearing itself, but is shown on its packaging, etc. When bearings with multiple oil holes are required, please consult IKO.



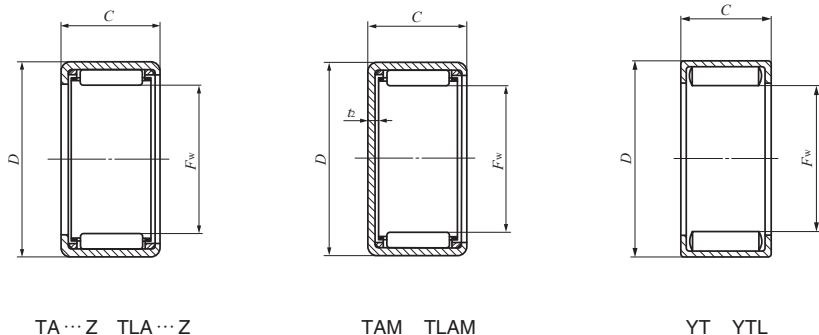
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 4 – 10mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 4                | —                     | —                    | —          | —                    | TLA 48 Z   | 1.54                 | TLAM 48    | 1.67                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YTL 48          | 1.73                 |
| 5                | —                     | —                    | —          | —                    | TLA 59 Z   | 1.9                  | TLAM 59    | 2                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YTL 59          | 2.4                  |
| 6                | —                     | —                    | —          | —                    | TLA 69 Z   | 2.2                  | TLAM 69    | 2.3                  | —               | —                    |
| 7                | —                     | —                    | —          | —                    | TLA 79 Z   | 2.5                  | TLAM 79    | 2.7                  | —               | —                    |
| 8                | —                     | —                    | —          | —                    | TLA 810 Z  | 3.1                  | TLAM 810   | 3.3                  | —               | —                    |
|                  | TA 810 Z              | 6.7                  | TAM 810    | 7.1                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 815 Z              | 9.7                  | TAM 815    | 10.1                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 820 Z              | 12.9                 | TAM 820    | 13.3                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 810          | 7.7                  |
| 9                | —                     | —                    | —          | —                    | TLA 910 Z  | 3.4                  | TLAM 910   | 3.6                  | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 912 Z  | 4                    | TLAM 912   | 4.3                  | —               | —                    |
|                  | TA 912 Z              | 8.7                  | TAM 912    | 9.2                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 916 Z              | 11.4                 | TAM 916    | 11.9                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 912          | 10.1                 |
| 10               | —                     | —                    | —          | —                    | TLA 1010 Z | 3.7                  | TLAM 1010  | 4                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1012 Z | 4.4                  | TLAM 1012  | 4.8                  | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1015 Z | 5.5                  | TLAM 1015  | 5.9                  | —               | —                    |
|                  | TA 1010 Z             | 7.9                  | TAM 1010   | 8.5                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1012 Z             | 9.3                  | TAM 1012   | 10                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1015 Z             | 11.5                 | TAM 1015   | 12.2                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1020 Z             | 15.4                 | TAM 1020   | 16                   | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions<br>mm |    |    |                        | Standard mounting dimensions mm |       |                   |        |        |        | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|------------------------|---------------------------------|-------|-------------------|--------|--------|--------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |       | Housing bore dia. |        |        |        | N                                 | N                                             | min <sup>-1</sup>                               |                         |
|                           |    |    |                        | Max.                            | Min.  | Max.              | Min.   | Max.   | Min.   |                                   |                                               |                                                 |                         |
| 4                         | 8  | 8  | 1                      | 4.000                           | 3.992 | —                 | —      | 7.996  | 7.981  | 1 350                             | 1 010                                         | 75 000                                          | —                       |
| 4                         | 8  | 8  | —                      | —                               | —     | —                 | —      | —      | —      | 3 010                             | 2 900                                         | 40 000                                          | —                       |
| 5                         | 9  | 9  | 1                      | 5.000                           | 4.992 | —                 | —      | 8.996  | 8.981  | 1 880                             | 1 600                                         | 65 000                                          | —                       |
| 5                         | 9  | 9  | —                      | —                               | —     | —                 | —      | —      | —      | 4 320                             | 4 750                                         | 30 000                                          | —                       |
| 6                         | 10 | 9  | 1                      | 6.000                           | 5.992 | —                 | —      | 9.996  | 9.981  | 2 100                             | 1 900                                         | 55 000                                          | —                       |
| 7                         | 11 | 9  | 1                      | 7.000                           | 6.991 | —                 | —      | 10.995 | 10.977 | 2 490                             | 2 450                                         | 50 000                                          | —                       |
| 8                         | 12 | 10 | 1                      | 8.000                           | 7.991 | —                 | —      | 11.995 | 11.977 | 3 320                             | 3 670                                         | 45 000                                          | —                       |
| 8                         | 15 | 10 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 3 470                             | 2 880                                         | 45 000                                          | —                       |
| 8                         | 15 | 15 | 1.3                    | 8.000                           | 7.991 | 15.010            | 14.992 | —      | —      | 5 780                             | 5 570                                         | 45 000                                          | —                       |
| 8                         | 15 | 20 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 8 340                             | 8 920                                         | 45 000                                          | —                       |
| 8                         | 15 | 10 | —                      | —                               | —     | —                 | —      | —      | —      | 7 530                             | 7 950                                         | 19 000                                          | —                       |
| 9                         | 13 | 10 | 1                      | 9.000                           | 8.991 | —                 | —      | 12.995 | 12.977 | 3 500                             | 4 040                                         | 45 000                                          | —                       |
| 9                         | 13 | 12 | 1                      | —                               | —     | —                 | —      | —      | —      | 4 460                             | 5 510                                         | 45 000                                          | —                       |
| 9                         | 16 | 12 | 1.3                    | 9.000                           | 8.991 | 16.010            | 15.992 | —      | —      | 5 140                             | 4 880                                         | 45 000                                          | —                       |
| 9                         | 16 | 16 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 6 960                             | 7 210                                         | 45 000                                          | —                       |
| 9                         | 16 | 12 | —                      | —                               | —     | —                 | —      | —      | —      | 9 690                             | 11 200                                        | 17 000                                          | —                       |
| 10                        | 14 | 10 | 1                      | 10.000                          | 9.991 | —                 | —      | 13.995 | 13.977 | 3 870                             | 4 740                                         | 40 000                                          | IRT 710                 |
| 10                        | 14 | 12 | 1                      | —                               | —     | —                 | —      | —      | —      | 4 920                             | 6 460                                         | 40 000                                          | IRT 712                 |
| 10                        | 14 | 15 | 1                      | —                               | —     | —                 | —      | —      | —      | 6 390                             | 9 040                                         | 40 000                                          | IRT 715                 |
| 10                        | 17 | 10 | 1.3                    | 10.000                          | 9.991 | 17.010            | 16.992 | —      | —      | 4 150                             | 3 780                                         | 40 000                                          | IRT 710                 |
| 10                        | 17 | 12 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 5 590                             | 5 540                                         | 40 000                                          | IRT 712                 |
| 10                        | 17 | 15 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 6 920                             | 7 300                                         | 40 000                                          | IRT 715                 |
| 10                        | 17 | 20 | 1.3                    | —                               | —     | —                 | —      | —      | —      | 9 990                             | 11 700                                        | 40 000                                          | —                       |

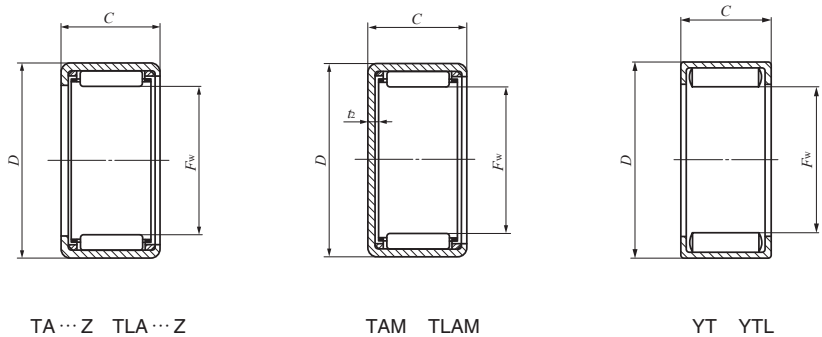
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 12 – 15mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 12               | —                     | —                    | —          | —                    | TLA 1210 Z | 4.3                  | TLAM 1210  | 4.7                  | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YTL 1210        | 5.1                  |
|                  | —                     | —                    | —          | —                    | TLA 1212 Z | 8.6                  | TLAM 1212  | 9.4                  | —               | —                    |
|                  | TA 1212 Z             | 10.5                 | TAM 1212   | 11.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1215 Z             | 13.1                 | TAM 1215   | 14                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1220 Z             | 17.3                 | TAM 1220   | 18.3                 | —          | —                    | —          | —                    | —               | —                    |
| 13               | TA 1225 Z             | 21.5                 | TAM 1225   | 22.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 1212         | 12.8                 |
|                  | —                     | —                    | —          | —                    | TLA 1312 Z | 9.2                  | TLAM 1312  | 10.1                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1412 Z | 9.8                  | TLAM 1412  | 10.8                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1416 Z | 13.2                 | TLAM 1416  | 14.3                 | —               | —                    |
|                  | TA 1416 Z             | 18.4                 | TAM 1416   | 19.6                 | —          | —                    | —          | —                    | —               | —                    |
| 14               | TA 1420 Z             | 23                   | TAM 1420   | 24                   | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1512 Z | 10.4                 | TLAM 1512  | 11.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1516 Z | 14                   | TLAM 1516  | 15.2                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1522 Z | 19.1                 | TLAM 1522  | 20.5                 | —               | —                    |
|                  | TA 1510 Z             | 10.8                 | TAM 1510   | 12.3                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1512 Z             | 12.9                 | TAM 1512   | 14.3                 | —          | —                    | —          | —                    | —               | —                    |
| 15               | TA 1515 Z             | 15.9                 | TAM 1515   | 17.3                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1520 Z             | 21                   | TAM 1520   | 22.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1525 Z             | 25                   | TAM 1525   | 26.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions<br>mm |      |      |                        | Standard mounting dimensions mm |        |                   |        |        |        | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|------|------|------------------------|---------------------------------|--------|-------------------|--------|--------|--------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D    | C    | t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |        |        |        | N                                 | N                                             | min <sup>-1</sup>                               |                         |
| Max.                      | Max. | Min. | Max.                   | Max.                            | Min.   | Max.              | Min.   | Max.   | Min.   |                                   |                                               |                                                 |                         |
| 12                        | 16   | 10   | 1                      | 12.000                          | 11.989 | —                 | —      | 15.995 | 15.977 | 4 350                             | 5 810                                         | 35 000                                          | IRT 810                 |
| 12                        | 16   | 10   | —                      | —                               | —      | —                 | —      | —      | —      | 7 470                             | 11 800                                        | 13 000                                          | IRT 810                 |
| 12                        | 18   | 12   | 1.3                    | 12.000                          | 11.989 | —                 | —      | 17.995 | 17.977 | 6 420                             | 7 490                                         | 35 000                                          | IRT 812                 |
| 12                        | 19   | 12   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 6 000                             | 6 310                                         | 35 000                                          | IRT 812                 |
| 12                        | 19   | 15   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 7 440                             | 8 320                                         | 35 000                                          | IRT 815                 |
| 12                        | 19   | 20   | 1.3                    | 12.000                          | 11.989 | 19.012            | 18.991 | —      | —      | 10 700                            | 13 300                                        | 35 000                                          | —                       |
| 12                        | 19   | 25   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 13 800                            | 18 300                                        | 35 000                                          | —                       |
| 12                        | 19   | 12   | —                      | —                               | —      | —                 | —      | —      | —      | 11 800                            | 15 200                                        | 13 000                                          | IRT 812                 |
| 13                        | 19   | 12   | 1.3                    | 13.000                          | 12.989 | —                 | —      | 18.993 | 18.972 | 6 760                             | 8 170                                         | 30 000                                          | IRT 1012                |
| 14                        | 20   | 12   | 1.3                    | 14.000                          | 13.989 | —                 | —      | 19.993 | 19.972 | 7 080                             | 8 840                                         | 30 000                                          | IRT 1012-2              |
| 14                        | 20   | 16   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 8 950                             | 12 000                                        | 30 000                                          | IRT 1016-2              |
| 14                        | 22   | 16   | 1.3                    | 14.000                          | 13.989 | 22.012            | 21.991 | —      | —      | 10 500                            | 12 000                                        | 30 000                                          | IRT 1016-2              |
| 14                        | 22   | 20   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 13 900                            | 17 200                                        | 30 000                                          | IRT 1020-2              |
| 15                        | 21   | 12   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 7 380                             | 9 520                                         | 25 000                                          | IRT 1212                |
| 15                        | 21   | 16   | 1.3                    | 15.000                          | 14.989 | —                 | —      | 20.993 | 20.972 | 9 330                             | 12 900                                        | 25 000                                          | IRT 1216                |
| 15                        | 21   | 22   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 13 600                            | 20 900                                        | 25 000                                          | IRT 1222                |
| 15                        | 22   | 10   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 5 290                             | 5 680                                         | 25 000                                          | IRT 1010-1              |
| 15                        | 22   | 12   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 7 120                             | 8 310                                         | 25 000                                          | IRT 1012-1              |
| 15                        | 22   | 15   | 1.3                    | 15.000                          | 14.989 | 22.012            | 21.991 | —      | —      | 8 830                             | 11 000                                        | 25 000                                          | IRT 1015-1              |
| 15                        | 22   | 20   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 12 700                            | 17 600                                        | 25 000                                          | IRT 1020-1              |
| 15                        | 22   | 25   | 1.3                    | —                               | —      | —                 | —      | —      | —      | 16 300                            | 24 200                                        | 25 000                                          | IRT 1025-1              |

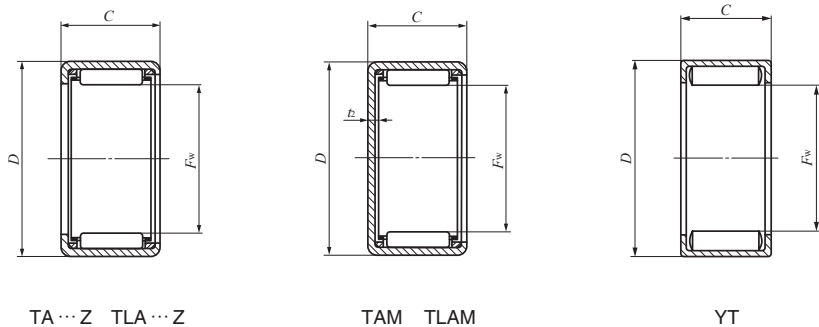
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 16 — 19mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 16               | —                     | —                    | —          | —                    | TLA 1612 Z | 10.9                 | TLAM 1612  | 12.2                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1616 Z | 14.8                 | TLAM 1616  | 16.1                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1622 Z | 20                   | TLAM 1622  | 21.5                 | —               | —                    |
|                  | TA 1616 Z             | 20                   | TAM 1616   | 22                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1620 Z             | 25                   | TAM 1620   | 27                   | —          | —                    | —          | —                    | —               | —                    |
| 17               | —                     | —                    | —          | —                    | TLA 1712 Z | 11.5                 | TLAM 1712  | 13                   | —               | —                    |
|                  | TA 1715 Z             | 17.6                 | TAM 1715   | 19.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1720 Z             | 23.5                 | TAM 1720   | 25                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1725 Z             | 29                   | TAM 1725   | 31                   | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 1715         | 20.5                 |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 1725         | 35.5                 |
| 18               | —                     | —                    | —          | —                    | TLA 1812 Z | 12                   | TLAM 1812  | 13.7                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 1816 Z | 16.2                 | TLAM 1816  | 17.9                 | —               | —                    |
|                  | TA 1813 Z             | 16.4                 | TAM 1813   | 18.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1815 Z             | 18.5                 | TAM 1815   | 20.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1817 Z             | 21                   | TAM 1817   | 23                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1819 Z             | 23.5                 | TAM 1819   | 25.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1820 Z             | 24.5                 | TAM 1820   | 26.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1825 Z             | 30.5                 | TAM 1825   | 32.5                 | —          | —                    | —          | —                    | —               | —                    |
| 19               | TA 1916 Z             | 23                   | TAM 1916   | 25.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 1920 Z             | 29                   | TAM 1920   | 31                   | —          | —                    | —          | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
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| Boundary dimensions<br>mm |    |    |                        | Standard mounting dimensions mm |        |                         |        |        |        | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|------------------------|---------------------------------|--------|-------------------------|--------|--------|--------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        |        |        | N                                 | N                                             | min <sup>-1</sup>                               |                         |
| Max.                      |    |    |                        | Max.                            | Min.   | Max.                    | Min.   | Max.   | Min.   |                                   |                                               |                                                 |                         |
| 16                        | 22 | 12 | 1.3                    |                                 |        |                         |        |        |        | 7 670                             | 10 200                                        | 25 000                                          | IRT 1212-1              |
| 16                        | 22 | 16 | 1.3                    | 16.000                          | 15.989 | —                       | —      | 21.993 | 21.972 | 9 700                             | 13 800                                        | 25 000                                          | IRT 1216-1              |
| 16                        | 22 | 22 | 1.3                    |                                 |        |                         |        |        |        | 14 200                            | 22 400                                        | 25 000                                          | IRT 1222-1              |
| 16                        | 24 | 16 | 1.3                    | 16.000                          | 15.989 | 24.012                  | 23.991 | —      | —      | 11 100                            | 13 300                                        | 25 000                                          | IRT 1216-1              |
| 16                        | 24 | 20 | 1.3                    |                                 |        |                         |        |        |        | 14 700                            | 19 100                                        | 25 000                                          | IRT 1220-1              |
| 17                        | 23 | 12 | 1.3                    | 17.000                          | 16.989 | —                       | —      | 22.993 | 22.972 | 7 960                             | 10 900                                        | 25 000                                          | —                       |
| 17                        | 24 | 15 | 1.3                    |                                 |        |                         |        |        |        | 9 660                             | 12 700                                        | 25 000                                          | IRT 1215-2              |
| 17                        | 24 | 20 | 1.3                    |                                 |        |                         |        |        |        | 13 900                            | 20 400                                        | 25 000                                          | IRT 1220-2              |
| 17                        | 24 | 25 | 1.3                    | 17.000                          | 16.989 | 24.012                  | 23.991 | —      | —      | 17 900                            | 28 100                                        | 25 000                                          | IRT 1225-2              |
| 17                        | 24 | 15 | —                      |                                 |        |                         |        |        |        | 16 600                            | 26 000                                        | 9 000                                           | IRT 1215-2              |
| 17                        | 24 | 25 | —                      |                                 |        |                         |        |        |        | 27 200                            | 49 000                                        | 9 000                                           | IRT 1225-2              |
| 18                        | 24 | 12 | 1.3                    | 18.000                          | 17.989 | —                       | —      | 23.993 | 23.972 | 8 230                             | 11 500                                        | 20 000                                          | IRT 1512                |
| 18                        | 24 | 16 | 1.3                    |                                 |        |                         |        |        |        | 10 400                            | 15 600                                        | 20 000                                          | IRT 1516                |
| 18                        | 25 | 13 | 1.3                    |                                 |        |                         |        |        |        | 9 100                             | 12 000                                        | 20 000                                          | IRT 1513                |
| 18                        | 25 | 15 | 1.3                    |                                 |        |                         |        |        |        | 10 100                            | 13 600                                        | 20 000                                          | IRT 1515                |
| 18                        | 25 | 17 | 1.3                    | 18.000                          | 17.989 | 25.012                  | 24.991 | —      | —      | 11 900                            | 16 900                                        | 20 000                                          | IRT 1517                |
| 18                        | 25 | 19 | 1.3                    |                                 |        |                         |        |        |        | 13 700                            | 20 200                                        | 20 000                                          | IRT 1519                |
| 18                        | 25 | 20 | 1.3                    |                                 |        |                         |        |        |        | 14 500                            | 21 800                                        | 20 000                                          | IRT 1520                |
| 18                        | 25 | 25 | 1.3                    |                                 |        |                         |        |        |        | 18 600                            | 30 000                                        | 20 000                                          | IRT 1525                |
| 19                        | 27 | 16 | 1.3                    | 19.000                          | 18.987 | 27.012                  | 26.991 | —      | —      | 12 200                            | 15 700                                        | 20 000                                          | IRT 1516-1              |
| 19                        | 27 | 20 | 1.3                    |                                 |        |                         |        |        |        | 16 100                            | 22 600                                        | 20 000                                          | IRT 1520-1              |

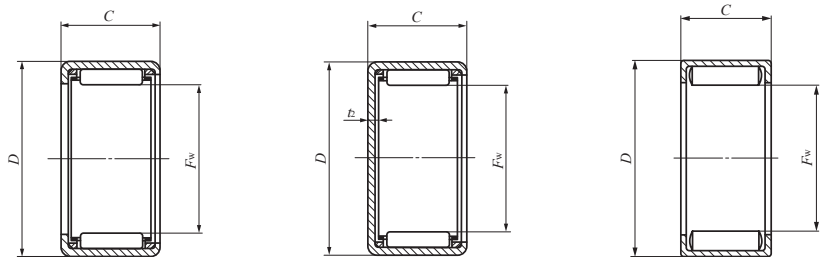
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 20 – 21mm

| Shaft dia.<br>mm | Identification number |                      |                   |                      |                   |                      |                  |                      |                 |                      |
|------------------|-----------------------|----------------------|-------------------|----------------------|-------------------|----------------------|------------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end        | Mass<br>(Ref. )<br>g | Standard          | Mass<br>(Ref. )<br>g | Closed end       | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 20               | —                     | —                    | —                 | —                    | <b>TLA 2012 Z</b> | 13.2                 | <b>TLAM 2012</b> | 15.2                 | —               | —                    |
|                  | —                     | —                    | —                 | —                    | <b>TLA 2016 Z</b> | 17.8                 | <b>TLAM 2016</b> | 19.9                 | —               | —                    |
|                  | —                     | —                    | —                 | —                    | <b>TLA 2020 Z</b> | 22                   | <b>TLAM 2020</b> | 24                   | —               | —                    |
|                  | —                     | —                    | —                 | —                    | <b>TLA 2030 Z</b> | 33                   | <b>TLAM 2030</b> | 35                   | —               | —                    |
|                  | <b>TA 2015 Z</b>      | 20                   | <b>TAM 2015</b>   | 22.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2020 Z</b>      | 26.5                 | <b>TAM 2020</b>   | 29                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2025 Z</b>      | 33                   | <b>TAM 2025</b>   | 35.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2030 Z</b>      | 39.5                 | <b>TAM 2030</b>   | 42                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 2015</b>       | 23.5            | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 2025</b>       | 41              | —                    |
|                  | <b>TA 202820 Z</b>    | 30                   | <b>TAM 202820</b> | 32.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 202820</b>     | 37.5            | —                    |
| 21               | <b>TA 2116 Z</b>      | 25                   | <b>TAM 2116</b>   | 28                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2120 Z</b>      | 31.5                 | <b>TAM 2120</b>   | 34.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 2116</b>       | 31              | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 2120</b>       | 39              | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



TA...Z TLA...Z TAM TLAM YT

| Boundary dimensions<br>mm |          |          |                               | Standard mounting dimensions mm |        |                   |            |        |            | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----------|----------|-------------------------------|---------------------------------|--------|-------------------|------------|--------|------------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| <i>F<sub>w</sub></i>      | <i>D</i> | <i>C</i> | <i>t</i> <sub>2</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |            |        |            | N                                 | N                                             | min <sup>-1</sup>                               |                         |
|                           |          |          |                               | Max.                            | Min.   | Max.              | J7<br>Min. | Max.   | N7<br>Min. |                                   |                                               |                                                 |                         |
| 20                        | 26       | 12       | 1.3                           | 20.000                          | 19.987 | —                 | —          | 25.993 | 25.972     | 8 740                             | 12 900                                        | 20 000                                          | —                       |
| 20                        | 26       | 16       | 1.3                           |                                 |        |                   |            |        |            | 11 100                            | 17 500                                        | 20 000                                          | <b>IRT 1716</b>         |
| 20                        | 26       | 20       | 1.3                           |                                 |        |                   |            |        |            | 14 500                            | 24 700                                        | 20 000                                          | <b>IRT 1720</b>         |
| 20                        | 26       | 30       | 1.3                           |                                 |        |                   |            |        |            | 22 300                            | 42 900                                        | 20 000                                          | <b>IRT 1730</b>         |
| 20                        | 26       | 30       | 1.3                           |                                 |        |                   |            |        |            | 22 300                            | 42 900                                        | 20 000                                          | <b>IRT 1730</b>         |
| 20                        | 27       | 15       | 1.3                           | 20.000                          | 19.987 | 27.012            | 26.991     | —      | —          | 10 400                            | 14 600                                        | 20 000                                          | <b>IRT 1515-2</b>       |
| 20                        | 27       | 20       | 1.3                           |                                 |        |                   |            |        |            | 15 000                            | 23 400                                        | 20 000                                          | <b>IRT 1520-2</b>       |
| 20                        | 27       | 25       | 1.3                           |                                 |        |                   |            |        |            | 19 200                            | 32 200                                        | 20 000                                          | <b>IRT 1525-2</b>       |
| 20                        | 27       | 30       | 1.3                           |                                 |        |                   |            |        |            | 23 100                            | 41 000                                        | 20 000                                          | <b>IRT 1530-2</b>       |
| 20                        | 27       | 15       | —                             |                                 |        |                   |            |        |            | 18 400                            | 30 900                                        | 7 500                                           | <b>IRT 1515-2</b>       |
| 20                        | 27       | 25       | —                             |                                 |        |                   |            |        |            | 30 000                            | 58 300                                        | 7 500                                           | <b>IRT 1525-2</b>       |
| 20                        | 28       | 20       | 1.3                           | 20.000                          | 19.987 | 28.012            | 27.991     | —      | —          | 16 900                            | 24 300                                        | 20 000                                          | <b>IRT 1520-2</b>       |
| 20                        | 28       | 20       | —                             |                                 |        |                   |            |        |            | 26 800                            | 44 600                                        | 7 500                                           | <b>IRT 1520-2</b>       |
| 21                        | 29       | 16       | 1.3                           | 21.000                          | 20.987 | 29.012            | 28.991     | —      | —          | 13 300                            | 18 100                                        | 19 000                                          | <b>IRT 1716-1</b>       |
| 21                        | 29       | 20       | 1.3                           |                                 |        |                   |            |        |            | 17 600                            | 25 900                                        | 19 000                                          | <b>IRT 1720-1</b>       |
| 21                        | 29       | 16       | —                             |                                 |        |                   |            |        |            | 22 100                            | 35 200                                        | 7 000                                           | <b>IRT 1716-1</b>       |
| 21                        | 29       | 20       | —                             |                                 |        |                   |            |        |            | 27 500                            | 46 800                                        | 7 000                                           | <b>IRT 1720-1</b>       |

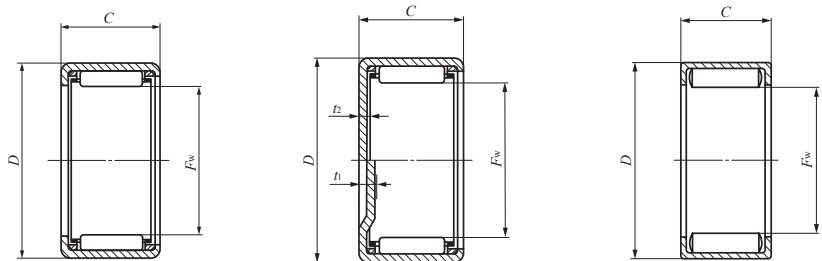
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 22 – 24mm

| Shaft dia.<br>mm | Identification number |                      |                   |                      |                   |                      |                  |                      |                 |                      |
|------------------|-----------------------|----------------------|-------------------|----------------------|-------------------|----------------------|------------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end        | Mass<br>(Ref. )<br>g | Standard          | Mass<br>(Ref. )<br>g | Closed end       | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 22               | —                     | —                    | —                 | —                    | <b>TLA 2212 Z</b> | 15.6                 | <b>TLAM 2212</b> | 18.1                 | —               | —                    |
|                  | —                     | —                    | —                 | —                    | <b>TLA 2216 Z</b> | 21.5                 | <b>TLAM 2216</b> | 24                   | —               | —                    |
|                  | —                     | —                    | —                 | —                    | <b>TLA 2220 Z</b> | 26.5                 | <b>TLAM 2220</b> | 29                   | —               | —                    |
|                  | <b>TA 2210 Z</b>      | 15                   | <b>TAM 2210</b>   | 18.1                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2215 Z</b>      | 21.5                 | <b>TAM 2215</b>   | 24.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2220 Z</b>      | 29                   | <b>TAM 2220</b>   | 32                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2225 Z</b>      | 35.5                 | <b>TAM 2225</b>   | 38.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2230 Z</b>      | 42.5                 | <b>TAM 2230</b>   | 45.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 223016 Z</b>    | 26                   | <b>TAM 223016</b> | 29                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 223020 Z</b>    | 32.5                 | <b>TAM 223020</b> | 35.5                 | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 223016</b>     | 32              | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 223020</b>     | 40.5            | —                    |
| 24               | <b>TA 2420 Z</b>      | 31                   | <b>TAM 2420</b>   | 35                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 2428 Z</b>      | 43.5                 | <b>TAM 2428</b>   | 47                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 2428</b>       | 54              | —                    |
|                  | <b>TA 243216 Z</b>    | 28                   | <b>TAM 243216</b> | 32                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | <b>TA 243220 Z</b>    | 35.5                 | <b>TAM 243220</b> | 39                   | —                 | —                    | —                | —                    | —               | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 243216</b>     | 34.5            | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | <b>YT 243220</b>     | 43.5            | —                    |
|                  | —                     | —                    | —                 | —                    | —                 | —                    | —                | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



TA...Z TLA...Z  
TAM TLAM  
t<sub>1</sub> (F<sub>w</sub>≥24)  
t<sub>2</sub> (F<sub>w</sub>≤22)  
YT

| Boundary dimensions<br>mm |    |    |                                         | Standard mounting dimensions mm |        |                            |        |        |        | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|-----------------------------------------|---------------------------------|--------|----------------------------|--------|--------|--------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>1</sub> , t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 N7 |        |        |        | N                                 | N                                             | min <sup>-1</sup>                               |                         |
| Max.                      |    |    |                                         | Max.                            | Min.   | Max.                       | Min.   | Max.   | Min.   |                                   |                                               |                                                 |                         |
| 22                        | 28 | 12 | 1.3                                     |                                 |        |                            |        |        |        | 9 230                             | 14 300                                        | 18 000                                          | —                       |
| 22                        | 28 | 16 | 1.3                                     | 22.000                          | 21.987 | —                          | —      | 27.993 | 27.972 | 11 700                            | 19 300                                        | 18 000                                          | <b>IRT 1716-2</b>       |
| 22                        | 28 | 20 | 1.3                                     |                                 |        |                            |        |        |        | 15 300                            | 27 300                                        | 18 000                                          | <b>IRT 1720-2</b>       |
| 22                        | 29 | 10 | 1.3                                     |                                 |        |                            |        |        |        | 6 650                             | 8 500                                         | 18 000                                          | <b>IRT 1710-2</b>       |
| 22                        | 29 | 15 | 1.3                                     |                                 |        |                            |        |        |        | 11 100                            | 16 400                                        | 18 000                                          | <b>IRT 1715-2</b>       |
| 22                        | 29 | 20 | 1.3                                     | 22.000                          | 21.987 | 29.012                     | 28.991 | —      | —      | 16 000                            | 26 300                                        | 18 000                                          | <b>IRT 1720-2</b>       |
| 22                        | 29 | 25 | 1.3                                     |                                 |        |                            |        |        |        | 19 700                            | 34 300                                        | 18 000                                          | <b>IRT 1725-2</b>       |
| 22                        | 29 | 30 | 1.3                                     |                                 |        |                            |        |        |        | 23 800                            | 43 700                                        | 18 000                                          | <b>IRT 1730-2</b>       |
| 22                        | 30 | 16 | 1.3                                     |                                 |        |                            |        |        |        | 13 200                            | 18 200                                        | 18 000                                          | <b>IRT 1716-2</b>       |
| 22                        | 30 | 20 | 1.3                                     | 22.000                          | 21.987 | 30.012                     | 29.991 | —      | —      | 17 500                            | 26 100                                        | 18 000                                          | <b>IRT 1720-2</b>       |
| 22                        | 30 | 16 | —                                       |                                 |        |                            |        |        |        | 22 600                            | 36 800                                        | 7 000                                           | <b>IRT 1716-2</b>       |
| 22                        | 30 | 20 | —                                       |                                 |        |                            |        |        |        | 28 200                            | 48 900                                        | 7 000                                           | <b>IRT 1720-2</b>       |
| 24                        | 31 | 20 | 3.4                                     |                                 |        |                            |        |        |        | 17 000                            | 29 200                                        | 16 000                                          | <b>IRT 2020</b>         |
| 24                        | 31 | 28 | 3.4                                     | 24.000                          | 23.987 | 31.014                     | 30.989 | —      | —      | 24 500                            | 46 700                                        | 16 000                                          | <b>IRT 2028</b>         |
| 24                        | 31 | 28 | —                                       |                                 |        |                            |        |        |        | 36 800                            | 79 900                                        | 6 500                                           | <b>IRT 2028</b>         |
| 24                        | 32 | 16 | 3.4                                     |                                 |        |                            |        |        |        | 14 200                            | 20 500                                        | 16 000                                          | <b>IRT 2016</b>         |
| 24                        | 32 | 20 | 3.4                                     | 24.000                          | 23.987 | 32.014                     | 31.989 | —      | —      | 18 800                            | 29 400                                        | 16 000                                          | <b>IRT 2020</b>         |
| 24                        | 32 | 16 | —                                       |                                 |        |                            |        |        |        | 23 700                            | 40 100                                        | 6 500                                           | <b>IRT 2016</b>         |
| 24                        | 32 | 20 | —                                       |                                 |        |                            |        |        |        | 29 500                            | 53 200                                        | 6 500                                           | <b>IRT 2020</b>         |

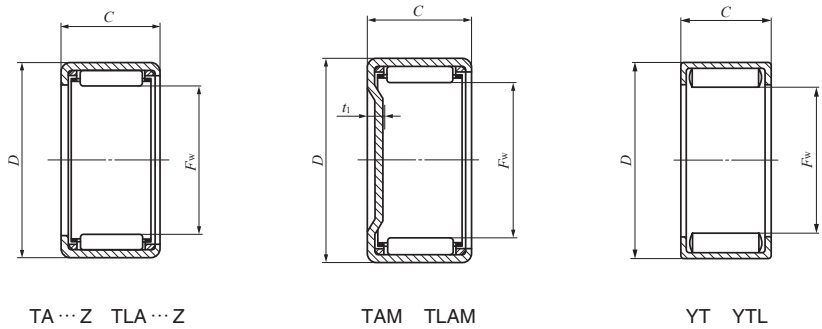
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 25 – 28mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 25               | —                     | —                    | —          | —                    | TLA 2512 Z | 19.7                 | TLAM 2512  | 23.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 2516 Z | 26                   | TLAM 2516  | 29.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 2520 Z | 32                   | TLAM 2520  | 36                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 2526 Z | 41.5                 | TLAM 2526  | 45.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLAW2538Z  | 58.5                 | TLAMW2538  | 62                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YTL 2526        | 51.5                 |
|                  | TA 2510 Z             | 19.1                 | TAM 2510   | 23                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2515 Z             | 28.5                 | TAM 2515   | 32.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2520 Z             | 36.5                 | TAM 2520   | 40.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2525 Z             | 45.5                 | TAM 2525   | 49                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2530 Z             | 54.5                 | TAM 2530   | 58.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2510         | 22.5                 |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2515         | 33                   |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2520         | 45                   |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2525         | 57                   |
| 26               | TA 2616 Z             | 30.5                 | TAM 2616   | 34.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2620 Z             | 38                   | TAM 2620   | 42.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2616         | 37                   |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2620         | 46.5                 |
| 28               | —                     | —                    | —          | —                    | TLA 2816 Z | 28.5                 | TLAM 2816  | 33.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 2820 Z | 35.5                 | TLAM 2820  | 40.5                 | —               | —                    |
|                  | TA 2820 Z             | 45                   | TAM 2820   | 50                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2830 Z             | 67.5                 | TAM 2830   | 72.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2820         | 56.5                 |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. "W" in the identification number indicates that rolling elements are arranged in double rows.  
2. Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions<br>mm |    |    |                        | Standard mounting dimensions mm |        |                   |            |        |            | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|------------------------|---------------------------------|--------|-------------------|------------|--------|------------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |            |        |            | N                                 | N                                             | min <sup>-1</sup>                               |                         |
|                           |    |    |                        | Max.                            | Min.   | Max.              | J7<br>Min. | Max.   | N7<br>Min. |                                   |                                               |                                                 |                         |
| 25                        | 32 | 12 | 2.8                    | 25.000                          | 24.987 | —                 | —          | 31.992 | 31.967     | 9 440                             | 13 900                                        | 15 000                                          | —                       |
| 25                        | 32 | 16 | 2.8                    |                                 |        |                   |            |        |            | 12 800                            | 20 500                                        | 15 000                                          | —                       |
| 25                        | 32 | 20 | 2.8                    |                                 |        |                   |            |        |            | 16 900                            | 29 300                                        | 15 000                                          | IRT 2020-1              |
| 25                        | 32 | 26 | 2.8                    |                                 |        |                   |            |        |            | 22 600                            | 42 500                                        | 15 000                                          | IRT 2026-1              |
| 25                        | 32 | 38 | 2.8                    |                                 |        |                   |            |        |            | 28 900                            | 58 500                                        | 15 000                                          | IRT 2038-1              |
| 25                        | 32 | 26 | —                      |                                 |        |                   |            |        |            | 35 000                            | 75 800                                        | 6 000                                           | IRT 2026-1              |
| 25                        | 33 | 10 | 3.4                    | 25.000                          | 24.987 | 33.014            | 32.989     | —      | —          | 7 990                             | 9 900                                         | 15 000                                          | IRT 2010-1              |
| 25                        | 33 | 15 | 3.4                    |                                 |        |                   |            |        |            | 13 400                            | 19 300                                        | 15 000                                          | IRT 2015-1              |
| 25                        | 33 | 20 | 3.4                    |                                 |        |                   |            |        |            | 19 500                            | 31 100                                        | 15 000                                          | IRT 2020-1              |
| 25                        | 33 | 25 | 3.4                    |                                 |        |                   |            |        |            | 24 100                            | 40 800                                        | 15 000                                          | IRT 2025-1              |
| 25                        | 33 | 30 | 3.4                    |                                 |        |                   |            |        |            | 29 100                            | 52 000                                        | 15 000                                          | IRT 2030-1              |
| 25                        | 33 | 10 | —                      |                                 |        |                   |            |        |            | 15 500                            | 23 600                                        | 6 000                                           | IRT 2010-1              |
| 25                        | 33 | 15 | —                      | 25.000                          | 24.987 | 33.014            | 32.989     | —      | —          | 22 700                            | 38 300                                        | 6 000                                           | IRT 2015-1              |
| 25                        | 33 | 20 | —                      |                                 |        |                   |            |        |            | 30 200                            | 55 400                                        | 6 000                                           | IRT 2020-1              |
| 25                        | 33 | 25 | —                      |                                 |        |                   |            |        |            | 37 200                            | 72 500                                        | 6 000                                           | IRT 2025-1              |
| 26                        | 34 | 16 | 3.4                    | 26.000                          | 25.987 | 34.014            | 33.989     | —      | —          | 15 200                            | 22 900                                        | 15 000                                          | IRT 2216                |
| 26                        | 34 | 20 | 3.4                    |                                 |        |                   |            |        |            | 20 100                            | 32 800                                        | 15 000                                          | IRT 2220                |
| 26                        | 34 | 16 | —                      |                                 |        |                   |            |        |            | 24 700                            | 43 300                                        | 6 000                                           | IRT 2216                |
| 26                        | 34 | 20 | —                      |                                 |        |                   |            |        |            | 30 800                            | 57 500                                        | 6 000                                           | IRT 2220                |
| 28                        | 35 | 16 | 2.8                    | 28.000                          | 27.987 | —                 | —          | 34.992 | 34.967     | 13 800                            | 23 500                                        | 13 000                                          | —                       |
| 28                        | 35 | 20 | 2.8                    |                                 |        |                   |            |        |            | 18 300                            | 33 600                                        | 13 000                                          | IRT 2220-1              |
| 28                        | 37 | 20 | 3.4                    | 28.000                          | 27.987 | 37.014            | 36.989     | —      | —          | 21 200                            | 32 300                                        | 13 000                                          | IRT 2220-1              |
| 28                        | 37 | 30 | 3.4                    |                                 |        |                   |            |        |            | 33 000                            | 56 900                                        | 13 000                                          | IRT 2230-1              |
| 28                        | 37 | 20 | —                      |                                 |        |                   |            |        |            | 34 700                            | 61 700                                        | 5 500                                           | IRT 2220-1              |

SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 29 — 35mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 29               | TA 2920 Z             | 47                   | TAM 2920   | 52                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 2930 Z             | 70                   | TAM 2930   | 75.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 2920         | 58.5                 |
| 30               | —                     | —                    | —          | —                    | TLA 3012 Z | 23.5                 | TLAM 3012  | 29                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3016 Z | 30.5                 | TLAM 3016  | 36                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3018 Z | 34.5                 | TLAM 3018  | 40                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3020 Z | 38                   | TLAM 3020  | 43.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3026 Z | 49                   | TLAM 3026  | 54.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLAW3038 Z | 69                   | TLAMW3038  | 74.5                 | —               | —                    |
|                  | TA 3013 Z             | 36.5                 | TAM 3013   | 42.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3015 Z             | 42                   | TAM 3015   | 47.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3020 Z             | 54.5                 | TAM 3020   | 60                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3025 Z             | 68                   | TAM 3025   | 73.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3030 Z             | 80                   | TAM 3030   | 85.5                 | —          | —                    | —          | —                    | —               | —                    |
| 32               | TA 3220 Z             | 57.5                 | TAM 3220   | 63.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3230 Z             | 86                   | TAM 3230   | 97.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 3220         | 71.5                 |
| 35               | —                     | —                    | —          | —                    | TLA 3512 Z | 27                   | TLAM 3512  | 34.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3516 Z | 35                   | TLAM 3516  | 42.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 3520 Z | 43.5                 | TLAM 3520  | 51                   | —               | —                    |
|                  | TA 3512 Z             | 38.5                 | TAM 3512   | 46                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3515 Z             | 48                   | TAM 3515   | 56                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3520 Z             | 62.5                 | TAM 3520   | 70                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3525 Z             | 78                   | TAM 3525   | 85.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3530 Z             | 97                   | TAM 3530   | 105                  | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

Remarks1. "W" in the identification number indicates that rolling elements are arranged in double rows.

2. Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.

| Boundary dimensions<br>mm |    |    |                        | Standard mounting dimensions mm |        |                   |            |        |            | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|------------------------|---------------------------------|--------|-------------------|------------|--------|------------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |            |        |            | N                                 | N                                             | min <sup>-1</sup>                               |                         |
|                           |    |    |                        | Max.                            | Min.   | Max.              | J7<br>Min. | Max.   | N7<br>Min. |                                   |                                               |                                                 |                         |
| 29                        | 38 | 20 | 3.4                    | 29.000                          | 28.987 | 38.014            | 37.989     | —      | —          | 22 000                            | 34 200                                        | 13 000                                          | IRT 2520                |
| 29                        | 38 | 30 | 3.4                    |                                 |        |                   |            |        |            | 34 200                            | 60 300                                        | 13 000                                          | IRT 2530                |
| 29                        | 38 | 20 | —                      |                                 |        |                   |            |        |            | 35 500                            | 64 100                                        | 5 000                                           | IRT 2520                |
| 30                        | 37 | 12 | 2.8                    | 30.000                          | 29.987 | —                 | —          | 36.992 | 36.967     | 10 400                            | 16 600                                        | 12 000                                          | —                       |
| 30                        | 37 | 16 | 2.8                    |                                 |        |                   |            |        |            | 14 100                            | 24 500                                        | 12 000                                          | —                       |
| 30                        | 37 | 18 | 2.8                    |                                 |        |                   |            |        |            | 16 400                            | 29 800                                        | 12 000                                          | —                       |
| 30                        | 37 | 20 | 2.8                    |                                 |        |                   |            |        |            | 18 600                            | 35 100                                        | 12 000                                          | IRT 2520-1              |
| 30                        | 37 | 26 | 2.8                    |                                 |        |                   |            |        |            | 24 800                            | 50 900                                        | 12 000                                          | IRT 2526-1              |
| 30                        | 37 | 38 | 2.8                    |                                 |        |                   |            |        |            | 31 900                            | 70 200                                        | 12 000                                          | IRT 2538-1              |
| 30                        | 40 | 13 | 3.4                    | 30.000                          | 29.987 | 40.014            | 39.989     | —      | —          | 13 500                            | 16 800                                        | 12 000                                          | —                       |
| 30                        | 40 | 15 | 3.4                    |                                 |        |                   |            |        |            | 16 800                            | 22 400                                        | 12 000                                          | IRT 2515-1              |
| 30                        | 40 | 20 | 3.4                    |                                 |        |                   |            |        |            | 24 500                            | 36 300                                        | 12 000                                          | IRT 2520-1              |
| 30                        | 40 | 25 | 3.4                    |                                 |        |                   |            |        |            | 31 600                            | 50 300                                        | 12 000                                          | IRT 2525-1              |
| 30                        | 40 | 30 | 3.4                    |                                 |        |                   |            |        |            | 36 700                            | 60 700                                        | 12 000                                          | IRT 2530-1              |
| 32                        | 42 | 20 | 3.4                    | 32.000                          | 31.984 | 42.014            | 41.989     | —      | —          | 25 400                            | 38 600                                        | 11 000                                          | IRT 2820                |
| 32                        | 42 | 30 | 3.4                    |                                 |        |                   |            |        |            | 39 500                            | 68 400                                        | 11 000                                          | IRT 2830                |
| 32                        | 42 | 20 | —                      |                                 |        |                   |            |        |            | 39 900                            | 70 100                                        | 4 500                                           | IRT 2820                |
| 35                        | 42 | 12 | 2.8                    | 35.000                          | 34.984 | —                 | —          | 41.992 | 41.967     | 11 600                            | 20 000                                        | 10 000                                          | IRT 3012                |
| 35                        | 42 | 16 | 2.8                    |                                 |        |                   |            |        |            | 15 700                            | 29 600                                        | 10 000                                          | —                       |
| 35                        | 42 | 20 | 2.8                    |                                 |        |                   |            |        |            | 20 700                            | 42 300                                        | 10 000                                          | IRT 3020                |
| 35                        | 45 | 12 | 3.4                    | 35.000                          | 34.984 | 45.014            | 44.989     | —      | —          | 14 800                            | 19 900                                        | 10 000                                          | IRT 3012                |
| 35                        | 45 | 15 | 3.4                    |                                 |        |                   |            |        |            | 18 500                            | 26 500                                        | 10 000                                          | IRT 3015                |
| 35                        | 45 | 20 | 3.4                    |                                 |        |                   |            |        |            | 27 000                            | 43 100                                        | 10 000                                          | IRT 3020                |
| 35                        | 45 | 25 | 3.4                    |                                 |        |                   |            |        |            | 34 800                            | 59 700                                        | 10 000                                          | IRT 3025                |
| 35                        | 45 | 30 | 3.4                    |                                 |        |                   |            |        |            | 40 600                            | 72 600                                        | 10 000                                          | IRT 3030                |

SHELL TYPE NEEDLE ROLLER BEARINGS



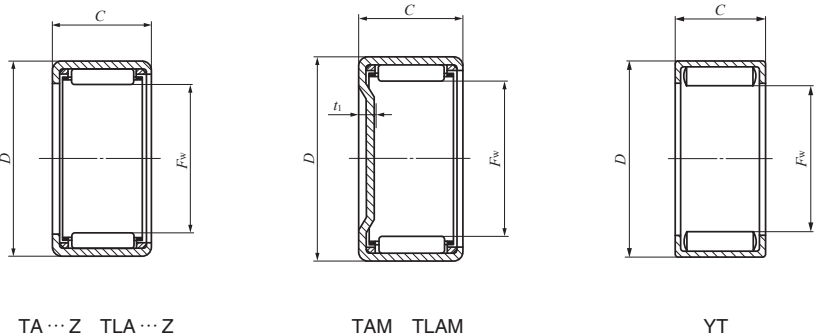
Shaft dia. 37 — 45mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 37               | TA 3720 Z             | 64.5                 | TAM 3720   | 73                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3730 Z             | 101                  | TAM 3730   | 110                  | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 3720         | 81                   |
| 38               | TA 3815 Z             | 51                   | TAM 3815   | 60                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3820 Z             | 65.5                 | TAM 3820   | 74.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3825 Z             | 82.5                 | TAM 3825   | 96                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 3830 Z             | 104                  | TAM 3830   | 114                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 3845 Z            | 149                  | TAMW 3845  | 159                  | —          | —                    | —          | —                    | —               | —                    |
| 40               | —                     | —                    | —          | —                    | TLA 4012 Z | 30                   | TLAM 4012  | 40                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 4016 Z | 39                   | TLAM 4016  | 49                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 4020 Z | 49                   | TLAM 4020  | 58.5                 | —               | —                    |
|                  | TA 4015 Z             | 54                   | TAM 4015   | 63.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4020 Z             | 69.5                 | TAM 4020   | 79                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4025 Z             | 86.5                 | TAM 4025   | 102                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4030 Z             | 110                  | TAM 4030   | 120                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4040 Z             | 144                  | TAM 4040   | 154                  | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 4015         | 63.5                 |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 4025         | 109                  |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
| 45               | —                     | —                    | —          | —                    | TLA 4516 Z | 43.5                 | TLAM 4516  | 56                   | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 4520 Z | 54.5                 | TLAM 4520  | 67                   | —               | —                    |
|                  | TA 4520 Z             | 77                   | TAM 4520   | 90                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4525 Z             | 102                  | TAM 4525   | 115                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4530 Z             | 122                  | TAM 4530   | 135                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 4540 Z             | 161                  | TAM 4540   | 174                  | —          | —                    | —          | —                    | —               | —                    |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 4520         | 96                   |
|                  | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YT 4525         | 122                  |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

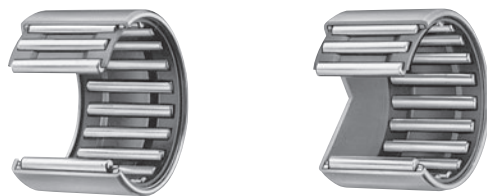
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2. Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions<br>mm |     |     |               | Standard mounting dimensions mm |        |                   |        |        |        | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|-----|-----|---------------|---------------------------------|--------|-------------------|--------|--------|--------|------------------------------|-----------------------------|-------------------------------------------------|-------------------------|
| $F_w$                     | $D$ | $C$ | $t_1$<br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |        |        |        | $C$<br>N                     | $C_0$<br>N                  | min <sup>-1</sup>                               |                         |
|                           |     |     |               | Max.                            | Min.   | Max.              | Min.   | Max.   | Min.   |                              |                             |                                                 |                         |
| 37                        | 47  | 20  | 3.4           |                                 |        |                   |        |        |        | 27 800                       | 45 400                      | 9 500                                           | IRT 3220                |
| 37                        | 47  | 30  | 3.4           | 37.000                          | 36.984 | 47.014            | 46.989 | —      | —      | 41 800                       | 76 700                      | 9 500                                           | IRT 3230                |
| 37                        | 47  | 20  | —             |                                 |        |                   |        |        |        | 43 300                       | 81 300                      | 4 000                                           | IRT 3220                |
| 38                        | 48  | 15  | 3.4           |                                 |        |                   |        |        |        | 19 000                       | 28 000                      | 9 000                                           | IRT 3215-1              |
| 38                        | 48  | 20  | 3.4           |                                 |        |                   |        |        |        | 27 700                       | 45 600                      | 9 000                                           | IRT 3220-1              |
| 38                        | 48  | 25  | 3.4           | 38.000                          | 37.984 | 48.014            | 47.989 | —      | —      | 35 600                       | 63 100                      | 9 000                                           | IRT 3225-1              |
| 38                        | 48  | 30  | 3.4           |                                 |        |                   |        |        |        | 43 100                       | 80 600                      | 9 000                                           | IRT 3230-1              |
| 38                        | 48  | 45  | 3.4           |                                 |        |                   |        |        |        | 55 700                       | 112 000                     | 9 000                                           | IRT 3245-1              |
| 40                        | 47  | 12  | 2.8           |                                 |        |                   |        |        |        | 12 400                       | 22 800                      | 8 500                                           | —                       |
| 40                        | 47  | 16  | 2.8           | 40.000                          | 39.984 | —                 | —      | 46.992 | 46.967 | 16 700                       | 33 700                      | 8 500                                           | —                       |
| 40                        | 47  | 20  | 2.8           |                                 |        |                   |        |        |        | 22 100                       | 48 200                      | 8 500                                           | IRT 3520                |
| 40                        | 50  | 15  | 3.4           |                                 |        |                   |        |        |        | 19 500                       | 29 400                      | 8 500                                           | IRT 3515                |
| 40                        | 50  | 20  | 3.4           |                                 |        |                   |        |        |        | 28 400                       | 47 800                      | 8 500                                           | IRT 3520                |
| 40                        | 50  | 25  | 3.4           |                                 |        |                   |        |        |        | 36 600                       | 66 200                      | 8 500                                           | IRT 3525                |
| 40                        | 50  | 30  | 3.4           | 40.000                          | 39.984 | 50.014            | 49.989 | —      | —      | 44 300                       | 84 600                      | 8 500                                           | IRT 3530                |
| 40                        | 50  | 40  | 3.4           |                                 |        |                   |        |        |        | 56 700                       | 116 000                     | 8 500                                           | IRT 3540                |
| 40                        | 50  | 15  | —             |                                 |        |                   |        |        |        | 33 400                       | 59 800                      | 4 000                                           | IRT 3515                |
| 40                        | 50  | 25  | —             |                                 |        |                   |        |        |        | 55 300                       | 114 000                     | 4 000                                           | IRT 3525                |
| 45                        | 52  | 16  | 2.8           |                                 |        |                   |        |        |        | 17 800                       | 37 800                      | 7 500                                           | —                       |
| 45                        | 52  | 20  | 2.8           | 45.000                          | 44.984 | —                 | —      | 51.991 | 51.961 | 23 400                       | 54 000                      | 7 500                                           | IRT 4020                |
| 45                        | 55  | 20  | 3.4           |                                 |        |                   |        |        |        | 30 600                       | 54 600                      | 7 500                                           | IRT 4020                |
| 45                        | 55  | 25  | 3.4           |                                 |        |                   |        |        |        | 39 400                       | 75 600                      | 7 500                                           | IRT 4025                |
| 45                        | 55  | 30  | 3.4           | 45.000                          | 44.984 | 55.018            | 54.988 | —      | —      | 47 700                       | 96 600                      | 7 500                                           | IRT 4030                |
| 45                        | 55  | 40  | 3.4           |                                 |        |                   |        |        |        | 61 300                       | 133 000                     | 7 500                                           | IRT 4040                |
| 45                        | 55  | 20  | —             |                                 |        |                   |        |        |        | 47 800                       | 98 200                      | 3 500                                           | IRT 4020                |
| 45                        | 55  | 25  | —             |                                 |        |                   |        |        |        | 59 100                       | 129 000                     | 3 500                                           | IRT 4025                |

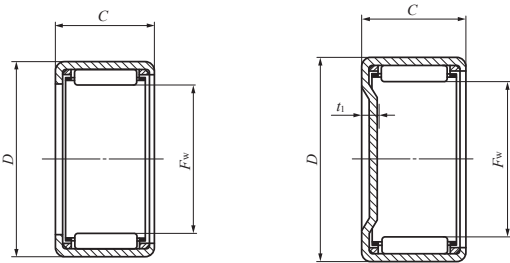
SHELL TYPE NEEDLE ROLLER BEARINGS



Shaft dia. 50 — 62mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 50               | —                     | —                    | —          | —                    | TLA 5020 Z | 69                   | TLAM 5020  | 84.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 5025 Z | 86                   | TLAM 5025  | 107                  | —               | —                    |
|                  | TA 5012 Z             | 62.5                 | TAM 5012   | 78                   | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5015 Z             | 78                   | TAM 5015   | 98.5                 | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5020 Z             | 107                  | TAM 5020   | 123                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5025 Z             | 134                  | TAM 5025   | 150                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5030 Z             | 161                  | TAM 5030   | 178                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5040 Z             | 210                  | TAM 5040   | 230                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 5045 Z            | 230                  | TAMW 5045  | 245                  | —          | —                    | —          | —                    | —               | —                    |
| 55               | —                     | —                    | —          | —                    | TLA 5520 Z | 75                   | TLAM 5520  | 98.5                 | —               | —                    |
|                  | —                     | —                    | —          | —                    | TLA 5525 Z | 98.5                 | TLAM 5525  | 118                  | —               | —                    |
|                  | TA 5520 Z             | 116                  | TAM 5520   | 136                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5525 Z             | 145                  | TAM 5525   | 165                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5530 Z             | 175                  | TAM 5530   | 195                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 5540 Z             | 230                  | TAM 5540   | 250                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 5545 Z            | 250                  | TAMW 5545  | 270                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 5550 Z            | 280                  | TAMW 5550  | 300                  | —          | —                    | —          | —                    | —               | —                    |
| 60               | TA 6025 Z             | 158                  | TAM 6025   | 182                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 6030 Z             | 191                  | TAM 6030   | 215                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TA 6040 Z             | 250                  | TAM 6040   | 275                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 6045 Z            | 270                  | TAMW 6045  | 295                  | —          | —                    | —          | —                    | —               | —                    |
|                  | TAW 6050 Z            | 305                  | TAMW 6050  | 330                  | —          | —                    | —          | —                    | —               | —                    |
| 62               | TA 6212 Z             | 78                   | TAM 6212   | 107                  | —          | —                    | —          | —                    | —               | —                    |

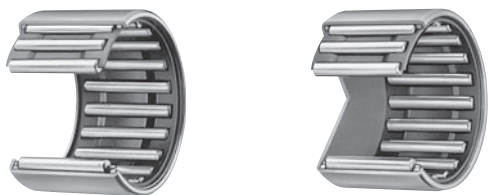
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TA ... Z TLA ... Z

TAM TLAM

| Boundary dimensions<br>mm |     |     |               | Standard mounting dimensions mm |        |                   |            |        |            | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|-----|-----|---------------|---------------------------------|--------|-------------------|------------|--------|------------|------------------------------|-----------------------------|-------------------------------------------------|-------------------------|
| $F_w$                     | $D$ | $C$ | $t_1$<br>Max. | Shaft dia.<br>h6                |        | Housing bore dia. |            |        |            | $C$                          | $C_0$                       | min <sup>-1</sup>                               |                         |
|                           |     |     |               | Max.                            | Min.   | Max.              | J7<br>Min. | Max.   | N7<br>Min. | N                            | N                           |                                                 |                         |
| 50                        | 58  | 20  | 2.8           | 50.000                          | 49.984 | —                 | —          | 57.991 | 57.961     | 28 800                       | 64 100                      | 6 500                                           | IRT 4520                |
| 50                        | 58  | 25  | 2.8           |                                 |        |                   |            |        |            | 36 900                       | 88 400                      | 6 500                                           | IRT 4525                |
| 50                        | 62  | 12  | 3.4           | 50.000                          | 49.984 | 62.018            | 61.988     | —      | —          | 17 700                       | 24 000                      | 6 500                                           | IRT 4512                |
| 50                        | 62  | 15  | 3.4           |                                 |        |                   |            |        |            | 25 800                       | 39 000                      | 6 500                                           | IRT 4515                |
| 50                        | 62  | 20  | 3.4           |                                 |        |                   |            |        |            | 38 000                       | 64 000                      | 6 500                                           | IRT 4520                |
| 50                        | 62  | 25  | 3.4           |                                 |        |                   |            |        |            | 49 100                       | 89 000                      | 6 500                                           | IRT 4525                |
| 50                        | 62  | 30  | 3.4           |                                 |        |                   |            |        |            | 59 500                       | 114 000                     | 6 500                                           | IRT 4530                |
| 50                        | 62  | 40  | 3.4           |                                 |        |                   |            |        |            | 76 500                       | 157 000                     | 6 500                                           | IRT 4540                |
| 50                        | 62  | 45  | 3.4           |                                 |        |                   |            |        |            | 76 700                       | 158 000                     | 6 500                                           | IRT 4545                |
| 55                        | 63  | 20  | 2.8           | 55.000                          | 54.981 | —                 | —          | 62.991 | 62.961     | 29 800                       | 69 400                      | 5 500                                           | IRT 5020-1              |
| 55                        | 63  | 25  | 2.8           |                                 |        |                   |            |        |            | 38 300                       | 95 700                      | 5 500                                           | IRT 5025-1              |
| 55                        | 67  | 20  | 3.4           | 55.000                          | 54.981 | 67.018            | 66.988     | —      | —          | 39 600                       | 69 700                      | 5 500                                           | IRT 5020-1              |
| 55                        | 67  | 25  | 3.4           |                                 |        |                   |            |        |            | 51 200                       | 97 000                      | 5 500                                           | IRT 5025-1              |
| 55                        | 67  | 30  | 3.4           |                                 |        |                   |            |        |            | 62 000                       | 124 000                     | 5 500                                           | IRT 5030-1              |
| 55                        | 67  | 40  | 3.4           |                                 |        |                   |            |        |            | 80 000                       | 172 000                     | 5 500                                           | IRT 5040-1              |
| 55                        | 67  | 45  | 3.4           |                                 |        |                   |            |        |            | 79 900                       | 172 000                     | 5 500                                           | IRT 5045-1              |
| 55                        | 67  | 50  | 3.4           |                                 |        |                   |            |        |            | 91 500                       | 205 000                     | 5 500                                           | IRT 5050-1              |
| 60                        | 72  | 25  | 3.4           | 60.000                          | 59.981 | 72.018            | 71.988     | —      | —          | 54 700                       | 108 000                     | 5 000                                           | IRT 5025                |
| 60                        | 72  | 30  | 3.4           |                                 |        |                   |            |        |            | 66 300                       | 139 000                     | 5 000                                           | IRT 5030                |
| 60                        | 72  | 40  | 3.4           |                                 |        |                   |            |        |            | 85 700                       | 193 000                     | 5 000                                           | IRT 5040                |
| 60                        | 72  | 45  | 3.4           |                                 |        |                   |            |        |            | 85 400                       | 193 000                     | 5 000                                           | IRT 5045                |
| 60                        | 72  | 50  | 3.4           |                                 |        |                   |            |        |            | 97 800                       | 229 000                     | 5 000                                           | IRT 5050                |
| 62                        | 74  | 12  | 3.4           | 62.000                          | 61.981 | 74.018            | 73.988     | —      | —          | 20 100                       | 30 300                      | 4 500                                           | IRT 5212                |



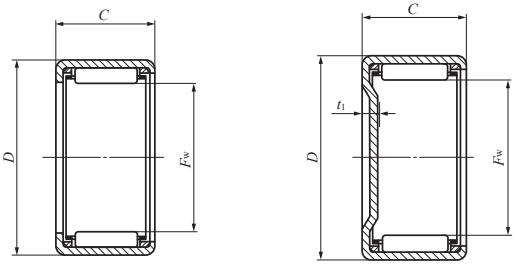
Shaft dia. 65 — 70mm

| Shaft dia.<br>mm | Identification number |                      |            |                      |          |                      |            |                      |                 |                      |
|------------------|-----------------------|----------------------|------------|----------------------|----------|----------------------|------------|----------------------|-----------------|----------------------|
|                  | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 65               | TA 6525 Z             | 169                  | TAM 6525   | 197                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TA 6530 Z             | 205                  | TAM 6530   | 230                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TAW 6545 Z            | 290                  | TAMW 6545  | 315                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TAW 6550 Z            | 330                  | TAMW 6550  | 355                  | —        | —                    | —          | —                    | —               | —                    |
| 70               | TA 7025 Z             | 181                  | TAM 7025   | 215                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TA 7030 Z             | 220                  | TAM 7030   | 250                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TA 7040 Z             | 290                  | TAM 7040   | 320                  | —        | —                    | —          | —                    | —               | —                    |
|                  | TAW 7050 Z            | 350                  | TAMW 7050  | 380                  | —        | —                    | —          | —                    | —               | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

Remarks1. "W" in the identification number indicates that rolling elements are arranged in double rows.

2. Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



TA...Z

TAM

| Boundary dimensions<br>mm |    |    |                        | Standard mounting dimensions mm |        |                         |        |      |      | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|---------------------------|----|----|------------------------|---------------------------------|--------|-------------------------|--------|------|------|-----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------|
| F <sub>w</sub>            | D  | C  | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        |      |      | N                                 | N                                             | min <sup>-1</sup>                               |                         |
|                           |    |    |                        | Max.                            | Min.   | Max.                    | Min.   | Max. | Min. |                                   |                                               |                                                 |                         |
| 65                        | 77 | 25 | 3.4                    | 65.000                          | 64.981 | 77.018                  | 76.988 | —    | —    | 56 500                            | 116 000                                       | 4 000                                           | IRT 5525                |
| 65                        | 77 | 30 | 3.4                    |                                 |        |                         |        |      |      | 68 500                            | 149 000                                       | 4 000                                           | IRT 5530                |
| 65                        | 77 | 45 | 3.4                    |                                 |        |                         |        |      |      | 88 300                            | 207 000                                       | 4 000                                           | IRT 5545                |
| 65                        | 77 | 50 | 3.4                    |                                 |        |                         |        |      |      | 101 000                           | 246 000                                       | 4 000                                           | IRT 5550                |
| 70                        | 82 | 25 | 3.4                    | 70.000                          | 69.981 | 82.022                  | 81.987 | —    | —    | 58 500                            | 124 000                                       | 3 500                                           | IRT 6025                |
| 70                        | 82 | 30 | 3.4                    |                                 |        |                         |        |      |      | 70 900                            | 159 000                                       | 3 500                                           | IRT 6030                |
| 70                        | 82 | 40 | 3.4                    |                                 |        |                         |        |      |      | 92 000                            | 222 000                                       | 3 500                                           | IRT 6040                |
| 70                        | 82 | 50 | 3.4                    |                                 |        |                         |        |      |      | 105 000                           | 262 000                                       | 3 500                                           | IRT 6050                |

SHELL TYPE NEEDLE ROLLER BEARINGS

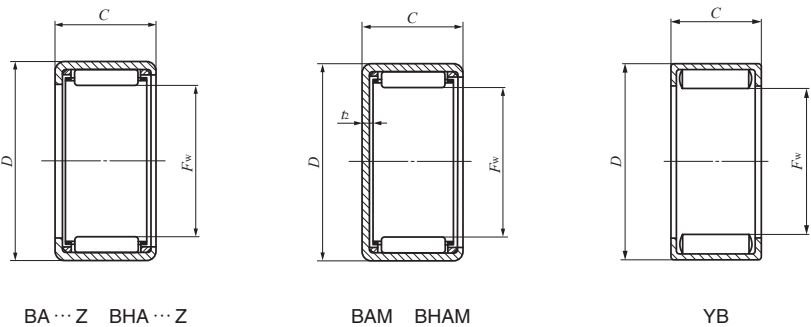
Inch Series



Shaft dia. 3.969 — 9.525mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |          |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|----------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 3.969<br>( 5/32 )          | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 2.5 2.5      | 0.64                 |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 2.5 4        | 0.96                 |
| 4.762<br>( 3/16 )          | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 34           | 1.6                  |
| 6.350<br>( 1/4 )           | BA 44                 | 2.1                  | —          | —                    | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 45 Z               | 2.5                  | BAM 45     | 2.7                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 47 Z               | 3.5                  | BAM 47     | 3.7                  | —        | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 45           | 3.2                  |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 47           | 4.6                  |
| 7.938<br>( 5/16 )          | BA 55 Z               | 3                    | BAM 55     | 3.3                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 56 Z               | 3.6                  | BAM 56     | 3.9                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 57 Z               | 4.3                  | BAM 57     | 4.6                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 59 Z               | 5.4                  | BAM 59     | 5.7                  | —        | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 55           | 3.8                  |
|                            | —                     | —                    | —          | —                    | BHA 57 Z | 6.3                  | BHAM 57    | 6.6                  | —               | —                    |
| 9.525<br>( 3/8 )           | BA 65 Z               | 3.5                  | BAM 65     | 3.9                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 66 Z               | 4.2                  | BAM 66     | 4.6                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 68 Z               | 5.7                  | BAM 68     | 6.1                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 69 Z               | 6.3                  | BAM 69     | 6.7                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 610 Z              | 7                    | BAM 610    | 7.4                  | —        | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 64           | 3.4                  |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 66           | 5.3                  |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 68           | 7.2                  |
|                            | —                     | —                    | —          | —                    | —        | —                    | —          | —                    | YB 610          | 9.1                  |
|                            | —                     | —                    | —          | —                    | BHA 68 Z | 8.2                  | BHAM 68    | 8.6                  | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                 |             |                        | Standard mounting dimensions mm |       |                         |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------|-----------------|-------------|------------------------|---------------------------------|-------|-------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| F <sub>w</sub>               | D               | C           | t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |       | Housing bore dia.<br>J7 |        | C                         | C <sub>0</sub>           | min <sup>-1</sup>             |                      |
|                              |                 |             |                        | Max.                            | Min.  | Max.                    | Min.   | N                         | N                        |                               |                      |
| 3.969 ( 5/32 )               | 7.144 ( 9/32 )  | 3.96(.156)  | —                      | 3.969                           | 3.961 | 7.152                   | 7.137  | 1 350                     | 1 220                    | 40 000                        | —                    |
| 3.969 ( 5/32 )               | 7.144 ( 9/32 )  | 6.35(.250)  | —                      | —                               | —     | —                       | —      | 2 320                     | 2 440                    | 40 000                        | —                    |
| 4.762 ( 3/16 )               | 8.731 ( 11/32 ) | 6.35(.250)  | —                      | 4.762                           | 4.754 | 8.739                   | 8.724  | 2 770                     | 2 700                    | 30 000                        | —                    |
| 6.350 ( 1/4 )                | 11.112 ( 7/16 ) | 6.35(.250)  | 1                      | —                               | —     | —                       | —      | 1 770                     | 1 390                    | 55 000                        | —                    |
| 6.350 ( 1/4 )                | 11.112 ( 7/16 ) | 7.92(.312)  | 1                      | —                               | —     | —                       | —      | 1 510                     | 1 120                    | 55 000                        | —                    |
| 6.350 ( 1/4 )                | 11.112 ( 7/16 ) | 11.13(.438) | 1                      | 6.350                           | 6.341 | 11.122                  | 11.104 | 2 650                     | 2 310                    | 55 000                        | —                    |
| 6.350 ( 1/4 )                | 11.112 ( 7/16 ) | 7.92(.312)  | —                      | —                               | —     | —                       | —      | 4 450                     | 4 870                    | 25 000                        | —                    |
| 6.350 ( 1/4 )                | 11.112 ( 7/16 ) | 11.13(.438) | —                      | —                               | —     | —                       | —      | 6 320                     | 7 650                    | 25 000                        | —                    |
| 7.938 ( 5/16 )               | 12.700 ( 1/2 )  | 7.92(.312)  | 1                      | —                               | —     | —                       | —      | 1 880                     | 1 560                    | 45 000                        | —                    |
| 7.938 ( 5/16 )               | 12.700 ( 1/2 )  | 9.52(.375)  | 1                      | —                               | —     | —                       | —      | 2 620                     | 2 390                    | 45 000                        | —                    |
| 7.938 ( 5/16 )               | 12.700 ( 1/2 )  | 11.13(.438) | 1                      | 7.938                           | 7.929 | 12.710                  | 12.692 | 3 310                     | 3 220                    | 45 000                        | —                    |
| 7.938 ( 5/16 )               | 12.700 ( 1/2 )  | 14.27(.562) | 1                      | —                               | —     | —                       | —      | 4 190                     | 4 360                    | 45 000                        | —                    |
| 7.938 ( 5/16 )               | 12.700 ( 1/2 )  | 7.92(.312)  | —                      | —                               | —     | —                       | —      | 5 110                     | 6 090                    | 20 000                        | —                    |
| 7.938 ( 5/16 )               | 14.288 ( 9/16 ) | 11.13(.438) | 1.3                    | 7.938                           | 7.929 | 14.298                  | 14.280 | 4 150                     | 3 730                    | 45 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 7.92(.312)  | 1                      | —                               | —     | —                       | —      | 2 220                     | 2 010                    | 40 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 9.52(.375)  | 1                      | —                               | —     | —                       | —      | 3 090                     | 3 080                    | 40 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 12.70(.500) | 1                      | 9.525                           | 9.516 | 14.298                  | 14.280 | 4 190                     | 4 560                    | 40 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 14.27(.562) | 1                      | —                               | —     | —                       | —      | 4 940                     | 5 630                    | 40 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 15.88(.625) | 1                      | —                               | —     | —                       | —      | 5 660                     | 6 700                    | 40 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 6.35(.250)  | —                      | —                               | —     | —                       | —      | 4 470                     | 5 360                    | 16 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 9.52(.375)  | —                      | 9.525                           | 9.516 | 14.298                  | 14.280 | 6 920                     | 9 410                    | 16 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 12.70(.500) | —                      | —                               | —     | —                       | —      | 9 210                     | 13 600                   | 16 000                        | —                    |
| 9.525 ( 3/8 )                | 14.288 ( 9/16 ) | 15.88(.625) | —                      | —                               | —     | —                       | —      | 11 300                    | 17 800                   | 16 000                        | —                    |
| 9.525 ( 3/8 )                | 15.875 ( 5/8 )  | 12.70(.500) | 1.3                    | 9.525                           | 9.516 | 15.885                  | 15.867 | 4 880                     | 4 740                    | 40 000                        | —                    |

SHELL TYPE NEEDLE ROLLER BEARINGS

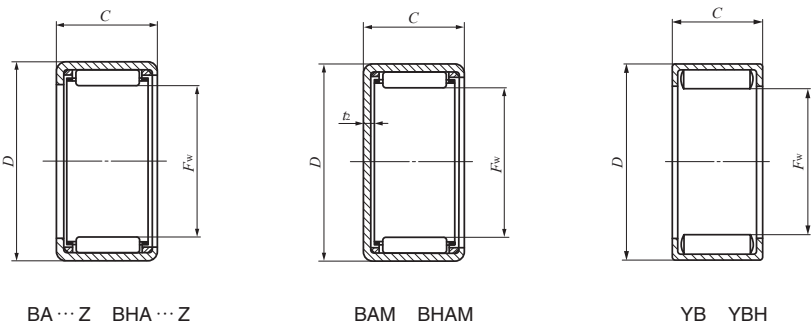
Inch Series



Shaft dia. 11.112 – 12.700mm

| Shaft dia.<br>mm<br>(inch)                 | Identification number |                      |            |                      |           |                      |            |                      |                 |                      |
|--------------------------------------------|-----------------------|----------------------|------------|----------------------|-----------|----------------------|------------|----------------------|-----------------|----------------------|
|                                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard  | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 11.112<br>( <sup>7</sup> / <sub>16</sub> ) | BA 76 Z               | 4.8                  | BAM 76     | 5.3                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 77 Z               | 5.6                  | BAM 77     | 6.2                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 78 Z               | 6.4                  | BAM 78     | 7                    | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 710 Z              | 7.9                  | BAM 710    | 8.5                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 78           | 8.2                  |
|                                            | —                     | —                    | —          | —                    | BHA 78 Z  | 9.3                  | BHAM 78    | 10                   | —               | —                    |
| 12.700<br>( <sup>1</sup> / <sub>2</sub> )  | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YBH 78          | 10.5                 |
|                                            | BA 85 Z               | 4.4                  | BAM 85     | 5.2                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 86 Z               | 5.3                  | BAM 86     | 6.1                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 87 Z               | 6.3                  | BAM 87     | 7                    | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 88 Z               | 7.2                  | BAM 88     | 7.9                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 810 Z              | 8.9                  | BAM 810    | 9.6                  | —         | —                    | —          | —                    | —               | —                    |
|                                            | BA 812 Z              | 10.6                 | BAM 812    | 11.3                 | —         | —                    | —          | —                    | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 84           | 4.3                  |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 86           | 6.7                  |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 87           | 7.9                  |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 88           | 9.1                  |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 810          | 11.5                 |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YB 812          | 13.9                 |
|                                            | —                     | —                    | —          | —                    | BHA 87 Z  | 9.1                  | BHAM 87    | 9.9                  | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 88 Z  | 10.4                 | BHAM 88    | 11.3                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 810 Z | 12.5                 | BHAM 810   | 13.3                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 812 Z | 15                   | BHAM 812   | 15.8                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —         | —                    | —          | —                    | YBH 810         | 16                   |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch)            |                                          |             |               | Standard mounting dimensions mm |        |                                      |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(1)</sup> | Assembled inner ring |
|-----------------------------------------|------------------------------------------|-------------|---------------|---------------------------------|--------|--------------------------------------|--------|---------------------------|--------------------------|-------------------------------------------|----------------------|
| $F_w$                                   | $D$                                      | $C$         | $t_2$<br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | $C$<br>N                  | $C_0$<br>N               | min <sup>-1</sup>                         |                      |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 9.52(.375)  | 1             | 11.112                          | 11.101 | 15.885                               | 15.867 | 3 290                     | 3 470                    | 35 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 11.13(.438) | 1             |                                 |        |                                      |        | 4 150                     | 4 680                    | 35 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 12.70(.500) | 1             |                                 |        |                                      |        | 4 460                     | 5 130                    | 35 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 15.88(.625) | 1             |                                 |        |                                      |        | 6 020                     | 7 550                    | 35 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 12.70(.500) | —             |                                 |        |                                      |        | 10 100                    | 15 900                   | 14 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 12.70(.500) | 1.3           | 11.112                          | 11.101 | 17.472                               | 17.454 | 5 680                     | 5 970                    | 35 000                                    | —                    |
| 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 12.70(.500) | —             |                                 |        |                                      |        | 12 500                    | 15 800                   | 14 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 7.92(.312)  | 1             | 12.700                          | 12.689 | 17.472                               | 17.454 | 2 490                     | 2 510                    | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 9.52(.375)  | 1             |                                 |        |                                      |        | 3 470                     | 3 850                    | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 11.13(.438) | 1             |                                 |        |                                      |        | 4 380                     | 5 190                    | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 12.70(.500) | 1             |                                 |        |                                      |        | 4 710                     | 5 700                    | 30 000                                    | IRB 58               |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 15.88(.625) | 1             |                                 |        |                                      |        | 6 350                     | 8 380                    | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 19.05(.750) | 1             |                                 |        |                                      |        | 7 840                     | 11 000                   | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 6.35(.250)  | —             |                                 |        |                                      |        | 5 260                     | 7 150                    | 12 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 9.52(.375)  | —             | 12.700                          | 12.689 | 17.472                               | 17.454 | 8 150                     | 12 600                   | 12 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 11.13(.438) | —             |                                 |        |                                      |        | 9 530                     | 15 300                   | 12 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 12.70(.500) | —             |                                 |        |                                      |        | 10 800                    | 18 100                   | 12 000                                    | IRB 58               |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 15.88(.625) | —             |                                 |        |                                      |        | 13 400                    | 23 700                   | 12 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 19.05(.750) | —             |                                 |        |                                      |        | 15 800                    | 29 300                   | 12 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 11.13(.438) | 1.3           |                                 |        |                                      |        | 5 670                     | 6 120                    | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 12.70(.500) | 1.3           |                                 |        |                                      |        | 6 040                     | 6 650                    | 30 000                                    | IRB 58               |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 15.88(.625) | 1.3           | 12.700                          | 12.689 | 19.062                               | 19.041 | 8 830                     | 10 900                   | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 19.05(.750) | 1.3           |                                 |        |                                      |        | 11 100                    | 14 500                   | 30 000                                    | —                    |
| 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 15.88(.625) | —             |                                 |        |                                      |        | 16 300                    | 23 500                   | 12 000                                    | —                    |

SHELL TYPE NEEDLE ROLLER BEARINGS

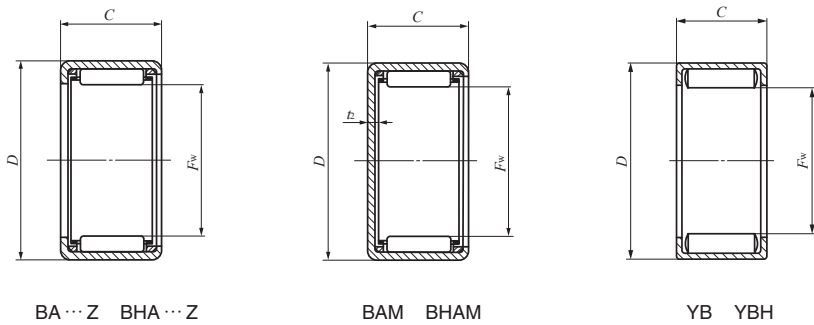
Inch Series



Shaft dia. 14.288 — 15.875mm

| Shaft dia.<br>mm<br>(inch)                 | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|--------------------------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 14.288<br>( <sup>9</sup> / <sub>16</sub> ) | BA 95 Z               | 4.9                  | BAM 95     | 5.8                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 96 Z               | 5.9                  | BAM 96     | 6.8                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 97 Z               | 6.9                  | BAM 97     | 7.8                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 98 Z               | 7.9                  | BAM 98     | 8.9                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 910 Z              | 9.9                  | BAM 910    | 10.8                 | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 912 Z              | 11.7                 | BAM 912    | 12.6                 | —          | —                    | —          | —                    | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 98           | 10.1                 |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 910          | 12.7                 |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 912          | 15.4                 |
|                                            | —                     | —                    | —          | —                    | BHA 98 Z   | 11.4                 | BHAM 98    | 12.5                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 910 Z  | 13.6                 | BHAM 910   | 14.7                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 912 Z  | 16.3                 | BHAM 912   | 17.4                 | —               | —                    |
|                                            | BA 105 Z              | 5.3                  | BAM 105    | 6.5                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 107 Z              | 7.6                  | BAM 107    | 8.7                  | —          | —                    | —          | —                    | —               | —                    |
| 15.875<br>( <sup>5</sup> / <sub>8</sub> )  | BA 108 Z              | 8.7                  | BAM 108    | 9.9                  | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 1010 Z             | 10.8                 | BAM 1010   | 12                   | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 1012 Z             | 12.9                 | BAM 1012   | 14                   | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 1014 Z             | 15.1                 | BAM 1014   | 16.2                 | —          | —                    | —          | —                    | —               | —                    |
|                                            | BA 1016 Z             | 17.3                 | BAM 1016   | 18.4                 | —          | —                    | —          | —                    | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 105          | 6.7                  |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 108          | 11                   |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1012         | 16.9                 |
|                                            | —                     | —                    | —          | —                    | BHA 108 Z  | 12.6                 | BHAM 108   | 13.9                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 1010 Z | 14.9                 | BHAM 1010  | 16.2                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 1012 Z | 18                   | BHAM 1012  | 19.3                 | —               | —                    |
|                                            | —                     | —                    | —          | —                    | BHA 1016 Z | 24                   | BHAM 1016  | 25                   | —               | —                    |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 108         | 15.3                 |
|                                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch)            |                                          |              |               | Standard mounting dimensions mm |        |                                      |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(1)</sup> | Assembled inner ring |
|-----------------------------------------|------------------------------------------|--------------|---------------|---------------------------------|--------|--------------------------------------|--------|---------------------------|--------------------------|-------------------------------------------|----------------------|
| $F_w$                                   | $D$                                      | $C$          | $t_2$<br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | $C$<br>N                  | $C_0$<br>N               | $\text{min}^{-1}$                         |                      |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 7.92( .312)  | 1.3           | 14.288                          | 14.277 | 19.062                               | 19.041 | 2 760                     | 2 970                    | 30 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 9.52( .375)  | 1.3           |                                 |        |                                      |        | 3 850                     | 4 560                    | 30 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 11.13( .438) | 1.3           |                                 |        |                                      |        | 4 860                     | 6 140                    | 30 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 12.70( .500) | 1.3           |                                 |        |                                      |        | 5 220                     | 6 740                    | 30 000                                    | IRB 68               |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 15.88( .625) | 1.3           |                                 |        |                                      |        | 7 050                     | 9 910                    | 30 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 19.05( .750) | 1.3           |                                 |        |                                      |        | 8 690                     | 13 000                   | 30 000                                    | IRB 612              |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 12.70( .500) | —             |                                 |        |                                      |        | 11 600                    | 20 400                   | 11 000                                    | IRB 68               |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 15.88( .625) | —             |                                 |        |                                      |        | 14 300                    | 26 700                   | 11 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 19.05( .750) | —             |                                 |        |                                      |        | 16 800                    | 33 000                   | 11 000                                    | IRB 612              |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 12.70( .500) | 1.3           | 14.288                          | 14.277 | 20.650                               | 20.629 | 6 380                     | 7 330                    | 30 000                                    | IRB 68               |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 15.88( .625) | 1.3           |                                 |        |                                      |        | 9 280                     | 11 900                   | 30 000                                    | —                    |
| 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 19.05( .750) | 1.3           |                                 |        |                                      |        | 11 600                    | 15 900                   | 30 000                                    | IRB 612              |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 7.92( .312)  | 1.3           | 15.875                          | 15.864 | 20.650                               | 20.629 | 2 870                     | 3 220                    | 25 000                                    | —                    |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 11.13( .438) | 1.3           |                                 |        |                                      |        | 5 040                     | 6 660                    | 25 000                                    | —                    |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 12.70( .500) | 1.3           |                                 |        |                                      |        | 5 420                     | 7 310                    | 25 000                                    | IRB 68-1             |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 15.88( .625) | 1.3           |                                 |        |                                      |        | 7 320                     | 10 700                   | 25 000                                    | —                    |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 19.05( .750) | 1.3           |                                 |        |                                      |        | 9 020                     | 14 100                   | 25 000                                    | IRB 612-1            |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 22.22( .875) | 1.3           |                                 |        |                                      |        | 10 700                    | 17 500                   | 25 000                                    | IRB 714              |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 25.40(1.000) | 1.3           |                                 |        |                                      |        | 12 300                    | 20 800                   | 25 000                                    | IRB 716              |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 7.92( .312)  | —             |                                 |        |                                      |        | 7 580                     | 12 200                   | 9 500                                     | —                    |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 12.70( .500) | —             |                                 |        |                                      |        | 12 300                    | 22 700                   | 9 500                                     | IRB 68-1             |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 19.05( .750) | —             |                                 |        |                                      |        | 17 800                    | 36 600                   | 9 500                                     | IRB 612-1            |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 12.70( .500) | 1.3           | 15.875                          | 15.864 | 22.237                               | 22.216 | 6 680                     | 8 020                    | 25 000                                    | IRB 68-1             |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 15.88( .625) | 1.3           |                                 |        |                                      |        | 10 200                    | 13 800                   | 25 000                                    | —                    |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 19.05( .750) | 1.3           |                                 |        |                                      |        | 12 700                    | 18 500                   | 25 000                                    | IRB 612-1            |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 25.40(1.000) | 1.3           |                                 |        |                                      |        | 17 400                    | 27 600                   | 25 000                                    | IRB 716              |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 12.70( .500) | —             |                                 |        |                                      |        | 15 000                    | 22 400                   | 9 500                                     | IRB 68-1             |
| 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | —            | —             |                                 |        |                                      |        | —                         | —                        | —                                         | —                    |

SHELL TYPE NEEDLE ROLLER BEARINGS

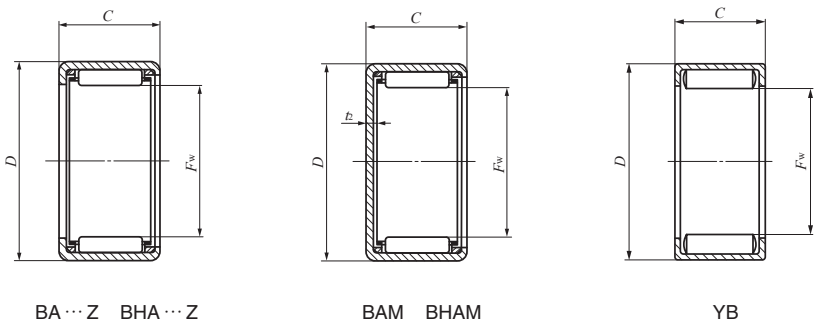
Inch Series



Shaft dia. 17.462 – 19.050mm

| Shaft dia.<br>mm<br>(inch)                  | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|---------------------------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                                             | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 17.462<br>( <sup>11</sup> / <sub>16</sub> ) | BA 116 Z              | 7                    | BAM 116    | 8.4                  | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 118 Z              | 9.5                  | BAM 118    | 10.8                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1110 Z             | 11.8                 | BAM 1110   | 13.2                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1112 Z             | 14                   | BAM 1112   | 15.4                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1112         | 18.3                 |
|                                             | —                     | —                    | —          | —                    | BHA 117 Z  | 11.9                 | BHAM 117   | 13.5                 | —               | —                    |
|                                             | —                     | —                    | —          | —                    | BHA 118 Z  | 13.7                 | BHAM 118   | 15.3                 | —               | —                    |
|                                             | —                     | —                    | —          | —                    | BHA 1110 Z | 16                   | BHAM 1110  | 17.6                 | —               | —                    |
|                                             | —                     | —                    | —          | —                    | BHA 1112 Z | 19.3                 | BHAM 1112  | 21                   | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
| 19.050<br>( <sup>3</sup> / <sub>4</sub> )   | BA 126 Z              | 10                   | BAM 126    | 11.7                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 128 Z              | 13.5                 | BAM 128    | 15.2                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1210 Z             | 17                   | BAM 1210   | 18.6                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1212 Z             | 20.5                 | BAM 1212   | 22                   | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1214 Z             | 23.5                 | BAM 1214   | 25                   | —          | —                    | —          | —                    | —               | —                    |
|                                             | BA 1216 Z             | 27                   | BAM 1216   | 28.5                 | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 124          | 8.5                  |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 128          | 17.8                 |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1210         | 22.5                 |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1212         | 27                   |
|                                             | —                     | —                    | —          | —                    | BHA 1212 Z | 26.5                 | BHAM 1212  | 28.5                 | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                                             | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch)             |                                           |                |               | Standard mounting dimensions mm |        |                                      |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------------------|-------------------------------------------|----------------|---------------|---------------------------------|--------|--------------------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| $F_w$                                    | $D$                                       | $C$            | $t_2$<br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | $C$<br>N                  | $C_0$<br>N               | min <sup>-1</sup>             |                      |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )    | 9.52( .375 )   | 1.3           | 17.462                          | 17.451 | 22.237                               | 22.216 | 4 530                     | 5 980                    | 25 000                        | IRB 86               |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )    | 12.70( .500 )  | 1.3           |                                 |        |                                      |        | 6 140                     | 8 850                    | 25 000                        | IRB 88               |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )    | 15.88( .625 )  | 1.3           |                                 |        |                                      |        | 8 280                     | 13 000                   | 25 000                        | —                    |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )    | 19.05( .750 )  | 1.3           |                                 |        |                                      |        | 10 200                    | 17 000                   | 25 000                        | IRB 812              |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )    | 19.05( .750 )  | —             |                                 |        |                                      |        | 18 700                    | 40 300                   | 8 500                         | IRB 812              |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 23.812 ( <sup>15</sup> / <sub>16</sub> )  | 11.13( .438 )  | 1.3           | 17.462                          | 17.451 | 23.824                               | 23.803 | 6 860                     | 8 530                    | 25 000                        | —                    |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 23.812 ( <sup>15</sup> / <sub>16</sub> )  | 12.70( .500 )  | 1.3           |                                 |        |                                      |        | 7 320                     | 9 270                    | 25 000                        | IRB 88               |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 23.812 ( <sup>15</sup> / <sub>16</sub> )  | 15.88( .625 )  | 1.3           |                                 |        |                                      |        | 10 500                    | 14 900                   | 25 000                        | —                    |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 23.812 ( <sup>15</sup> / <sub>16</sub> )  | 15.88( .625 )  | 1.3           |                                 |        |                                      |        | 13 200                    | 19 900                   | 25 000                        | IRB 812              |
| 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 23.812 ( <sup>15</sup> / <sub>16</sub> )  | 19.05( .750 )  | 1.3           |                                 |        |                                      |        | —                         | —                        | —                             | —                    |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 9.52( .375 )   | 1.3           | 19.050                          | 19.037 | 25.412                               | 25.391 | 5 040                     | 5 850                    | 20 000                        | —                    |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 12.70( .500 )  | 1.3           |                                 |        |                                      |        | 6 910                     | 8 780                    | 20 000                        | IRB 88-1             |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 15.88( .625 )  | 1.3           |                                 |        |                                      |        | 9 500                     | 13 200                   | 20 000                        | IRB 810-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 19.05( .750 )  | 1.3           |                                 |        |                                      |        | 11 900                    | 17 700                   | 20 000                        | IRB 812-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 22.22( .875 )  | 1.3           |                                 |        |                                      |        | 14 200                    | 22 200                   | 20 000                        | IRB 814-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 25.40( 1.000 ) | 1.3           |                                 |        |                                      |        | 16 300                    | 26 500                   | 20 000                        | IRB 816-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 6.35( .250 )   | —             | 19.050                          | 19.037 | 25.412                               | 25.391 | 7 820                     | 10 200                   | 8 000                         | —                    |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 12.70( .500 )  | —             |                                 |        |                                      |        | 16 600                    | 26 900                   | 8 000                         | IRB 88-1             |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 15.88( .625 )  | —             |                                 |        |                                      |        | 20 500                    | 35 300                   | 8 000                         | IRB 810-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 19.05( .750 )  | —             |                                 |        |                                      |        | 24 100                    | 43 400                   | 8 000                         | IRB 812-1            |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.400 ( 1 )                              | 19.05( .750 )  | —             |                                 |        |                                      |        | —                         | —                        | —                             | —                    |
| 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 26.988 ( 1 <sup>1</sup> / <sub>16</sub> ) | 19.05( .750 )  | 1.3           | 19.050                          | 19.037 | 27.000                               | 26.979 | 16 600                    | 22 600                   | 20 000                        | IRB 812-1            |

SHELL TYPE NEEDLE ROLLER BEARINGS

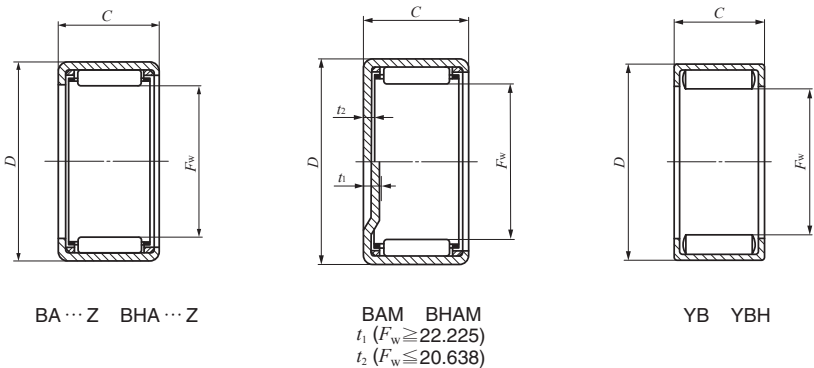
Inch Series



Shaft dia. 20.638 — 22.225mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 20.638<br>(13/16)          | BA 136 Z              | 10.7                 | BAM 136    | 12.6                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 138 Z              | 14.5                 | BAM 138    | 16.4                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1310 Z             | 18.2                 | BAM 1310   | 20                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1312 Z             | 22                   | BAM 1312   | 23.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1314 Z             | 25                   | BAM 1314   | 27                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1316 Z             | 28.5                 | BAM 1316   | 30.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1320 Z             | 35.5                 | BAM 1320   | 37.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 136          | 14.1                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 138          | 19.1                 |
|                            | —                     | —                    | —          | —                    | BHA 138 Z  | 20                   | BHAM 138   | 22.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1310 Z | 23.5                 | BHAM 1310  | 25.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1312 Z | 28.5                 | BHAM 1312  | 30.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 1310        | 30.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 1312        | 37                   |
| 22.225<br>(7/8)            | BA 146 Z              | 11.5                 | BAM 146    | 13.8                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 148 Z              | 15.6                 | BAM 148    | 17.8                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1412 Z             | 23.5                 | BAM 1412   | 26                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1414 Z             | 27                   | BAM 1414   | 29.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1416 Z             | 31                   | BAM 1416   | 33.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1418 Z             | 34.5                 | BAM 1418   | 37                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1422 Z             | 42.5                 | BAM 1422   | 44.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 148          | 20.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1412         | 31                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1416         | 41.5                 |
|                            | —                     | —                    | —          | —                    | BHA 1410 Z | 25                   | BHAM 1410  | 27.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1412 Z | 30                   | BHAM 1412  | 32.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1416 Z | 39.5                 | BHAM 1416  | 42                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 1412        | 39                   |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                 |               |                                          | Standard mounting dimensions mm |        |                         |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------|-----------------|---------------|------------------------------------------|---------------------------------|--------|-------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| F <sub>w</sub>               | D               | C             | t <sub>1</sub><br>t <sub>2</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        | C                         | C <sub>0</sub>           |                               |                      |
|                              |                 |               |                                          | Max.                            | Min.   | Max.                    | Min.   | N                         | N                        | min <sup>-1</sup>             |                      |
| 20.638 (13/16)               | 26.988 (1 1/16) | 9.52 ( .375)  | 1.3                                      | 20.638                          | 20.625 | 27.000                  | 26.979 | 5 230                     | 6 300                    | 19 000                        | —                    |
| 20.638 (13/16)               | 26.988 (1 1/16) | 12.70 ( .500) | 1.3                                      |                                 |        |                         |        | 7 170                     | 9 450                    | 19 000                        | IRB 98               |
| 20.638 (13/16)               | 26.988 (1 1/16) | 15.88 ( .625) | 1.3                                      |                                 |        |                         |        | 9 870                     | 14 200                   | 19 000                        | IRB 910              |
| 20.638 (13/16)               | 26.988 (1 1/16) | 19.05 ( .750) | 1.3                                      |                                 |        |                         |        | 12 400                    | 19 000                   | 19 000                        | IRB 912              |
| 20.638 (13/16)               | 26.988 (1 1/16) | 22.22 ( .875) | 1.3                                      |                                 |        |                         |        | 14 700                    | 23 800                   | 19 000                        | IRB 914              |
| 20.638 (13/16)               | 26.988 (1 1/16) | 25.40 (1.000) | 1.3                                      |                                 |        |                         |        | 16 900                    | 28 500                   | 19 000                        | IRB 916              |
| 20.638 (13/16)               | 26.988 (1 1/16) | 31.75 (1.250) | 1.3                                      |                                 |        |                         |        | 21 200                    | 38 100                   | 19 000                        | IRB 920              |
| 20.638 (13/16)               | 26.988 (1 1/16) | 9.52 ( .375)  | —                                        |                                 |        |                         |        | 13 000                    | 20 100                   | 7 500                         | —                    |
| 20.638 (13/16)               | 26.988 (1 1/16) | 12.70 ( .500) | —                                        |                                 |        |                         |        | 17 400                    | 29 200                   | 7 500                         | IRB 98               |
| 20.638 (13/16)               | 28.575 (1 1/8)  | 12.70 ( .500) | 1.3                                      | 20.638                          | 20.625 | 28.587                  | 28.566 | 9 500                     | 11 200                   | 19 000                        | IRB 98               |
| 20.638 (13/16)               | 28.575 (1 1/8)  | 15.88 ( .625) | 1.3                                      |                                 |        |                         |        | 13 800                    | 18 200                   | 19 000                        | IRB 910              |
| 20.638 (13/16)               | 28.575 (1 1/8)  | 19.05 ( .750) | 1.3                                      |                                 |        |                         |        | 17 300                    | 24 400                   | 19 000                        | IRB 912              |
| 20.638 (13/16)               | 28.575 (1 1/8)  | 15.88 ( .625) | —                                        |                                 |        |                         |        | 22 900                    | 36 300                   | 7 500                         | IRB 910              |
| 20.638 (13/16)               | 28.575 (1 1/8)  | 19.05 ( .750) | —                                        |                                 |        |                         |        | 27 200                    | 45 300                   | 7 500                         | IRB 912              |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 9.52 ( .375)  | 2.8                                      | 22.225                          | 22.212 | 28.587                  | 28.566 | 5 430                     | 6 740                    | 18 000                        | IRB 106              |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 12.70 ( .500) | 2.8                                      |                                 |        |                         |        | 7 440                     | 10 100                   | 18 000                        | IRB 108              |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 19.05 ( .750) | 2.8                                      |                                 |        |                         |        | 12 800                    | 20 400                   | 18 000                        | IRB 1012             |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 22.22 ( .875) | 2.8                                      |                                 |        |                         |        | 15 300                    | 25 500                   | 18 000                        | IRB 1014             |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 25.40 (1.000) | 2.8                                      |                                 |        |                         |        | 17 600                    | 30 500                   | 18 000                        | IRB 1016             |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 28.58 (1.125) | 2.8                                      |                                 |        |                         |        | 19 800                    | 35 600                   | 18 000                        | —                    |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 34.92 (1.375) | 2.8                                      |                                 |        |                         |        | 24 100                    | 45 700                   | 18 000                        | IRB 1022             |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 12.70 ( .500) | —                                        |                                 |        |                         |        | 18 100                    | 31 400                   | 7 000                         | IRB 108              |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 19.05 ( .750) | —                                        |                                 |        |                         |        | 26 300                    | 50 700                   | 7 000                         | IRB 1012             |
| 22.225 (7/8)                 | 28.575 (1 1/8)  | 25.40 (1.000) | —                                        |                                 |        |                         |        | 33 800                    | 70 200                   | 7 000                         | IRB 1016             |
| 22.225 (7/8)                 | 30.162 (1 3/16) | 15.88 ( .625) | 3.4                                      | 22.225                          | 22.212 | 30.176                  | 30.151 | 14 300                    | 19 500                   | 18 000                        | —                    |
| 22.225 (7/8)                 | 30.162 (1 3/16) | 19.05 ( .750) | 3.4                                      |                                 |        |                         |        | 18 000                    | 26 100                   | 18 000                        | IRB 1012             |
| 22.225 (7/8)                 | 30.162 (1 3/16) | 25.40 (1.000) | 3.4                                      |                                 |        |                         |        | 23 600                    | 36 900                   | 18 000                        | IRB 1016             |
| 22.225 (7/8)                 | 30.162 (1 3/16) | 19.05 ( .750) | —                                        |                                 |        |                         |        | 28 200                    | 49 000                   | 7 000                         | IRB 1012             |

SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series



Shaft dia. 23.812 – 26.988mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 23.812<br>(15/16)          | BA 158 Z              | 16.5                 | BAM 158    | 19                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1510 Z             | 20.5                 | BAM 1510   | 23                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1516 Z             | 33                   | BAM 1516   | 35.5                 | —          | —                    | —          | —                    | —               | —                    |
| 25.400<br>(1)              | BA 166 Z              | 13.1                 | BAM 166    | 16                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 167 Z              | 15.4                 | BAM 167    | 18.3                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 168 Z              | 17.7                 | BAM 168    | 20.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1610 Z             | 22                   | BAM 1610   | 25                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1612 Z             | 26.5                 | BAM 1612   | 29.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1614 Z             | 31                   | BAM 1614   | 33.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1616 Z             | 35.5                 | BAM 1616   | 38                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1620 Z             | 44                   | BAM 1620   | 46.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 168          | 23                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1612         | 34.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1616         | 46.5                 |
|                            | —                     | —                    | —          | —                    | BHA 168 Z  | 24                   | BHAM 168   | 27                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1610 Z | 28                   | BHAM 1610  | 31                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1612 Z | 33.5                 | BHAM 1612  | 37                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1614 Z | 39.5                 | BHAM 1614  | 42.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1616 Z | 45                   | BHAM 1616  | 48                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1620 Z | 56.5                 | BHAM 1620  | 59.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1624 Z | 67.5                 | BHAM 1624  | 71                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 168         | 29                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 1612        | 44.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YBH 1616        | 59.5                 |
| 26.988<br>(1 1/16)         | BA 1710 Z             | 23.5                 | BAM 1710   | 26.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1716 Z             | 37                   | BAM 1716   | 40.5                 | —          | —                    | —          | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.

| Boundary dimensions mm(inch) |                 |               |               | Standard mounting dimensions mm |        |                                      |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------|-----------------|---------------|---------------|---------------------------------|--------|--------------------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| $F_w$                        | $D$             | $C$           | $t_1$<br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | $C$<br>N                  | $C_0$<br>N               | min <sup>-1</sup>             |                      |
| 23.812 (15/16)               | 30.162 (1 3/16) | 12.70 ( .500) | 2.8           | 23.812                          | 23.799 | 30.176                               | 30.151 | 8 000                     | 11 400                   | 16 000                        | —                    |
| 23.812 (15/16)               | 30.162 (1 3/16) | 15.88 ( .625) | 2.8           |                                 |        |                                      |        | 11 000                    | 17 100                   | 16 000                        | IRB 1110             |
| 23.812 (15/16)               | 30.162 (1 3/16) | 25.40 (1.000) | 2.8           |                                 |        |                                      |        | 18 900                    | 34 300                   | 16 000                        | IRB 1116             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 9.52 ( .375)  | 2.8           |                                 |        |                                      |        | 6 010                     | 8 020                    | 15 000                        | —                    |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 11.13 ( .438) | 2.8           | 25.400                          | 25.387 | 31.764                               | 31.739 | 7 720                     | 11 100                   | 15 000                        | —                    |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 12.70 ( .500) | 2.8           |                                 |        |                                      |        | 8 240                     | 12 000                   | 15 000                        | IRB 128              |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 15.88 ( .625) | 2.8           |                                 |        |                                      |        | 11 300                    | 18 100                   | 15 000                        | —                    |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 19.05 ( .750) | 2.8           |                                 |        |                                      |        | 14 200                    | 24 300                   | 15 000                        | IRB 1212             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 22.22 ( .875) | 2.8           |                                 |        |                                      |        | 16 900                    | 30 400                   | 15 000                        | IRB 1214             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 25.40 (1.000) | 2.8           |                                 |        |                                      |        | 19 400                    | 36 300                   | 15 000                        | IRB 1216             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 31.75 (1.250) | 2.8           |                                 |        |                                      |        | 24 400                    | 48 500                   | 15 000                        | IRB 1220             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 12.70 ( .500) | —             |                                 |        |                                      |        | 19 400                    | 36 000                   | 6 000                         | IRB 128              |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 19.05 ( .750) | —             |                                 |        |                                      |        | 28 200                    | 58 000                   | 6 000                         | IRB 1212             |
| 25.400 (1 )                  | 31.750 (1 1/4)  | 25.40 (1.000) | —             |                                 |        |                                      |        | 36 300                    | 80 300                   | 6 000                         | IRB 1216             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 12.70 ( .500) | 3.4           |                                 |        |                                      |        | 10 200                    | 13 100                   | 15 000                        | IRB 128              |
| 25.400 (1 )                  | 33.338 (1 5/16) | 15.88 ( .625) | 3.4           |                                 |        |                                      |        | 15 300                    | 22 100                   | 15 000                        | —                    |
| 25.400 (1 )                  | 33.338 (1 5/16) | 19.05 ( .750) | 3.4           |                                 |        |                                      |        | 19 300                    | 29 700                   | 15 000                        | IRB 1212             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 22.22 ( .875) | 3.4           |                                 |        |                                      |        | 23 000                    | 37 200                   | 15 000                        | IRB 1214             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 25.40 (1.000) | 3.4           |                                 |        |                                      |        | 26 400                    | 44 500                   | 15 000                        | IRB 1216             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 31.75 (1.250) | 3.4           |                                 |        |                                      |        | 33 200                    | 59 600                   | 15 000                        | IRB 1220             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 38.10 (1.500) | 3.4           |                                 |        |                                      |        | 39 400                    | 74 400                   | 15 000                        | —                    |
| 25.400 (1 )                  | 33.338 (1 5/16) | 12.70 ( .500) | —             |                                 |        |                                      |        | 20 900                    | 34 100                   | 6 000                         | IRB 128              |
| 25.400 (1 )                  | 33.338 (1 5/16) | 19.05 ( .750) | —             |                                 |        |                                      |        | 30 700                    | 56 100                   | 6 000                         | IRB 1212             |
| 25.400 (1 )                  | 33.338 (1 5/16) | 25.40 (1.000) | —             |                                 |        |                                      |        | 39 900                    | 78 400                   | 6 000                         | IRB 1216             |
| 26.988 (1 1/16)              | 33.338 (1 5/16) | 15.88 ( .625) | 2.8           | 26.988                          | 26.975 | 33.352                               | 33.327 | 11 600                    | 19 200                   | 14 000                        | —                    |
| 26.988 (1 1/16)              | 33.338 (1 5/16) | 25.40 (1.000) | 2.8           |                                 |        |                                      |        | 20 000                    | 38 300                   | 14 000                        | —                    |

SHELL TYPE NEEDLE ROLLER BEARINGS

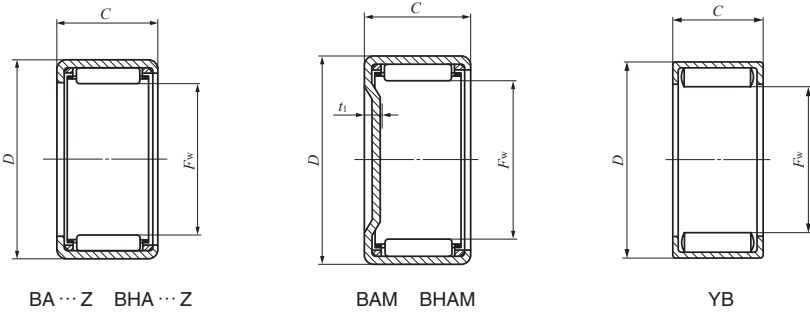
Inch Series



Shaft dia. 28.575 — 30.162mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 28.575<br>(1 1/8)          | BA 186 Z              | 14.5                 | BAM 186    | 18.1                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 188 Z              | 19.5                 | BAM 188    | 23                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1812 Z             | 29.5                 | BAM 1812   | 33                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1816 Z             | 39                   | BAM 1816   | 42.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1820 Z             | 48.5                 | BAM 1820   | 52                   | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 188          | 25.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1812         | 38.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1816         | 51.5                 |
|                            | —                     | —                    | —          | —                    | BHA 1812 Z | 45                   | BHAM 1812  | 49                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1816 Z | 60                   | BHAM 1816  | 64                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1818 Z | 67.5                 | BHAM 1818  | 71.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 1820 Z | 73.5                 | BHAM 1820  | 78                   | —               | —                    |
|                            | BA 1910 Z             | 32.5                 | BAM 1910   | 37.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 1916 Z             | 52                   | BAM 1916   | 57                   | —          | —                    | —          | —                    | —               | —                    |
| 30.162<br>(1 3/16)         | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 1910         | 42.5                 |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                |               |                        | Standard mounting dimensions mm |        |                         |        | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed(1) | Assembled<br>inner ring |
|------------------------------|----------------|---------------|------------------------|---------------------------------|--------|-------------------------|--------|------------------------------|-----------------------------|-------------------------------------|-------------------------|
| F <sub>w</sub>               | D              | C             | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        | C<br>N                       | C <sub>0</sub><br>N         | min <sup>-1</sup>                   |                         |
| Max.                         |                |               |                        | Max.                            | Min.   | Max.                    | Min.   |                              |                             |                                     |                         |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 9.52( . 375)  | 2.8                    | 28.575                          | 28.562 | 34.939                  | 34.914 | 6 330                        | 8 910                       | 13 000                              | —                       |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 12.70( . 500) | 2.8                    |                                 |        |                         |        | 8 680                        | 13 400                      | 13 000                              | IRB 148                 |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 19.05( . 750) | 2.8                    |                                 |        |                         |        | 15 000                       | 26 900                      | 13 000                              | IRB 1412                |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 25.40(1.000)  | 2.8                    |                                 |        |                         |        | 20 500                       | 40 300                      | 13 000                              | IRB 1416                |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 31.75(1.250)  | 2.8                    |                                 |        |                         |        | 25 700                       | 53 900                      | 13 000                              | IRB 1420                |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 12.70( . 500) | —                      |                                 |        |                         |        | 20 700                       | 40 500                      | 5 500                               | IRB 148                 |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 19.05( . 750) | —                      |                                 |        |                         |        | 30 000                       | 65 300                      | 5 500                               | IRB 1412                |
| 28.575 (1 1/8)               | 34.925 (1 3/8) | 25.40(1.000)  | —                      |                                 |        |                         |        | 38 700                       | 90 400                      | 5 500                               | IRB 1416                |
| 28.575 (1 1/8)               | 38.100 (1 1/2) | 19.05( . 750) | 3.4                    | 28.575                          | 28.562 | 38.114                  | 38.089 | 22 500                       | 32 200                      | 13 000                              | IRB 1412                |
| 28.575 (1 1/8)               | 38.100 (1 1/2) | 25.40(1.000)  | 3.4                    |                                 |        |                         |        | 30 900                       | 48 600                      | 13 000                              | IRB 1416                |
| 28.575 (1 1/8)               | 38.100 (1 1/2) | 28.58(1.125)  | 3.4                    |                                 |        |                         |        | 34 900                       | 56 600                      | 13 000                              | —                       |
| 28.575 (1 1/8)               | 38.100 (1 1/2) | 28.58(1.125)  | 3.4                    |                                 |        |                         |        | 37 100                       | 61 100                      | 13 000                              | —                       |
| 28.575 (1 1/8)               | 38.100 (1 1/2) | 31.75(1.250)  | 3.4                    |                                 |        |                         |        | 37 100                       | 61 100                      | 13 000                              | IRB 1420                |
| 30.162 (1 3/16)              | 38.100 (1 1/2) | 15.88( . 625) | 2.8                    | 30.162                          | 30.146 | 38.114                  | 38.089 | 15 000                       | 22 500                      | 12 000                              | —                       |
| 30.162 (1 3/16)              | 38.100 (1 1/2) | 25.40(1.000)  | 2.8                    |                                 |        |                         |        | 25 800                       | 45 300                      | 12 000                              | —                       |
| 30.162 (1 3/16)              | 38.100 (1 1/2) | 15.88( . 625) | —                      |                                 |        |                         |        | 28 400                       | 53 600                      | 5 000                               | —                       |

SHELL TYPE NEEDLE ROLLER BEARINGS

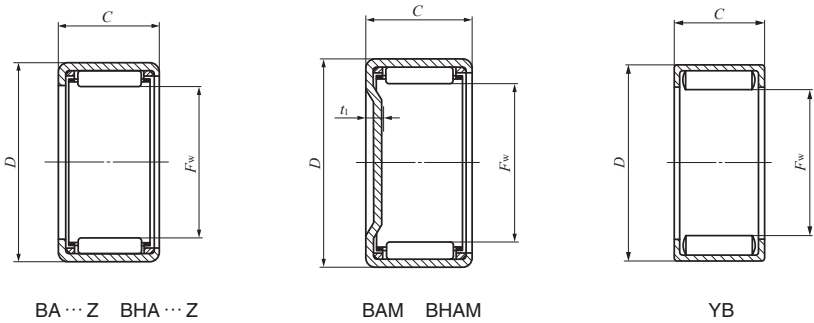
Inch Series



Shaft dia. 31.750 — 33.338mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 31.750<br>(1 1/4)          | BA 208 Z              | 21.5                 | BAM 208    | 26                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2010 Z             | 27                   | BAM 2010   | 31.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2012 Z             | 32.5                 | BAM 2012   | 37                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2016 Z             | 43                   | BAM 2016   | 47.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2020 Z             | 53.5                 | BAM 2020   | 58                   | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2010         | 35                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2012         | 42.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2016         | 57                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2018         | 64                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2020         | 68                   |
|                            | —                     | —                    | —          | —                    | BHA 208 Z  | 34.5                 | BHAM 208   | 40                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2012 Z | 49.5                 | BHAM 2012  | 54.5                 | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2016 Z | 66                   | BHAM 2016  | 71                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2020 Z | 81.5                 | BHAM 2020  | 86.5                 | —               | —                    |
| 33.338<br>(1 5/16)         | BA 218 Z              | 28.5                 | BAM 218    | 35                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2110 Z             | 35.5                 | BAM 2110   | 41.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2112 Z             | 43                   | BAM 2112   | 49                   | —          | —                    | —          | —                    | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                |              |                        | Standard mounting dimensions mm |        |                                      |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------|----------------|--------------|------------------------|---------------------------------|--------|--------------------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| F <sub>w</sub>               | D              | C            | t <sub>1</sub><br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | C<br>N                    | C <sub>0</sub><br>N      | min <sup>-1</sup>             |                      |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 12.70( .500) | 2.8                    | 31.750                          | 31.734 | 38.114                               | 38.089 | 9 100                     | 14 700                   | 12 000                        | IRB 168              |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 15.88( .625) | 2.8                    |                                 |        |                                      |        | 12 500                    | 22 200                   | 12 000                        | IRB 1610             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 19.05( .750) | 2.8                    |                                 |        |                                      |        | 15 700                    | 29 600                   | 12 000                        | IRB 1612             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 25.40(1.000) | 2.8                    |                                 |        |                                      |        | 21 500                    | 44 300                   | 12 000                        | IRB 1616             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 31.75(1.250) | 2.8                    |                                 |        |                                      |        | 26 900                    | 59 200                   | 12 000                        | IRB 1620             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 15.88( .625) | —                      |                                 |        |                                      |        | 27 000                    | 59 000                   | 4 500                         | IRB 1610             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 19.05( .750) | —                      | 31.750                          | 31.734 | 38.114                               | 38.089 | 31 800                    | 72 500                   | 4 500                         | IRB 1612             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 25.40(1.000) | —                      |                                 |        |                                      |        | 40 900                    | 100 000                  | 4 500                         | IRB 1616             |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 28.58(1.125) | —                      |                                 |        |                                      |        | 45 300                    | 114 000                  | 4 500                         | —                    |
| 31.750 (1 1/4)               | 38.100 (1 1/2) | 31.75(1.250) | —                      |                                 |        |                                      |        | 49 400                    | 128 000                  | 4 500                         | IRB 1620             |
| 31.750 (1 1/4)               | 41.275 (1 5/8) | 12.70( .500) | 3.4                    | 31.750                          | 31.734 | 41.289                               | 41.264 | 13 700                    | 17 600                   | 12 000                        | IRB 168              |
| 31.750 (1 1/4)               | 41.275 (1 5/8) | 19.05( .750) | 3.4                    |                                 |        |                                      |        | 24 100                    | 36 400                   | 12 000                        | IRB 1612             |
| 31.750 (1 1/4)               | 41.275 (1 5/8) | 25.40(1.000) | 3.4                    |                                 |        |                                      |        | 33 200                    | 55 000                   | 12 000                        | IRB 1616             |
| 31.750 (1 1/4)               | 41.275 (1 5/8) | 31.75(1.250) | 3.4                    |                                 |        |                                      |        | 40 000                    | 69 600                   | 12 000                        | IRB 1620             |
| 33.338 (1 5/16)              | 41.275 (1 5/8) | 12.70( .500) | 2.8                    | 33.338                          | 33.322 | 41.289                               | 41.264 | 11 100                    | 15 800                   | 11 000                        | IRB 168-1            |
| 33.338 (1 5/16)              | 41.275 (1 5/8) | 15.88( .625) | 2.8                    |                                 |        |                                      |        | 15 400                    | 23 900                   | 11 000                        | IRB 1610-1           |
| 33.338 (1 5/16)              | 41.275 (1 5/8) | 19.05( .750) | 2.8                    |                                 |        |                                      |        | 19 300                    | 32 100                   | 11 000                        | IRB 1612-1           |

SHELL TYPE NEEDLE ROLLER BEARINGS

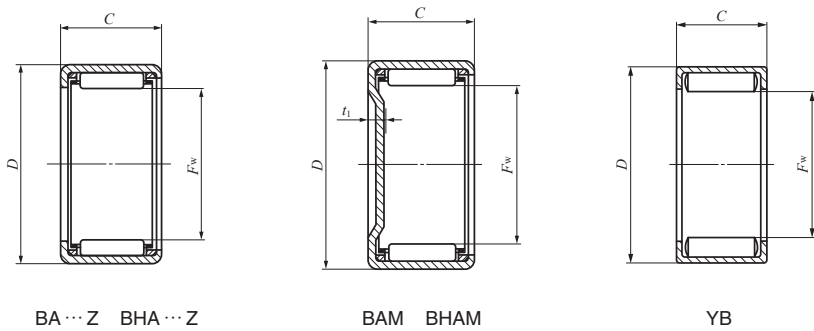
Inch Series



Shaft dia. 34.925 — 38.100mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 34.925<br>(1 3⁄8)          | BA 228 Z              | 23.5                 | BAM 228    | 29                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2212 Z             | 35.5                 | BAM 2212   | 41                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2216 Z             | 47.5                 | BAM 2216   | 53                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2220 Z             | 59                   | BAM 2220   | 64                   | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 228          | 30.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2212         | 46                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2220         | 77.5                 |
|                            | —                     | —                    | —          | —                    | BHA 228 Z  | 37                   | BHAM 228   | 43                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2210 Z | 44                   | BHAM 2210  | 50                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2212 Z | 53                   | BHAM 2212  | 59                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2216 Z | 71                   | BHAM 2216  | 77                   | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 2220 Z | 87                   | BHAM 2220  | 98.5                 | —               | —                    |
|                            | BA 248 Z              | 38.5                 | BAM 248    | 47.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2410 Z             | 48.5                 | BAM 2410   | 57.5                 | —          | —                    | —          | —                    | —               | —                    |
| 38.100<br>(1 1⁄2)          | BA 2412 Z             | 58.5                 | BAM 2412   | 67.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2414 Z             | 69                   | BAM 2414   | 78                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2416 Z             | 79                   | BAM 2416   | 88                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2420 Z             | 97.5                 | BAM 2420   | 106                  | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 246          | 38                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 248          | 51.5                 |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2414         | 91                   |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2416         | 105                  |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2420         | 131                  |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | —               | —                    |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                |               |               | Standard mounting dimensions mm |        |                                      |        | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup> | Assembled<br>inner ring |
|------------------------------|----------------|---------------|---------------|---------------------------------|--------|--------------------------------------|--------|------------------------------|-----------------------------|-------------------------------------------------|-------------------------|
| $F_w$                        | $D$            | $C$           | $t_1$<br>Max. | Shaft dia.<br>h6<br>Max. Min.   |        | Housing bore dia.<br>J7<br>Max. Min. |        | $C$<br>N                     | $C_0$<br>N                  | min <sup>-1</sup>                               |                         |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 12.70 ( .500) | 2.8           | 34.925                          | 34.909 | 41.289                               | 41.264 | 9 770                        | 16 600                      | 10 000                                          | IRB 188                 |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 19.05 ( .750) | 2.8           |                                 |        |                                      |        | 16 900                       | 33 500                      | 10 000                                          | IRB 1812                |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 25.40 (1.000) | 2.8           |                                 |        |                                      |        | 23 100                       | 50 200                      | 10 000                                          | IRB 1816                |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 31.75 (1.250) | 2.8           |                                 |        |                                      |        | 28 900                       | 67 100                      | 10 000                                          | IRB 1820                |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 12.70 ( .500) | —             |                                 |        |                                      |        | 23 000                       | 49 500                      | 4 500                                           | IRB 188                 |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 19.05 ( .750) | —             |                                 |        |                                      |        | 33 400                       | 79 800                      | 4 500                                           | IRB 1812                |
| 34.925 (1 3⁄8)               | 41.275 (1 5⁄8) | 31.75 (1.250) | —             |                                 |        |                                      |        | 52 000                       | 141 000                     | 4 500                                           | IRB 1820                |
| 34.925 (1 3⁄8)               | 44.450 (1 3⁄4) | 12.70 ( .500) | 3.4           | 34.925                          | 34.909 | 44.464                               | 44.439 | 14 100                       | 18 800                      | 10 000                                          | IRB 188                 |
| 34.925 (1 3⁄8)               | 44.450 (1 3⁄4) | 15.88 ( .625) | 3.4           |                                 |        |                                      |        | 19 700                       | 28 800                      | 10 000                                          | —                       |
| 34.925 (1 3⁄8)               | 44.450 (1 3⁄4) | 19.05 ( .750) | 3.4           |                                 |        |                                      |        | 24 800                       | 38 800                      | 10 000                                          | IRB 1812                |
| 34.925 (1 3⁄8)               | 44.450 (1 3⁄4) | 25.40 (1.000) | 3.4           |                                 |        |                                      |        | 34 100                       | 58 400                      | 10 000                                          | IRB 1816                |
| 34.925 (1 3⁄8)               | 44.450 (1 3⁄4) | 31.75 (1.250) | 3.4           |                                 |        |                                      |        | 41 200                       | 74 200                      | 10 000                                          | IRB 1820                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 12.70 ( .500) | 2.8           | 38.100                          | 38.084 | 47.639                               | 47.614 | 12 900                       | 17 900                      | 9 000                                           | —                       |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 15.88 ( .625) | 2.8           |                                 |        |                                      |        | 17 800                       | 27 100                      | 9 000                                           | IRB 2010                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 19.05 ( .750) | 2.8           |                                 |        |                                      |        | 22 500                       | 36 600                      | 9 000                                           | —                       |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 22.22 ( .875) | 2.8           |                                 |        |                                      |        | 26 700                       | 45 600                      | 9 000                                           | IRB 2014                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 25.40 (1.000) | 2.8           |                                 |        |                                      |        | 31 100                       | 55 400                      | 9 000                                           | IRB 2016                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 31.75 (1.250) | 2.8           |                                 |        |                                      |        | 39 000                       | 74 200                      | 9 000                                           | IRB 2020                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 9.52 ( .375)  | —             | 38.100                          | 38.084 | 47.639                               | 47.614 | 21 000                       | 34 100                      | 4 000                                           | —                       |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 12.70 ( .500) | —             |                                 |        |                                      |        | 28 700                       | 50 900                      | 4 000                                           | —                       |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 22.22 ( .875) | —             |                                 |        |                                      |        | 48 900                       | 101 000                     | 4 000                                           | IRB 2014                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 25.40 (1.000) | —             |                                 |        |                                      |        | 55 100                       | 118 000                     | 4 000                                           | IRB 2016                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 31.75 (1.250) | —             |                                 |        |                                      |        | 66 800                       | 151 000                     | 4 000                                           | IRB 2020                |
| 38.100 (1 1⁄2)               | 47.625 (1 7⁄8) | 31.75 (1.250) | —             |                                 |        |                                      |        | —                            | —                           | —                                               | —                       |

SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series



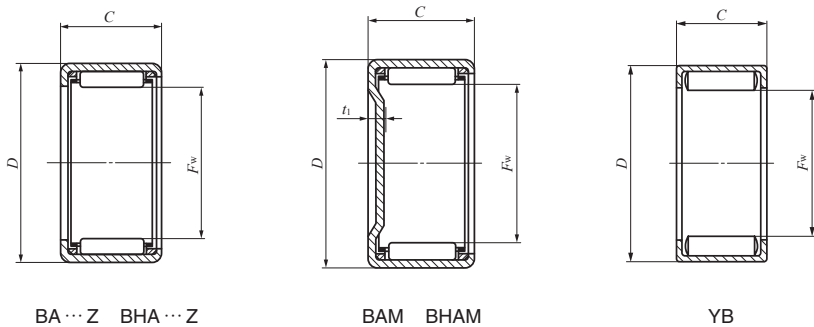
Shaft dia. 41.275 — 52.388mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |            |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard   | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 41.275<br>(1 5/8)          | BA 268 Z              | 41                   | BAM 268    | 51.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2610 Z             | 52                   | BAM 2610   | 62.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2616 Z             | 85                   | BAM 2616   | 95.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2620 Z             | 105                  | BAM 2620   | 115                  | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2610         | 69                   |
| 44.450<br>(1 3/4)          | BA 2812 Z             | 67.5                 | BAM 2812   | 79.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2816 Z             | 91                   | BAM 2816   | 103                  | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2820 Z             | 112                  | BAM 2820   | 125                  | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 2824 Z             | 136                  | BAM 2824   | 148                  | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 2816         | 119                  |
| 47.625<br>(1 7/8)          | BA 308 Z              | 47.5                 | BAM 308    | 61                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3010 Z             | 60                   | BAM 3010   | 74                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3012 Z             | 72.5                 | BAM 3012   | 86.5                 | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3016 Z             | 97.5                 | BAM 3016   | 112                  | —          | —                    | —          | —                    | —               | —                    |
|                            | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 3012         | 95                   |
| 50.800<br>(2)              | BA 328 Z              | 50                   | BAM 328    | 66                   | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3216 Z             | 104                  | BAM 3216   | 119                  | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3220 Z             | 128                  | BAM 3220   | 144                  | —          | —                    | —          | —                    | —               | —                    |
|                            | BA 3224 Z             | 155                  | BAM 3224   | 170                  | —          | —                    | —          | —                    | —               | —                    |
|                            | BAW3228Z              | 180                  | BAMW3228   | 196                  | —          | —                    | —          | —                    | —               | —                    |
| 52.388<br>(2 1/16)         | —                     | —                    | —          | —                    | —          | —                    | —          | —                    | YB 3216         | 130                  |
|                            | —                     | —                    | —          | —                    | BHA 3312 Z | 104                  | BHAM 3312  | 122                  | —               | —                    |
|                            | —                     | —                    | —          | —                    | BHA 3316 Z | 139                  | BHAM 3316  | 157                  | —               | —                    |
|                            |                       |                      |            |                      | BHA 3324 Z | 205                  | BHAM 3324  | 225                  | —               | —                    |

Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

Remarks1. "W" in the identification number indicates that rolling elements are arranged in double rows.

2. Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |                  |              |                        | Standard mounting dimensions mm |        |                         |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed(1) | Assembled inner ring |
|------------------------------|------------------|--------------|------------------------|---------------------------------|--------|-------------------------|--------|---------------------------|--------------------------|-------------------------------|----------------------|
| F <sub>w</sub>               | D                | C            | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        | C<br>N                    | C <sub>0</sub><br>N      | min <sup>-1</sup>             |                      |
|                              |                  |              |                        | Max.                            | Min.   | Max.                    | Min.   |                           |                          |                               |                      |
| 41.275 (1 5/8)               | 50.800 (2 )      | 12.70( .500) | 2.8                    | 41.275                          | 41.259 | 50.818                  | 50.788 | 13 700                    | 19 800                   | 8 000                         | —                    |
| 41.275 (1 5/8)               | 50.800 (2 )      | 15.88( .625) | 2.8                    |                                 |        |                         |        | 18 900                    | 30 000                   | 8 000                         | IRB 2210             |
| 41.275 (1 5/8)               | 50.800 (2 )      | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 33 000                    | 61 400                   | 8 000                         | —                    |
| 41.275 (1 5/8)               | 50.800 (2 )      | 31.75(1.250) | 2.8                    |                                 |        |                         |        | 41 400                    | 82 100                   | 8 000                         | IRB 2220             |
| 41.275 (1 5/8)               | 50.800 (2 )      | 15.88( .625) | —                      |                                 |        |                         |        | 37 000                    | 71 700                   | 3 500                         | IRB 2210             |
| 44.450 (1 3/4)               | 53.975 (2 1/8)   | 19.05( .750) | 2.8                    | 44.450                          | 44.434 | 53.993                  | 53.963 | 25 200                    | 44 500                   | 7 500                         | IRB 2412             |
| 44.450 (1 3/4)               | 53.975 (2 1/8)   | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 34 800                    | 67 400                   | 7 500                         | IRB 2416             |
| 44.450 (1 3/4)               | 53.975 (2 1/8)   | 31.75(1.250) | 2.8                    |                                 |        |                         |        | 43 600                    | 90 200                   | 7 500                         | —                    |
| 44.450 (1 3/4)               | 53.975 (2 1/8)   | 38.10(1.500) | 2.8                    |                                 |        |                         |        | 52 000                    | 113 000                  | 7 500                         | IRB 2424             |
| 44.450 (1 3/4)               | 53.975 (2 1/8)   | 25.40(1.000) | —                      |                                 |        |                         |        | 59 500                    | 136 000                  | 3 500                         | IRB 2416             |
| 44.450 (1 3/4)               | 57.150 (2 1/4)   | 38.10(1.500) | 3.4                    | 44.450                          | 44.434 | 57.168                  | 57.138 | 72 200                    | 135 000                  | 7 500                         | IRB 2424             |
| 47.625 (1 7/8)               | 57.150 (2 1/4)   | 12.70( .500) | 2.8                    | 47.625                          | 47.609 | 57.168                  | 57.138 | 14 700                    | 22 800                   | 7 000                         | IRB 248-1            |
| 47.625 (1 7/8)               | 57.150 (2 1/4)   | 15.88( .625) | 2.8                    |                                 |        |                         |        | 20 300                    | 34 500                   | 7 000                         | IRB 2410-1           |
| 47.625 (1 7/8)               | 57.150 (2 1/4)   | 19.05( .750) | 2.8                    |                                 |        |                         |        | 25 700                    | 46 700                   | 7 000                         | —                    |
| 47.625 (1 7/8)               | 57.150 (2 1/4)   | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 35 400                    | 70 600                   | 7 000                         | —                    |
| 47.625 (1 7/8)               | 57.150 (2 1/4)   | 19.05( .750) | —                      |                                 |        |                         |        | 47 800                    | 105 000                  | 3 000                         | —                    |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 12.70( .500) | 2.8                    | 50.800                          | 50.781 | 60.343                  | 60.313 | 15 400                    | 24 700                   | 6 000                         | —                    |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 37 100                    | 76 500                   | 6 000                         | IRB 2616             |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 31.75(1.250) | 2.8                    |                                 |        |                         |        | 46 600                    | 102 000                  | 6 000                         | IRB 2720             |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 38.10(1.500) | 2.8                    |                                 |        |                         |        | 55 500                    | 128 000                  | 6 000                         | —                    |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 44.45(1.750) | 2.8                    |                                 |        |                         |        | 57 900                    | 136 000                  | 6 000                         | IRB 2628             |
| 50.800 (2 )                  | 60.325 (2 3/8)   | 25.40(1.000) | —                      |                                 |        |                         |        | 64 100                    | 156 000                  | 2 500                         | IRB 2616             |
| 52.388 (2 1/16)              | 64.294 (2 17/32) | 19.05( .750) | 3.4                    | 52.388                          | 52.369 | 64.312                  | 64.282 | 36 400                    | 62 100                   | 6 000                         | —                    |
| 52.388 (2 1/16)              | 64.294 (2 17/32) | 25.40(1.000) | 3.4                    |                                 |        |                         |        | 50 600                    | 94 700                   | 6 000                         | —                    |
| 52.388 (2 1/16)              | 64.294 (2 17/32) | 38.10(1.500) | 3.4                    |                                 |        |                         |        | 73 900                    | 154 000                  | 6 000                         | —                    |

SHELL TYPE NEEDLE ROLLER BEARINGS

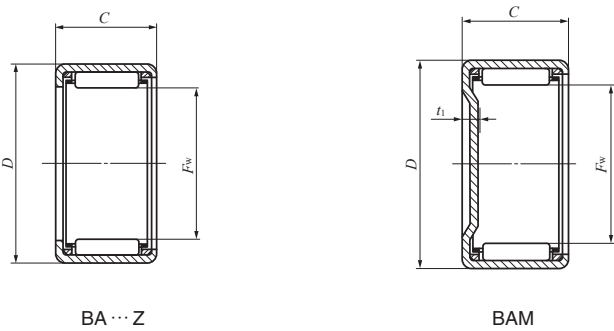
Inch Series



Shaft dia. 53.975 — 69.850mm

| Shaft dia.<br>mm<br>(inch) | Identification number |                      |            |                      |          |                      |            |                      |                 |                      |
|----------------------------|-----------------------|----------------------|------------|----------------------|----------|----------------------|------------|----------------------|-----------------|----------------------|
|                            | Standard              | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Standard | Mass<br>(Ref. )<br>g | Closed end | Mass<br>(Ref. )<br>g | Grease retained | Mass<br>(Ref. )<br>g |
| 53.975<br>(2 1/8)          | BA 348 Z              | 53                   | BAM 348    | 70.5                 | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 3416 Z             | 109                  | BAM 3416   | 127                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 3424 Z             | 162                  | BAM 3424   | 180                  | —        | —                    | —          | —                    | —               | —                    |
| 57.150<br>(2 1/4)          | BA 3612 Z             | 85.5                 | BAM 3612   | 105                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 3616 Z             | 115                  | BAM 3616   | 135                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 3620 Z             | 143                  | BAM 3620   | 163                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 3624 Z             | 172                  | BAM 3624   | 192                  | —        | —                    | —          | —                    | —               | —                    |
| 66.675<br>(2 5/8)          | BA 4216 Z             | 133                  | BAM 4216   | 161                  | —        | —                    | —          | —                    | —               | —                    |
| 69.850<br>(2 3/4)          | BA 4410 Z             | 85.5                 | BAM 4410   | 115                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 4412 Z             | 103                  | BAM 4412   | 133                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 4416 Z             | 139                  | BAM 4416   | 169                  | —        | —                    | —          | —                    | —               | —                    |
|                            | BA 4420 Z             | 173                  | BAM 4420   | 205                  | —        | —                    | —          | —                    | —               | —                    |

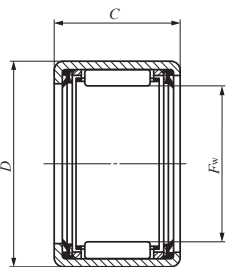
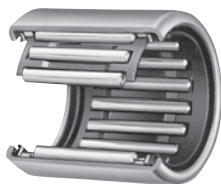
Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided with prepacked grease, so perform proper lubrication when using these types of bearings.



| Boundary dimensions mm(inch) |               |              |                        | Standard mounting dimensions mm |        |                         |        | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(1)</sup> | Assembled inner ring |
|------------------------------|---------------|--------------|------------------------|---------------------------------|--------|-------------------------|--------|---------------------------|--------------------------|-------------------------------------------|----------------------|
| F <sub>w</sub>               | D             | C            | t <sub>1</sub><br>Max. | Shaft dia.<br>h6                |        | Housing bore dia.<br>J7 |        | C<br>N                    | C <sub>0</sub><br>N      | min <sup>-1</sup>                         |                      |
|                              |               |              |                        | Max.                            | Min.   | Max.                    | Min.   |                           |                          |                                           |                      |
| 53.975(2 1/8)                | 63.500(2 1/2) | 12.70( .500) | 2.8                    | 53.975                          | 53.956 | 63.518                  | 63.488 | 16 100                    | 26 600                   | 5 500                                     | —                    |
| 53.975(2 1/8)                | 63.500(2 1/2) | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 38 700                    | 82 500                   | 5 500                                     | IRB 3016             |
| 53.975(2 1/8)                | 63.500(2 1/2) | 38.10(1.500) | 2.8                    |                                 |        |                         |        | 57 900                    | 138 000                  | 5 500                                     | IRB 3024             |
| 57.150(2 1/4)                | 66.675(2 5/8) | 19.05( .750) | 2.8                    | 57.150                          | 57.131 | 66.693                  | 66.663 | 28 500                    | 56 700                   | 5 000                                     | —                    |
| 57.150(2 1/4)                | 66.675(2 5/8) | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 39 300                    | 85 700                   | 5 000                                     | —                    |
| 57.150(2 1/4)                | 66.675(2 5/8) | 31.75(1.250) | 2.8                    |                                 |        |                         |        | 49 400                    | 115 000                  | 5 000                                     | —                    |
| 57.150(2 1/4)                | 66.675(2 5/8) | 38.10(1.500) | 2.8                    |                                 |        |                         |        | 58 800                    | 144 000                  | 5 000                                     | —                    |
| 66.675(2 5/8)                | 76.200(3 )    | 25.40(1.000) | 2.8                    | 66.675                          | 66.656 | 76.218                  | 76.188 | 42 000                    | 97 900                   | 4 000                                     | IRB 3616             |
| 69.850(2 3/4)                | 79.375(3 1/8) | 15.88( .625) | 2.8                    | 69.850                          | 69.831 | 79.393                  | 79.363 | 25 000                    | 50 800                   | 3 500                                     | —                    |
| 69.850(2 3/4)                | 79.375(3 1/8) | 19.05( .750) | 2.8                    |                                 |        |                         |        | 31 500                    | 68 700                   | 3 500                                     | —                    |
| 69.850(2 3/4)                | 79.375(3 1/8) | 25.40(1.000) | 2.8                    |                                 |        |                         |        | 43 500                    | 104 000                  | 3 500                                     | IRB 4016             |
| 69.850(2 3/4)                | 79.375(3 1/8) | 31.75(1.250) | 2.8                    |                                 |        |                         |        | 54 600                    | 139 000                  | 3 500                                     | IRB 4020             |

SHELL TYPE NEEDLE ROLLER BEARINGS

With seals



TLA ... UU

Shaft dia. 12 – 50mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref. )<br>g | Boundary dimensions mm |    |    | Standard mounting dimensions mm |        |                         |        |
|------------------|-----------------------|----------------------|------------------------|----|----|---------------------------------|--------|-------------------------|--------|
|                  |                       |                      | F <sub>w</sub>         | D  | C  | Shaft dia.<br>h6                |        | Housing bore dia.<br>N7 |        |
|                  |                       |                      |                        |    |    | Max.                            | Min.   | Max.                    | Min.   |
| 12               | TLA 1216 UU           | 11.7                 | 12                     | 18 | 16 | 12.000                          | 11.989 | 17.995                  | 17.977 |
| 14               | TLA 1416 UU           | 13.3                 | 14                     | 20 | 16 | 14.000                          | 13.989 | 19.993                  | 19.972 |
| 15               | TLA 1516 UU           | 14                   | 15                     | 21 | 16 | 15.000                          | 14.989 | 20.993                  | 20.972 |
| 16               | TLA 1616 UU           | 14.8                 | 16                     | 22 | 16 | 16.000                          | 15.989 | 21.993                  | 21.972 |
| 18               | TLA 1816 UU           | 16.3                 | 18                     | 24 | 16 | 18.000                          | 17.989 | 23.993                  | 23.972 |
| 20               | TLA 2016 UU           | 17.8                 | 20                     | 26 | 16 | 20.000                          | 19.987 | 25.993                  | 25.972 |
|                  | TLA 2020 UU           | 22.5                 | 20                     | 26 | 20 |                                 |        |                         |        |
| 22               | TLA 2216 UU           | 19.4                 | 22                     | 28 | 16 | 22.000                          | 21.987 | 27.993                  | 27.972 |
|                  | TLA 2220 UU           | 25                   | 22                     | 28 | 20 |                                 |        |                         |        |
| 25               | TLA 2516 UU           | 26                   | 25                     | 32 | 16 | 25.000                          | 24.987 | 31.992                  | 31.967 |
|                  | TLA 2520 UU           | 33                   | 25                     | 32 | 20 |                                 |        |                         |        |
| 28               | TLA 2820 UU           | 36.5                 | 28                     | 35 | 20 | 28.000                          | 27.987 | 34.992                  | 34.967 |
| 30               | TLA 3016 UU           | 30.5                 | 30                     | 37 | 16 | 30.000                          | 29.987 | 36.992                  | 36.967 |
|                  | TLA 3020 UU           | 39                   | 30                     | 37 | 20 |                                 |        |                         |        |
| 35               | TLA 3516 UU           | 35                   | 35                     | 42 | 16 | 35.000                          | 34.984 | 41.992                  | 41.967 |
|                  | TLA 3520 UU           | 45                   | 35                     | 42 | 20 |                                 |        |                         |        |
| 40               | TLA 4016 UU           | 39.5                 | 40                     | 47 | 16 | 40.000                          | 39.984 | 46.992                  | 46.967 |
|                  | TLA 4020 UU           | 50.5                 | 40                     | 47 | 20 |                                 |        |                         |        |
| 45               | TLA 4520 UU           | 56                   | 45                     | 52 | 20 | 45.000                          | 44.984 | 51.991                  | 51.961 |
| 50               | TLA 5026 UU           | 89                   | 50                     | 58 | 26 | 50.000                          | 49.984 | 57.991                  | 57.961 |

Note(1) Allowable rotational speed applies to grease lubrication.  
Remark The type with seals is provided with prepacked grease.

| Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|----------------------------------------|----------------------------------------------------|----------------------------------------------------------------------|
| 6 420                                  | 7 490                                              | 14 000                                                               |
| 7 080                                  | 8 840                                              | 12 000                                                               |
| 7 380                                  | 9 520                                              | 11 000                                                               |
| 7 670                                  | 10 200                                             | 11 000                                                               |
| 8 230                                  | 11 500                                             | 9 000                                                                |
| 8 740                                  | 12 900                                             | 9 000                                                                |
| 11 100                                 | 17 500                                             | 9 000                                                                |
| 9 230                                  | 14 300                                             | 8 000                                                                |
| 11 700                                 | 19 300                                             | 8 000                                                                |
| 9 440                                  | 13 900                                             | 7 000                                                                |
| 12 800                                 | 20 500                                             | 7 000                                                                |
| 13 800                                 | 23 500                                             | 6 000                                                                |
| 10 400                                 | 16 600                                             | 5 500                                                                |
| 14 100                                 | 24 500                                             | 5 500                                                                |
| 11 600                                 | 20 000                                             | 5 000                                                                |
| 15 700                                 | 29 600                                             | 5 000                                                                |
| 12 400                                 | 22 800                                             | 4 500                                                                |
| 16 700                                 | 33 700                                             | 4 500                                                                |
| 17 800                                 | 37 800                                             | 4 000                                                                |
| 28 800                                 | 64 100                                             | 3 500                                                                |

# NEEDLE ROLLER CAGES FOR GENERAL USAGE

- High carbon steel cage type
- Synthetic resin cage type



## Structure and Features

IKO Needle Roller Cages for General Usage are bearings which display excellent rotational performance. Needle rollers with extremely small dimensional variations in diameter are incorporated and retained in their specially shaped cages with high rigidity and accuracy, which precisely guide the needle rollers.

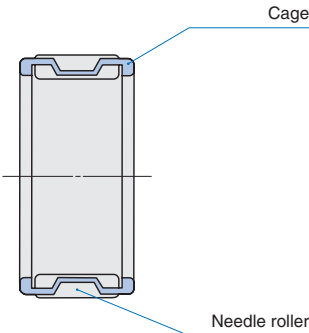
When combined with shafts and housing bores that are heat treated and accurately ground as raceway surfaces, Needle Roller Cages for General Usage are particularly useful in small spaces.

In addition, since they are lightweight and have high rigidity as well as a large lubricant holding capacity, they can withstand severe operating conditions such as high speed rotation and shock loads, and they are used in a wide range of applications.

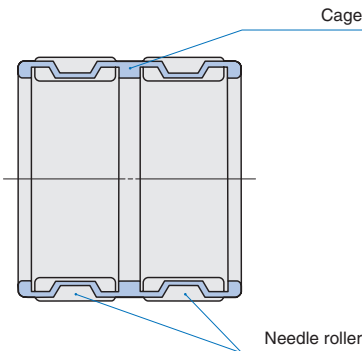
### Structures of Needle Roller Cages for General Usage

#### High carbon steel cage type

KT

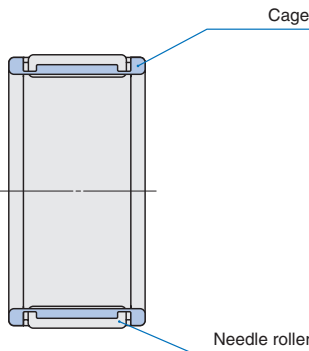


KTW



#### Synthetic resin cage type

KT...N



Types

Needle Roller Cages for General Usage are available in the types shown in Table 1.

For applications such as crank shafts where these bearings are difficult to install, it is also possible to make split type bearings.

If such bearings are required, please contact IKO.

For Needle Roller Cages for Engine Connecting Rods (KT...EG and KTV...EG), see page C17.

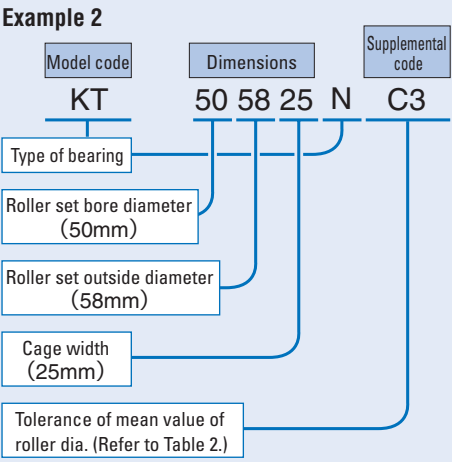
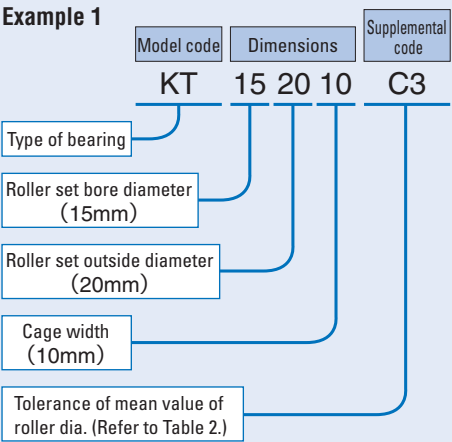
Table 1 Model of bearing

| Item                        | Model of bearing         |                          |
|-----------------------------|--------------------------|--------------------------|
|                             | Single row needle roller | Double row needle roller |
| High carbon steel cage type | KT                       | KTW                      |
| Synthetic resin cage type   | KT...N                   | —                        |

Identification Number

The identification number of Needle Roller Cages for General Usage consists of a model code, dimensions and any supplemental codes. The arrangement examples are shown below.

Examples of identification number



Accuracy

The diameter tolerances of needle rollers of Needle Roller Cages for General Usage are classified by classification symbols shown in Table 2. If a classification symbol is not indicated in an identification number, the classification symbol "C3" is applied.

When two or more bearings are used in tandem arrangement on the same shaft, it is necessary to select bearings of the same classification symbol to obtain an even load distribution.

The tolerance of the cage width  $B_c$  is  $-0.20 \sim -0.55$  mm.

Table 2 Diameter tolerances of needle rollers unit:  $\mu$  m

| Classification symbol | Tolerance of mean value of needle roller diameter |
|-----------------------|---------------------------------------------------|
| C 3                   | 0 ~ - 3                                           |
| B 2                   | 0 ~ - 2                                           |
| B 4                   | - 2 ~ - 4                                         |
| B 6                   | - 4 ~ - 6                                         |
| B 8                   | - 6 ~ - 8                                         |
| B10                   | - 8 ~ - 10                                        |

Fit

Radial clearances of Needle Roller Cages for General Usage are determined by the dimensional accuracy of the raceways and needle rollers. Table 3 shows the recommended fits for the operating conditions.

Table 3 Recommended fits of shaft to the housing bore diameter G6

| Operating conditions                                                                               | Tolerance class of shaft |                     |
|----------------------------------------------------------------------------------------------------|--------------------------|---------------------|
|                                                                                                    | $F_w \leq 68\text{mm}$   | $F_w > 68\text{mm}$ |
| When high operating accuracy is required.<br>When shock loads and oscillating motions are applied. | j5                       | h5                  |
| For general use                                                                                    | h5                       | g5                  |
| When the temperature is high, or mounting errors are large.                                        | g6                       | f6                  |

**Remark** When setting the required radial clearance according to the operating conditions, the clearance can easily be obtained by selecting and matching the tolerances of needle rollers, shaft and housing bore. When variation of the clearance does not create any problems, h6 and G7 are used for shaft and housing bore, respectively.

Specifications of shaft and housing

For the raceways, a surface hardness of 58 ~ 64HRC and a surface roughness  $0.2 \mu\text{m} R_a$  or less are desirable. However, when the operating conditions are not severe, a surface roughness  $0.8 \mu\text{m} R_a$  or less can be used.

When the surface hardness is low, it is necessary to correct the load rating by the hardness factor specified on page A20.

Operating temperature range

The operating temperature range for high carbon steel cage types is  $-20$  to  $120^\circ\text{C}$ . The maximum allowable temperature for synthetic resin cage types is  $+110^\circ\text{C}$ , and  $+100^\circ\text{C}$  when they are continuously operated.

Mounting

The dimensions related to mounting of Needle Roller Cages for General Usage are shown in Figs. 1 and 2.

When mounting Needle Roller Cages for General Usage, they are axially positioned by using, for example, Cir-clips for shaft and housing bore (WR and AR on page L17) as shown in Figs. 3, 4 and 5.

For high rotational speed applications, a heat treated and ground spacer is positioned between the cage and the cir-clip as shown in Fig. 5 so that the cage does not make direct contact with the cir-clip. In this case, the cir-clip is normally mounted on the non-rotating side.

Fig. 3 shows a mounting example in the case of outer ring rotation, and Figs. 4 and 5 show examples in the case of inner ring rotation.

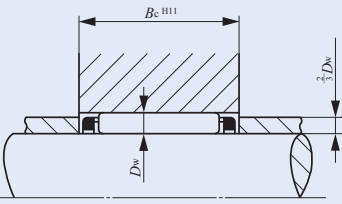


Fig.1

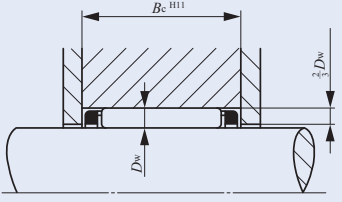


Fig.2

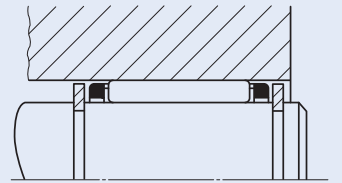


Fig.3

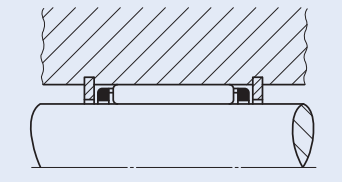


Fig.4

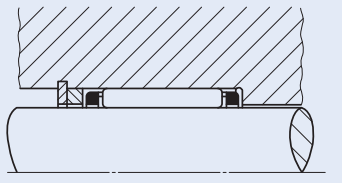
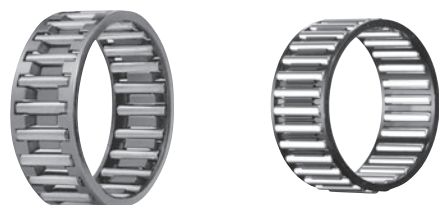


Fig.5

NEEDLE ROLLER CAGES FOR GENERAL USAGE

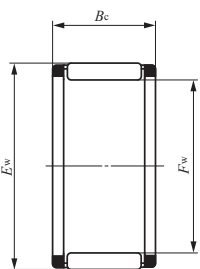


High carbon steel cage type      Synthetic resin cage type

Shaft dia. 3 – 14mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 3                | KT 367N               | 0.39                | 3                         | 6                     | 7                     | 1 480                                         | 990                                                       | 140 000                                                              |
| 4                | KT 477N               | 0.47                | 4                         | 7                     | 7                     | 1 800                                         | 1 300                                                     | 100 000                                                              |
| 5                | KT 587N               | 0.53                | 5                         | 8                     | 7                     | 2 070                                         | 1 600                                                     | 85 000                                                               |
|                  | KT 588N               | 0.66                | 5                         | 8                     | 8                     | 2 420                                         | 1 950                                                     | 85 000                                                               |
| 6                | KT 697N               | 0.63                | 6                         | 9                     | 7                     | 2 310                                         | 1 900                                                     | 75 000                                                               |
|                  | KT 698N               | 0.75                | 6                         | 9                     | 8                     | 2 700                                         | 2 320                                                     | 75 000                                                               |
|                  | KT 6910               | 1.45                | 6                         | 9                     | 10                    | 3 010                                         | 2 660                                                     | 75 000                                                               |
|                  | KT 61013              | 2.7                 | 6                         | 10                    | 13                    | 4 410                                         | 3 720                                                     | 75 000                                                               |
| 7                | KT 7108N              | 0.86                | 7                         | 10                    | 8                     | 2 960                                         | 2 690                                                     | 65 000                                                               |
|                  | KT 71010              | 1.69                | 7                         | 10                    | 10                    | 3 340                                         | 3 130                                                     | 65 000                                                               |
| 8                | KT 8118N              | 0.96                | 8                         | 11                    | 8                     | 3 190                                         | 3 060                                                     | 60 000                                                               |
|                  | KT 81110              | 1.9                 | 8                         | 11                    | 10                    | 3 630                                         | 3 600                                                     | 60 000                                                               |
|                  | KT 81110N             | 1.2                 | 8                         | 11                    | 10                    | 3 630                                         | 3 600                                                     | 60 000                                                               |
|                  | KT 81113              | 2.5                 | 8                         | 12                    | 13                    | 4 500                                         | 4 750                                                     | 60 000                                                               |
|                  | KT 8128               | 2.1                 | 8                         | 12                    | 8                     | 3 630                                         | 3 040                                                     | 60 000                                                               |
|                  | KT 81211              | 3                   | 8                         | 12                    | 11                    | 4 630                                         | 4 170                                                     | 60 000                                                               |
|                  | KT 91210              | 2.1                 | 9                         | 12                    | 10                    | 3 900                                         | 4 070                                                     | 55 000                                                               |
|                  | KT 91213              | 2.8                 | 9                         | 12                    | 13                    | 4 840                                         | 5 370                                                     | 55 000                                                               |
| 9                | KT 10138              | 1.9                 | 10                        | 13                    | 8                     | 3 370                                         | 3 470                                                     | 50 000                                                               |
|                  | KT 101310             | 2.3                 | 10                        | 13                    | 10                    | 4 160                                         | 4 550                                                     | 50 000                                                               |
|                  | KT 101313             | 3                   | 10                        | 13                    | 13                    | 5 160                                         | 6 000                                                     | 50 000                                                               |
|                  | KT 101410             | 3.2                 | 10                        | 14                    | 10                    | 4 900                                         | 4 680                                                     | 50 000                                                               |
| 10               | KT 101412             | 3.8                 | 10                        | 14                    | 12                    | 5 940                                         | 6 000                                                     | 50 000                                                               |
|                  | KT 101413             | 4.2                 | 10                        | 14                    | 13                    | 6 100                                         | 6 200                                                     | 50 000                                                               |
|                  | KT 101415             | 4.8                 | 10                        | 14                    | 15                    | 7 080                                         | 7 520                                                     | 50 000                                                               |
| 11               | KT 111410             | 2.5                 | 11                        | 14                    | 10                    | 4 400                                         | 5 020                                                     | 45 000                                                               |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remark For synthetic resin cage types, "N" is added at the end of the identification number. For sizes not listed in the dimension tables, please contact IKO.



KT (…N)

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 12               | KT 12158              | 2.2                 | 12                        | 15                    | 8                     | 3 750                                         | 4 200                                                     | 40 000                                                               |
|                  | KT 121510             | 2.7                 | 12                        | 15                    | 10                    | 4 620                                         | 5 490                                                     | 40 000                                                               |
|                  | KT 121512             | 3.2                 | 12                        | 15                    | 12                    | 5 590                                         | 7 020                                                     | 40 000                                                               |
|                  | KT 121513             | 3.6                 | 12                        | 15                    | 13                    | 5 730                                         | 7 250                                                     | 40 000                                                               |
|                  | KT 121514             | 3.8                 | 12                        | 15                    | 14                    | 6 200                                         | 8 010                                                     | 40 000                                                               |
|                  | KT 121610             | 4                   | 12                        | 16                    | 10                    | 5 650                                         | 5 890                                                     | 40 000                                                               |
|                  | KT 121613             | 5.2                 | 12                        | 16                    | 13                    | 7 020                                         | 7 800                                                     | 40 000                                                               |
|                  | KT 121618             | 7                   | 12                        | 16                    | 18                    | 9 790                                         | 11 900                                                    | 40 000                                                               |
|                  | KT 121710             | 5.1                 | 12                        | 17                    | 10                    | 6 170                                         | 5 740                                                     | 40 000                                                               |
|                  | KT 121812             | 7.8                 | 12                        | 18                    | 12                    | 9 030                                         | 8 460                                                     | 40 000                                                               |
| 13               | KT 121820             | 13.2                | 12                        | 18                    | 20                    | 13 700                                        | 14 400                                                    | 40 000                                                               |
|                  | KT 131710             | 4.3                 | 13                        | 17                    | 10                    | 5 990                                         | 6 500                                                     | 40 000                                                               |
|                  | KT 131815             | 8.2                 | 13                        | 18                    | 15                    | 9 660                                         | 10 400                                                    | 40 000                                                               |
|                  | KT 131816             | 8.7                 | 13                        | 18                    | 16                    | 10 300                                        | 11 400                                                    | 40 000                                                               |
| 14               | KT 14188              | 3.7                 | 14                        | 18                    | 8                     | 5 110                                         | 5 410                                                     | 35 000                                                               |
|                  | KT 141810             | 4.6                 | 14                        | 18                    | 10                    | 6 320                                         | 7 110                                                     | 35 000                                                               |
|                  | KT 141811             | 5.2                 | 14                        | 18                    | 11                    | 6 520                                         | 7 410                                                     | 35 000                                                               |
|                  | KT 141813             | 6                   | 14                        | 18                    | 13                    | 7 860                                         | 9 410                                                     | 35 000                                                               |
|                  | KT 141816             | 7.3                 | 14                        | 18                    | 16                    | 9 750                                         | 12 400                                                    | 35 000                                                               |
|                  | KT 141910             | 5.9                 | 14                        | 19                    | 10                    | 7 130                                         | 7 180                                                     | 35 000                                                               |
|                  | KT 141916             | 9.4                 | 14                        | 19                    | 16                    | 11 100                                        | 12 600                                                    | 35 000                                                               |
|                  | KT 141918             | 10.5                | 14                        | 19                    | 18                    | 12 400                                        | 14 700                                                    | 35 000                                                               |
|                  | KT 142012             | 8.7                 | 14                        | 20                    | 12                    | 9 790                                         | 9 680                                                     | 35 000                                                               |
|                  | KT 142017             | 12.4                | 14                        | 20                    | 17                    | 13 300                                        | 14 400                                                    | 35 000                                                               |

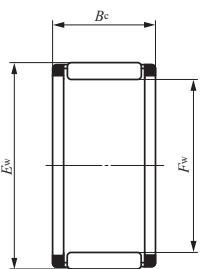


High carbon steel cage type

Shaft dia. 15 — 18mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 15               | KT 15199              | 4.4                 | 15                        | 19                    | 9                     | 6 120                                         | 6 950                                                     | 35 000                                                               |
|                  | KT 151910             | 4.9                 | 15                        | 19                    | 10                    | 6 630                                         | 7 720                                                     | 35 000                                                               |
|                  | KT 151911             | 5.5                 | 15                        | 19                    | 11                    | 6 850                                         | 8 040                                                     | 35 000                                                               |
|                  | KT 151913             | 6.4                 | 15                        | 19                    | 13                    | 8 250                                         | 10 200                                                    | 35 000                                                               |
|                  | KT 151917             | 8.2                 | 15                        | 19                    | 17                    | 10 900                                        | 14 600                                                    | 35 000                                                               |
|                  | KT 151918             | 8.7                 | 15                        | 19                    | 18                    | 11 500                                        | 15 600                                                    | 35 000                                                               |
|                  | KT 152010             | 6.3                 | 15                        | 20                    | 10                    | 7 580                                         | 7 920                                                     | 35 000                                                               |
|                  | KT 152115             | 11.9                | 15                        | 21                    | 15                    | 12 600                                        | 13 500                                                    | 35 000                                                               |
| 16               | KT 162010             | 5.2                 | 16                        | 20                    | 10                    | 6 930                                         | 8 330                                                     | 30 000                                                               |
|                  | KT 162013             | 6.8                 | 16                        | 20                    | 13                    | 8 620                                         | 11 000                                                    | 30 000                                                               |
|                  | KT 162016             | 8.3                 | 16                        | 20                    | 16                    | 10 700                                        | 14 600                                                    | 30 000                                                               |
|                  | KT 162017             | 8.7                 | 16                        | 20                    | 17                    | 11 400                                        | 15 700                                                    | 30 000                                                               |
|                  | KT 162118             | 12                  | 16                        | 21                    | 18                    | 14 000                                        | 17 700                                                    | 30 000                                                               |
|                  | KT 162120             | 13.6                | 16                        | 21                    | 20                    | 14 700                                        | 18 900                                                    | 30 000                                                               |
|                  | KT 162125             | 16.6                | 16                        | 21                    | 25                    | 18 300                                        | 25 100                                                    | 30 000                                                               |
|                  | KT 162212             | 9.7                 | 16                        | 22                    | 12                    | 10 500                                        | 10 900                                                    | 30 000                                                               |
|                  | KT 162214             | 11.5                | 16                        | 22                    | 14                    | 11 600                                        | 12 500                                                    | 30 000                                                               |
|                  | KT 162217             | 13.8                | 16                        | 22                    | 17                    | 14 200                                        | 16 100                                                    | 30 000                                                               |
|                  | KT 162220             | 16.5                | 16                        | 22                    | 20                    | 15 900                                        | 18 600                                                    | 30 000                                                               |
|                  | KT 162420             | 23.5                | 16                        | 24                    | 20                    | 18 500                                        | 19 000                                                    | 30 000                                                               |
| 17               | KT 172110             | 5.5                 | 17                        | 21                    | 10                    | 7 220                                         | 8 950                                                     | 30 000                                                               |
|                  | KT 172113             | 7.2                 | 17                        | 21                    | 13                    | 8 980                                         | 11 800                                                    | 30 000                                                               |
|                  | KT 172115             | 8.2                 | 17                        | 21                    | 15                    | 10 400                                        | 14 400                                                    | 30 000                                                               |
|                  | KT 172117             | 9.3                 | 17                        | 21                    | 17                    | 11 800                                        | 16 900                                                    | 30 000                                                               |
|                  | KT 172220             | 14                  | 17                        | 22                    | 20                    | 15 500                                        | 20 500                                                    | 30 000                                                               |
|                  | KT 172311             | 9.6                 | 17                        | 23                    | 11                    | 10 100                                        | 10 500                                                    | 30 000                                                               |
|                  | KT 172315             | 13.1                | 17                        | 23                    | 15                    | 13 300                                        | 15 100                                                    | 30 000                                                               |
|                  | KT 172418             | 18.6                | 17                        | 24                    | 18                    | 16 500                                        | 18 000                                                    | 30 000                                                               |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



KT

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 18               | KT 18228              | 4.7                 | 18                        | 22                    | 8                     | 6 060                                         | 7 270                                                     | 30 000                                                               |
|                  | KT 182210             | 5.8                 | 18                        | 22                    | 10                    | 7 500                                         | 9 560                                                     | 30 000                                                               |
|                  | KT 182213             | 7.6                 | 18                        | 22                    | 13                    | 9 330                                         | 12 700                                                    | 30 000                                                               |
|                  | KT 182216             | 9.2                 | 18                        | 22                    | 16                    | 11 600                                        | 16 700                                                    | 30 000                                                               |
|                  | KT 182412             | 11                  | 18                        | 24                    | 12                    | 11 800                                        | 13 100                                                    | 30 000                                                               |
|                  | KT 182416             | 14.8                | 18                        | 24                    | 16                    | 15 100                                        | 17 900                                                    | 30 000                                                               |
|                  | KT 182417             | 15.7                | 18                        | 24                    | 17                    | 16 000                                        | 19 400                                                    | 30 000                                                               |
|                  | KT 182420             | 18.7                | 18                        | 24                    | 20                    | 17 900                                        | 22 400                                                    | 30 000                                                               |
|                  | KT 182517             | 18.8                | 18                        | 25                    | 17                    | 16 700                                        | 18 600                                                    | 30 000                                                               |
|                  | KT 182519             | 21                  | 18                        | 25                    | 19                    | 18 700                                        | 21 400                                                    | 30 000                                                               |
|                  | KT 182522             | 24.5                | 18                        | 25                    | 22                    | 20 600                                        | 24 200                                                    | 30 000                                                               |
|                  | KT 182614             | 18.1                | 18                        | 26                    | 14                    | 14 600                                        | 14 400                                                    | 30 000                                                               |
|                  | KT 182620             | 26                  | 18                        | 26                    | 20                    | 20 000                                        | 21 600                                                    | 30 000                                                               |

NEEDLE ROLLER CAGES FOR GENERAL USAGE

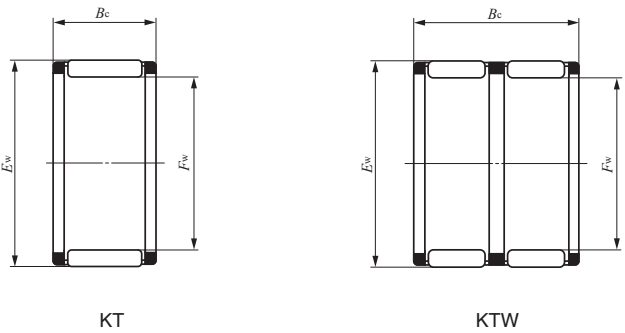


High carbon steel cage type

Shaft dia. 20 – 24mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 20               | KT 202410             | 6.3                 | 20                        | 24                    | 10                    | 7 710                                         | 10 200                                                    | 25 000                                                               |
|                  | KT 202413             | 8.3                 | 20                        | 24                    | 13                    | 9 590                                         | 13 500                                                    | 25 000                                                               |
|                  | KT 202417             | 10.6                | 20                        | 24                    | 17                    | 12 600                                        | 19 300                                                    | 25 000                                                               |
|                  | KTW 202422            | 14.6                | 20                        | 24                    | 22                    | 13 700                                        | 21 300                                                    | 25 000                                                               |
|                  | KT 202525             | 19.7                | 20                        | 25                    | 25                    | 19 900                                        | 29 800                                                    | 25 000                                                               |
|                  | KTW 202531.6          | 26.5                | 20                        | 25                    | 31.6                  | 21 700                                        | 33 200                                                    | 25 000                                                               |
|                  | KTW 202540            | 32.5                | 20                        | 25                    | 40                    | 27 500                                        | 44 900                                                    | 25 000                                                               |
|                  | KT 202611             | 11.1                | 20                        | 26                    | 11                    | 11 200                                        | 12 500                                                    | 25 000                                                               |
|                  | KT 202612             | 12                  | 20                        | 26                    | 12                    | 12 400                                        | 14 300                                                    | 25 000                                                               |
|                  | KT 202614             | 14.2                | 20                        | 26                    | 14                    | 13 700                                        | 16 400                                                    | 25 000                                                               |
|                  | KT 202617             | 17                  | 20                        | 26                    | 17                    | 16 800                                        | 21 200                                                    | 25 000                                                               |
|                  | KT 202620             | 20.5                | 20                        | 26                    | 20                    | 18 700                                        | 24 400                                                    | 25 000                                                               |
|                  | KT 202624             | 24                  | 20                        | 26                    | 24                    | 22 500                                        | 30 900                                                    | 25 000                                                               |
|                  | KT 202627             | 26.5                | 20                        | 26                    | 27                    | 26 000                                        | 37 300                                                    | 25 000                                                               |
|                  | KT 202814             | 20                  | 20                        | 28                    | 14                    | 15 700                                        | 16 100                                                    | 25 000                                                               |
|                  | KT 202820             | 29                  | 20                        | 28                    | 20                    | 21 500                                        | 24 200                                                    | 25 000                                                               |
|                  | KT 203225             | 49.5                | 20                        | 32                    | 25                    | 30 800                                        | 30 500                                                    | 25 000                                                               |
| 21               | KT 212610             | 8.5                 | 21                        | 26                    | 10                    | 9 090                                         | 11 000                                                    | 25 000                                                               |
|                  | KT 212611             | 9.6                 | 21                        | 26                    | 11                    | 9 390                                         | 11 500                                                    | 25 000                                                               |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 22               | KT 222610             | 6.9                 | 22                        | 26                    | 10                    | 8 220                                         | 11 500                                                    | 25 000                                                               |
|                  | KT 222613             | 9.1                 | 22                        | 26                    | 13                    | 10 200                                        | 15 200                                                    | 25 000                                                               |
|                  | KT 222617             | 11.6                | 22                        | 26                    | 17                    | 13 500                                        | 21 600                                                    | 25 000                                                               |
|                  | KTW 222625            | 17.7                | 22                        | 26                    | 25                    | 17 100                                        | 29 400                                                    | 25 000                                                               |
|                  | KT 222720             | 17.9                | 22                        | 27                    | 20                    | 17 400                                        | 25 700                                                    | 25 000                                                               |
|                  | KT 222726             | 22.5                | 22                        | 27                    | 26                    | 22 500                                        | 35 800                                                    | 25 000                                                               |
|                  | KT 222817             | 18.4                | 22                        | 28                    | 17                    | 17 500                                        | 23 000                                                    | 25 000                                                               |
|                  | KT 222912             | 16.1                | 22                        | 29                    | 12                    | 12 900                                        | 14 000                                                    | 25 000                                                               |
|                  | KT 222916             | 21                  | 22                        | 29                    | 16                    | 17 600                                        | 20 900                                                    | 25 000                                                               |
|                  | KT 222917             | 22.5                | 22                        | 29                    | 17                    | 18 700                                        | 22 600                                                    | 25 000                                                               |
|                  | KT 222918             | 23.5                | 22                        | 29                    | 18                    | 19 800                                        | 24 400                                                    | 25 000                                                               |
|                  | KT 222920             | 26.5                | 22                        | 29                    | 20                    | 20 900                                        | 26 100                                                    | 25 000                                                               |
|                  | KT 223015             | 23.5                | 22                        | 30                    | 15                    | 17 900                                        | 19 700                                                    | 25 000                                                               |
|                  | KT 223230             | 52.5                | 22                        | 32                    | 30                    | 36 400                                        | 42 700                                                    | 25 000                                                               |
|                  | KT 223232             | 56                  | 22                        | 32                    | 32                    | 38 800                                        | 46 300                                                    | 25 000                                                               |
| 23               | KT 232824             | 22                  | 23                        | 28                    | 24                    | 21 600                                        | 34 500                                                    | 20 000                                                               |
|                  | KT 232913             | 15.1                | 23                        | 29                    | 13                    | 13 800                                        | 17 200                                                    | 20 000                                                               |
|                  | KT 233015             | 21                  | 23                        | 30                    | 15                    | 17 300                                        | 20 800                                                    | 20 000                                                               |
|                  | KT 233016             | 22                  | 23                        | 30                    | 16                    | 18 600                                        | 22 600                                                    | 20 000                                                               |
| 24               | KT 242813             | 9.9                 | 24                        | 28                    | 13                    | 10 800                                        | 16 800                                                    | 20 000                                                               |
|                  | KT 242816             | 12                  | 24                        | 28                    | 16                    | 13 400                                        | 22 200                                                    | 20 000                                                               |
|                  | KTW 242834            | 27                  | 24                        | 28                    | 34                    | 21 600                                        | 40 700                                                    | 20 000                                                               |
|                  | KT 242913             | 12.8                | 24                        | 29                    | 13                    | 12 700                                        | 17 600                                                    | 20 000                                                               |
|                  | KT 243020             | 23.5                | 24                        | 30                    | 20                    | 20 300                                        | 28 500                                                    | 20 000                                                               |

NEEDLE ROLLER CAGES FOR GENERAL USAGE



High carbon steel cage type

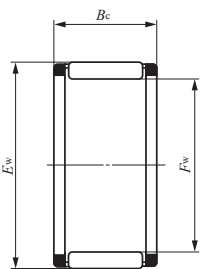


Synthetic resin cage type

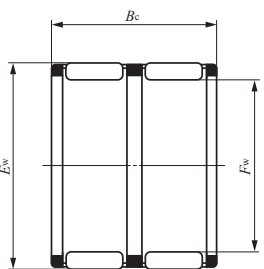
Shaft dia. 25 – 32mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 25               | KT 252910             | 7.9                 | 25                        | 29                    | 10                    | 8 940                                         | 13 300                                                    | 20 000                                                               |
|                  | KT 252913             | 10.3                | 25                        | 29                    | 13                    | 11 100                                        | 17 600                                                    | 20 000                                                               |
|                  | KT 253013             | 13.3                | 25                        | 30                    | 13                    | 13 100                                        | 18 600                                                    | 20 000                                                               |
|                  | KT 253016             | 16.2                | 25                        | 30                    | 16                    | 16 300                                        | 24 600                                                    | 20 000                                                               |
|                  | KT 253017             | 17.1                | 25                        | 30                    | 17                    | 17 300                                        | 26 600                                                    | 20 000                                                               |
|                  | KT 253020             | 20                  | 25                        | 30                    | 20                    | 18 600                                        | 29 100                                                    | 20 000                                                               |
|                  | KT 253113             | 16.2                | 25                        | 31                    | 13                    | 14 300                                        | 18 400                                                    | 20 000                                                               |
|                  | KT 253116             | 19.6                | 25                        | 31                    | 16                    | 17 800                                        | 24 400                                                    | 20 000                                                               |
|                  | KT 253117             | 20.5                | 25                        | 31                    | 17                    | 19 000                                        | 26 500                                                    | 20 000                                                               |
|                  | KT 253120             | 25                  | 25                        | 31                    | 20                    | 21 200                                        | 30 500                                                    | 20 000                                                               |
|                  | KT 253216             | 23.5                | 25                        | 32                    | 16                    | 19 400                                        | 24 500                                                    | 20 000                                                               |
|                  | KT 253224             | 35                  | 25                        | 32                    | 24                    | 27 700                                        | 38 700                                                    | 20 000                                                               |
|                  | KT 253515             | 33                  | 25                        | 35                    | 15                    | 22 600                                        | 23 800                                                    | 20 000                                                               |
|                  | KT 253525             | 48                  | 25                        | 35                    | 25                    | 32 500                                        | 37 900                                                    | 20 000                                                               |
|                  | KT 253530             | 58                  | 25                        | 35                    | 30                    | 39 100                                        | 48 000                                                    | 20 000                                                               |
| 26               | KT 263013             | 10.7                | 26                        | 30                    | 13                    | 11 400                                        | 18 400                                                    | 19 000                                                               |
|                  | KT 263832             | 79.5                | 26                        | 38                    | 32                    | 47 200                                        | 55 300                                                    | 19 000                                                               |
| 28               | KT 283313             | 14.8                | 28                        | 33                    | 13                    | 13 800                                        | 20 700                                                    | 18 000                                                               |
|                  | KT 283317             | 18.9                | 28                        | 33                    | 17                    | 18 300                                        | 29 500                                                    | 18 000                                                               |
|                  | KT 283327             | 29                  | 28                        | 33                    | 27                    | 26 300                                        | 47 300                                                    | 18 000                                                               |
|                  | KT 283417             | 23                  | 28                        | 34                    | 17                    | 20 300                                        | 29 900                                                    | 18 000                                                               |
|                  | KT 283516             | 26                  | 28                        | 35                    | 16                    | 20 100                                        | 26 500                                                    | 18 000                                                               |
|                  | KT 283528             | 44.5                | 28                        | 35                    | 28                    | 33 200                                        | 50 600                                                    | 18 000                                                               |
|                  | KT 283620             | 38.5                | 28                        | 36                    | 20                    | 26 500                                        | 34 700                                                    | 18 000                                                               |
|                  | KT 284138             | 110                 | 28                        | 41                    | 38                    | 58 700                                        | 71 100                                                    | 18 000                                                               |
| 29               | KT 293825N            | 40.7                | 29                        | 38                    | 25                    | 35 800                                        | 47 800                                                    | 17 500                                                               |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remark For synthetic resin cage types, "N" is added at the end of the identification number. For sizes not listed in the dimension tables, please contact IKO.



KT ( ... N)



KTW

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                       |                       | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|-----------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>     | <i>E</i> <sub>w</sub> | <i>B</i> <sub>c</sub> |                                               |                                                           |                                                                      |
| 30               | KT 303513             | 15.6                | 30                        | 35                    | 13                    | 14 100                                        | 21 700                                                    | 17 000                                                               |
|                  | KT 303516             | 18.9                | 30                        | 35                    | 16                    | 17 500                                        | 28 700                                                    | 17 000                                                               |
|                  | KT 303517             | 20                  | 30                        | 35                    | 17                    | 18 700                                        | 31 100                                                    | 17 000                                                               |
|                  | KT 303524             | 28.5                | 30                        | 35                    | 24                    | 24 900                                        | 45 100                                                    | 17 000                                                               |
|                  | KT 303527             | 31.5                | 30                        | 35                    | 27                    | 27 900                                        | 52 100                                                    | 17 000                                                               |
|                  | KT 303613             | 19.1                | 30                        | 36                    | 13                    | 15 800                                        | 22 100                                                    | 17 000                                                               |
|                  | KT 303620             | 29.5                | 30                        | 36                    | 20                    | 23 300                                        | 36 500                                                    | 17 000                                                               |
|                  | KT 303630             | 41.5                | 30                        | 36                    | 30                    | 33 200                                        | 57 500                                                    | 17 000                                                               |
|                  | KT 303715             | 26                  | 30                        | 37                    | 15                    | 19 500                                        | 26 000                                                    | 17 000                                                               |
|                  | KT 303716             | 27.5                | 30                        | 37                    | 16                    | 20 800                                        | 28 400                                                    | 17 000                                                               |
|                  | KT 303720             | 35                  | 30                        | 37                    | 20                    | 24 700                                        | 35 400                                                    | 17 000                                                               |
|                  | KT 303723             | 39.5                | 30                        | 37                    | 23                    | 28 500                                        | 42 500                                                    | 17 000                                                               |
|                  | KT 303818             | 36.5                | 30                        | 38                    | 18                    | 26 200                                        | 34 800                                                    | 17 000                                                               |
|                  | KT 303824             | 48.5                | 30                        | 38                    | 24                    | 33 200                                        | 47 200                                                    | 17 000                                                               |
|                  | KT 304232             | 93                  | 30                        | 42                    | 32                    | 54 000                                        | 68 100                                                    | 17 000                                                               |
|                  | KTW 304237            | 117                 | 30                        | 42                    | 37                    | 55 900                                        | 71 300                                                    | 17 000                                                               |
| 32               | KT 323713             | 16.7                | 32                        | 37                    | 13                    | 14 900                                        | 23 700                                                    | 16 000                                                               |
|                  | KT 323717             | 21.5                | 32                        | 37                    | 17                    | 19 600                                        | 33 900                                                    | 16 000                                                               |
|                  | KT 323723             | 28.5                | 32                        | 37                    | 23                    | 24 400                                        | 44 800                                                    | 16 000                                                               |
|                  | KT 323813             | 20.5                | 32                        | 38                    | 13                    | 16 800                                        | 24 400                                                    | 16 000                                                               |
|                  | KT 323820             | 31.5                | 32                        | 38                    | 20                    | 24 800                                        | 40 300                                                    | 16 000                                                               |
|                  | KT 323916             | 29                  | 32                        | 39                    | 16                    | 21 600                                        | 30 200                                                    | 16 000                                                               |
|                  | KT 323920             | 37                  | 32                        | 39                    | 20                    | 25 600                                        | 37 700                                                    | 16 000                                                               |
|                  | KT 324519             | 63.5                | 32                        | 45                    | 19                    | 33 700                                        | 35 900                                                    | 16 000                                                               |
|                  | KT 324525             | 84.5                | 32                        | 45                    | 25                    | 45 600                                        | 53 000                                                    | 16 000                                                               |
|                  | KT 324532             | 109                 | 32                        | 45                    | 32                    | 58 500                                        | 73 000                                                    | 16 000                                                               |
|                  | KT 324550             | 162                 | 32                        | 45                    | 50                    | 81 500                                        | 111 000                                                   | 16 000                                                               |

NEEDLE ROLLER CAGES FOR GENERAL USAGE



High carbon steel cage type

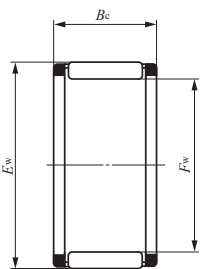


Synthetic resin cage type

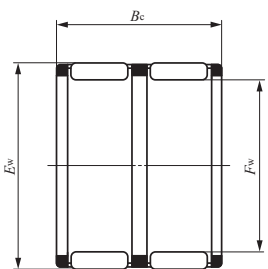
Shaft dia. 35 — 52mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |       |       | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup> |
|------------------|-----------------------|---------------------|---------------------------|-------|-------|------------------------------|-----------------------------|-------------------------------------------------|
|                  |                       |                     | $F_w$                     | $E_w$ | $B_c$ | $C$<br>N                     | $C_0$<br>N                  | $\text{min}^{-1}$                               |
| 35               | KT 354013             | 18.1                | 35                        | 40    | 13    | 15 500                       | 25 800                      | 14 000                                          |
|                  | KT 354017             | 23                  | 35                        | 40    | 17    | 20 500                       | 36 900                      | 14 000                                          |
|                  | KT 354026             | 34.5                | 35                        | 40    | 26    | 28 700                       | 56 800                      | 14 000                                          |
|                  | KT 354113             | 22.5                | 35                        | 41    | 13    | 17 700                       | 26 800                      | 14 000                                          |
|                  | KT 354216             | 32                  | 35                        | 42    | 16    | 23 100                       | 33 900                      | 14 000                                          |
|                  | KT 354218             | 35.5                | 35                        | 42    | 18    | 26 000                       | 39 500                      | 14 000                                          |
|                  | KT 354220             | 40.5                | 35                        | 42    | 20    | 27 400                       | 42 300                      | 14 000                                          |
|                  | KT 354230             | 59                  | 35                        | 42    | 30    | 40 600                       | 70 300                      | 14 000                                          |
|                  | KT 354525             | 68.5                | 35                        | 45    | 25    | 42 100                       | 57 900                      | 14 000                                          |
| 36               | KT 364216             | 27.5                | 36                        | 42    | 16    | 21 900                       | 35 700                      | 14 000                                          |
| 38               | KT 384417             | 30.5                | 38                        | 44    | 17    | 23 800                       | 40 400                      | 13 000                                          |
|                  | KT 384620             | 50                  | 38                        | 46    | 20    | 30 500                       | 45 400                      | 13 000                                          |
|                  | KT 384632             | 80                  | 38                        | 46    | 32    | 45 400                       | 75 700                      | 13 000                                          |
| 40               | KT 404513             | 20.5                | 40                        | 45    | 13    | 16 800                       | 29 800                      | 12 000                                          |
|                  | KT 404517             | 26.5                | 40                        | 45    | 17    | 22 200                       | 42 700                      | 12 000                                          |
|                  | KT 404527             | 41                  | 40                        | 45    | 27    | 32 400                       | 69 200                      | 12 000                                          |
|                  | KT 404817             | 44                  | 40                        | 48    | 17    | 28 100                       | 41 600                      | 12 000                                          |
|                  | KT 404820             | 52.5                | 40                        | 48    | 20    | 31 400                       | 48 000                      | 12 000                                          |
|                  | KT 404825             | 64.5                | 40                        | 48    | 25    | 39 300                       | 64 000                      | 12 000                                          |
|                  | KT 404834             | 87.5                | 40                        | 48    | 34    | 51 100                       | 89 600                      | 12 000                                          |
|                  | KT 405015             | 48.5                | 40                        | 50    | 15    | 28 200                       | 35 900                      | 12 000                                          |
|                  | KT 405017             | 56.5                | 40                        | 50    | 17    | 30 200                       | 39 200                      | 12 000                                          |
|                  | KT 405020             | 61                  | 40                        | 50    | 20    | 35 700                       | 48 600                      | 12 000                                          |
|                  | KTW 405238            | 158                 | 40                        | 52    | 38    | 65 000                       | 93 000                      | 12 000                                          |
|                  | KT 405432             | 144                 | 40                        | 54    | 32    | 66 800                       | 87 200                      | 12 000                                          |
|                  | KT 405450             | 215                 | 40                        | 54    | 50    | 93 600                       | 134 000                     | 12 000                                          |
|                  | KT 405463             | 270                 | 40                        | 54    | 63    | 115 000                      | 175 000                     | 12 000                                          |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remark For synthetic resin cage types, "N" is added at the end of the identification number. For sizes not listed in the dimension tables, please contact IKO.



KT ( ... N)



KTW

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |       |       | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup> |
|------------------|-----------------------|---------------------|---------------------------|-------|-------|------------------------------|-----------------------------|-------------------------------------------------|
|                  |                       |                     | $F_w$                     | $E_w$ | $B_c$ | $C$<br>N                     | $C_0$<br>N                  | $\text{min}^{-1}$                               |
| 41               | KT 414835             | 78.5                | 41                        | 48    | 35    | 47 800                       | 90 800                      | 12 000                                          |
| 42               | KT 424717             | 27.5                | 42                        | 47    | 17    | 22 500                       | 44 200                      | 12 000                                          |
|                  | KT 424815             | 30                  | 42                        | 48    | 15    | 22 400                       | 38 600                      | 12 000                                          |
|                  | KT 424816             | 32                  | 42                        | 48    | 16    | 24 000                       | 42 100                      | 12 000                                          |
|                  | KT 425020             | 55                  | 42                        | 50    | 20    | 32 400                       | 50 600                      | 12 000                                          |
|                  | KT 425030             | 80.5                | 42                        | 50    | 30    | 48 200                       | 84 400                      | 12 000                                          |
| 45               | KT 455017             | 29.5                | 45                        | 50    | 17    | 23 300                       | 47 100                      | 11 000                                          |
|                  | KT 455027             | 46                  | 45                        | 50    | 27    | 34 800                       | 79 000                      | 11 000                                          |
|                  | KT 455320             | 58                  | 45                        | 53    | 20    | 33 200                       | 53 300                      | 11 000                                          |
|                  | KT 455325             | 71.5                | 45                        | 53    | 25    | 41 500                       | 71 100                      | 11 000                                          |
|                  | KT 455330             | 86                  | 45                        | 53    | 30    | 47 800                       | 85 300                      | 11 000                                          |
|                  | KT 455335             | 101                 | 45                        | 53    | 35    | 53 900                       | 99 500                      | 11 000                                          |
| 48               | KT 455527             | 90.5                | 45                        | 55    | 27    | 50 300                       | 78 200                      | 11 000                                          |
|                  | KT 485320             | 37                  | 48                        | 53    | 20    | 26 800                       | 57 600                      | 10 000                                          |
| 50               | KT 485420             | 46                  | 48                        | 54    | 20    | 30 600                       | 60 400                      | 10 000                                          |
|                  | KT 505520             | 38.5                | 50                        | 55    | 20    | 27 100                       | 59 300                      | 10 000                                          |
|                  | KT 505527             | 50.5                | 50                        | 55    | 27    | 35 600                       | 84 100                      | 10 000                                          |
|                  | KT 505820             | 65                  | 50                        | 58    | 20    | 35 900                       | 61 100                      | 10 000                                          |
|                  | KT 505825             | 80                  | 50                        | 58    | 25    | 44 900                       | 81 500                      | 10 000                                          |
|                  | KT 505825N            | 66.3                | 50                        | 58    | 25    | 51 400                       | 97 800                      | 10 000                                          |
|                  | KT 505830             | 96.5                | 50                        | 58    | 30    | 51 700                       | 97 800                      | 10 000                                          |
|                  | KT 505835             | 113                 | 50                        | 58    | 35    | 58 300                       | 114 000                     | 10 000                                          |
| 52               | KT 525817             | 41                  | 52                        | 58    | 17    | 28 300                       | 56 000                      | 9 500                                           |
|                  | KT 526024             | 80                  | 52                        | 60    | 24    | 44 000                       | 80 800                      | 9 500                                           |

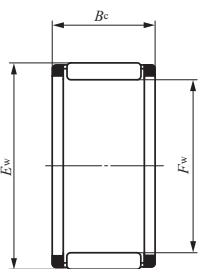


High carbon steel cage type

Shaft dia. 55 – 100mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                      |                      | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|----------------------|----------------------|------------------------------|-----------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F<sub>w</sub></i>      | <i>E<sub>w</sub></i> | <i>B<sub>c</sub></i> | <i>C</i><br>N                | <i>C<sub>0</sub></i><br>N   |                                                                      |
| 55               | KT 556020             | 42.5                | 55                        | 60                   | 20                   | 28 600                       | 66 000                      | 9 000                                                                |
|                  | KT 556027             | 55.5                | 55                        | 60                   | 27                   | 37 600                       | 93 900                      | 9 000                                                                |
|                  | KT 556120             | 52                  | 55                        | 61                   | 20                   | 32 600                       | 68 500                      | 9 000                                                                |
|                  | KT 556315             | 52.5                | 55                        | 63                   | 15                   | 29 400                       | 48 700                      | 9 000                                                                |
|                  | KT 556320             | 71                  | 55                        | 63                   | 20                   | 37 400                       | 66 400                      | 9 000                                                                |
|                  | KT 556325             | 87                  | 55                        | 63                   | 25                   | 46 800                       | 88 600                      | 9 000                                                                |
| 58               | KT 586320             | 44.5                | 58                        | 63                   | 20                   | 29 300                       | 69 400                      | 8 500                                                                |
|                  | KT 586420             | 54.5                | 58                        | 64                   | 20                   | 33 600                       | 72 500                      | 8 500                                                                |
| 60               | KT 606520             | 45.5                | 60                        | 65                   | 20                   | 29 700                       | 71 100                      | 8 500                                                                |
|                  | KT 606820             | 76.5                | 60                        | 68                   | 20                   | 38 900                       | 71 700                      | 8 500                                                                |
|                  | KT 606825             | 94                  | 60                        | 68                   | 25                   | 48 600                       | 95 600                      | 8 500                                                                |
|                  | KT 606827             | 101                 | 60                        | 68                   | 27                   | 52 400                       | 105 000                     | 8 500                                                                |
|                  | KT 607236             | 205                 | 60                        | 72                   | 36                   | 86 700                       | 152 000                     | 8 500                                                                |
| 63               | KT 637120             | 79.5                | 63                        | 71                   | 20                   | 39 500                       | 74 400                      | 8 000                                                                |
| 65               | KT 657320             | 83.5                | 65                        | 73                   | 20                   | 41 200                       | 79 600                      | 7 500                                                                |
|                  | KT 657330             | 124                 | 65                        | 73                   | 30                   | 59 300                       | 127 000                     | 7 500                                                                |
| 68               | KT 687620             | 86.5                | 68                        | 76                   | 20                   | 41 800                       | 82 200                      | 7 500                                                                |
| 70               | KT 707820             | 89                  | 70                        | 78                   | 20                   | 42 500                       | 84 900                      | 7 000                                                                |
|                  | KT 707830             | 132                 | 70                        | 78                   | 30                   | 61 200                       | 136 000                     | 7 000                                                                |
| 72               | KT 728020             | 91.5                | 72                        | 80                   | 20                   | 43 200                       | 87 500                      | 7 000                                                                |
| 75               | KT 758320             | 94.5                | 75                        | 83                   | 20                   | 43 800                       | 90 200                      | 6 500                                                                |
|                  | KT 758325             | 116                 | 75                        | 83                   | 25                   | 54 800                       | 120 000                     | 6 500                                                                |
|                  | KT 758330             | 141                 | 75                        | 83                   | 30                   | 63 100                       | 144 000                     | 6 500                                                                |
|                  | KT 758335             | 164                 | 75                        | 83                   | 35                   | 71 200                       | 168 000                     | 6 500                                                                |

Note<sup>(1)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



KT

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                      |                      | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(1)</sup><br>min <sup>-1</sup> |
|------------------|-----------------------|---------------------|---------------------------|----------------------|----------------------|------------------------------|-----------------------------|----------------------------------------------------------------------|
|                  |                       |                     | <i>F<sub>w</sub></i>      | <i>E<sub>w</sub></i> | <i>B<sub>c</sub></i> | <i>C</i><br>N                | <i>C<sub>0</sub></i><br>N   |                                                                      |
| 80               | KT 808822             | 110                 | 80                        | 88                   | 22                   | 49 700                       | 108 000                     | 6 000                                                                |
|                  | KT 808825             | 123                 | 80                        | 88                   | 25                   | 56 400                       | 127 000                     | 6 000                                                                |
|                  | KT 808830             | 149                 | 80                        | 88                   | 30                   | 65 000                       | 153 000                     | 6 000                                                                |
| 85               | KT 859112             | 44.5                | 85                        | 91                   | 12                   | 25 200                       | 56 700                      | 6 000                                                                |
|                  | KT 859325             | 130                 | 85                        | 93                   | 25                   | 57 800                       | 134 000                     | 6 000                                                                |
|                  | KT 859330             | 157                 | 85                        | 93                   | 30                   | 66 600                       | 161 000                     | 6 000                                                                |
| 90               | KT 909825             | 138                 | 90                        | 98                   | 25                   | 60 400                       | 145 000                     | 5 500                                                                |
|                  | KT 909830             | 167                 | 90                        | 98                   | 30                   | 69 600                       | 174 000                     | 5 500                                                                |
| 95               | KT 9510330            | 175                 | 95                        | 103                  | 30                   | 70 900                       | 182 000                     | 5 500                                                                |
| 100              | KT 10010830           | 184                 | 100                       | 108                  | 30                   | 72 500                       | 191 000                     | 4 500                                                                |

# NEEDLE ROLLER CAGES FOR ENGINE CONNECTING RODS

- Needle Roller Cages for Big End
- Needle Roller Cages for Small End



## Structure and Features

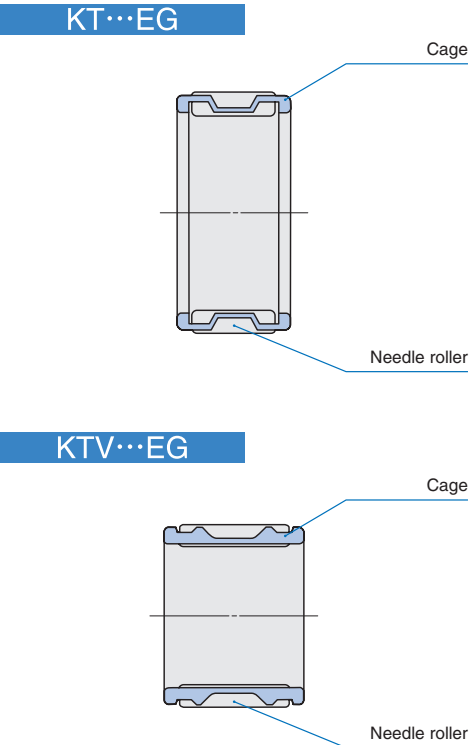
IKO Needle Roller Cages for Engine Connecting Rods are bearings for use in engine connecting rods. These bearings have superior performance proven in high performance engines of racing motor cycles, and are widely used in small motor vehicles, motor cycles, outboard marines, snow mobiles, high-speed compressors, etc. and also in general-purpose engines. Bearings for engine connecting rods are used under extremely severe and complex operating conditions such as heavy shock loads, high speeds, high temperatures and stringent lubrication. Needle Roller Cages for Engine Connecting Rods are lightweight, and have high load ratings and high rigidity as well as superior wear resistance to withstand these severe conditions.

## Types

In Needle Roller Cages for Engine Connecting Rods, the types shown in Table 1 are available.

| Table 1 Types |             |               |
|---------------|-------------|---------------|
| Type          | For big end | For small end |
| Model code    | KT···EG     | KTV···EG      |

Structures of Needle Roller Cages  
for Engine Connecting Rods



C  
KT···EG  
KTV···EG

Needle Roller Cages for Big End KT...EG

These roller cages are subjected to acceleration and deceleration during their rotating and epicyclic motion due to crank shaft rotation. To withstand such conditions, they are made of a special alloy and are lightweight with high rigidity.

They are guided on their outer periphery surface with superior lubricating properties.

For the purpose of using them under severe conditions such as high rotational speed and stringent lubrication, bearings plated with non-ferrous metals are also available on request.

High-load capacity and high-rigidity cages to be used for racing motor cycles (See the photo below.), split needle cages for solid (one-piece) type crank-shafts and other special specification cages of various types are also available. Please consult IKO when required.



Needle Roller Cages for Small End KTV...EG

These roller cages oscillates at high speeds within a limited loading zone under heavy shock loads. Thus, these cages are designed to be lightweight and have high rigidity with a well-balanced structure. In these cages, a number of needle rollers having a small diameter are incorporated to reduce the rolling contact stress in the loading zone.

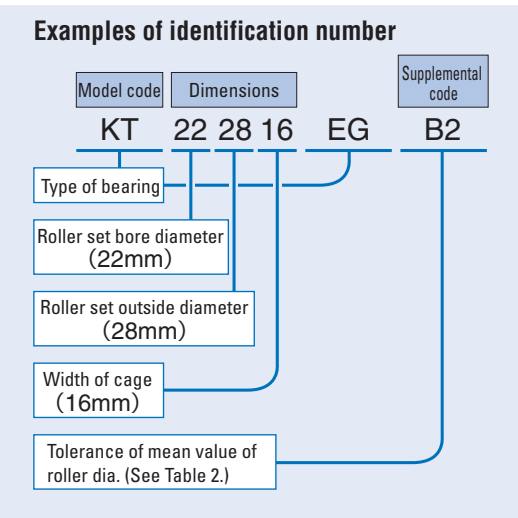
Needle Roller Cages for Small End are classified into two types, the outer surface guide type and the inner surface guide type. This classification is shown in the table of dimensions.

In the outer surface guide type, the cage is guided by the sliding contact between the inner surface of the connecting rod and the outer surface of the cage.

In the inner surface guide type, the cage is guided by the sliding contact between the outer surface of the pin and the inner surface of the cage.

Identification Number

The identification number of Needle Roller Cages for Engine Connecting Rods consists of a model code, dimensions and any supplemental codes as shown below.



Accuracy

The diameter tolerances of needle rollers of Needle Roller Cages for Engine Connecting Rods are classified as shown in Table 2. When the classification symbol is not indicated in the identification number, the classification symbol "B2" is applied.

The tolerance of the cage width  $B_c$  is  $-0.2 \sim -0.4$  mm. But cages with marks in the  $B_c$  column in the dimension tables are manufactured with the following width tolerances.

● :  $0 \sim -0.2$  mm      ■ :  $-0.1 \sim -0.3$  mm

| Table 2 Tolerances of needle roller diameter unit: $\mu$ m |                                      |                                                       |
|------------------------------------------------------------|--------------------------------------|-------------------------------------------------------|
| Class                                                      | Classification symbol <sup>(1)</sup> | Tolerance of mean value of roller dia. <sup>(2)</sup> |
| Standard                                                   | B 2                                  | $0 \sim -2$                                           |
|                                                            | B 4                                  | $-2 \sim -4$                                          |
| Semi-standard                                              | B 6                                  | $-4 \sim -6$                                          |
|                                                            | B 8                                  | $-6 \sim -8$                                          |
|                                                            | B10                                  | $-8 \sim -10$                                         |

Notes<sup>(1)</sup> The classification symbol is indicated at the end of the identification number.

<sup>(2)</sup> Tolerances for circularity are based on JIS B 1506 (Rolling bearings - Rollers).

Clearance

Radial internal clearances are selected according to the type of engine and the operating conditions (rotational speed, load, lubricating conditions, etc.). If a bearing is used with an inadequate clearance, bearing troubles such as seizure, early flaking and noise increase may occur, leading to an engine failure. Therefore, it is necessary to select the clearance carefully according to test results and experience.

Recommended radial internal clearances are shown in Table 3. When operating at high speeds, it is recommended to select the upper limit of the clearance.

Fit

To obtain the recommended clearance shown in Table 3, it is general practice to match a connecting rod, crank pin or piston pin and needle roller cage of suitable tolerances for assembly.

Precautions for Use

When designing a connecting rod, crank pin and piston pin, the following precautions should be taken, because the raceways are subjected to loads under extremely severe conditions.

- 1 Material**  
It is recommended to use carburizing steel because the raceways are subjected to fluctuating loads with frequent and heavy shock loads. Generally, chromium molybdenum steel is used. Nickel chromium molybdenum steel is also used.
- 2 Hardness**  
The recommended surface hardness of the raceway is 697~800HV (60~64HRC). While the effective hardening depth differs depending on the applications, the general value is 0.6~1.2 mm.
- 3 Surface roughness**  
To minimize initial wear and to extend life, it is recommended that the surface roughness of the crank pin and piston pin be  $0.1 \mu m R_a$  or less, and the surface roughness of the connecting rod large end and small end bores be  $0.2 \mu m R_a$  or less.
- 4 Accuracy**  
Circularity and cylindricity of connecting rod, piston pin and crank pin are as shown in Table 4.
- 5 Parallelism and torsional accuracy of connecting rod bores**

$L \pm 0.02$  mm and  $E \pm 0.02$  mm shown in Fig. 1 indicate the parallelism and torsional accuracy between the big end and small end bores of the connecting rod, respectively. The tolerance range is 0.04 mm or less per 100 mm in case of a general-purpose engine and 0.02 mm or less for a high-speed engine such as a racing motorcycle engine. When these accuracy conditions are not satisfied, the axial forces on the needle roller cage and connecting rod will increase, directly leading to a failure such as seizure. Careful consideration is required.

Table 3 Recommended radial internal clearance unit:  $\mu$ m

| Shaft dia. mm |       | Big end               | Small end |
|---------------|-------|-----------------------|-----------|
| Over          | Incl. |                       |           |
| —             | 18    | $(d_p - 6) \sim d_p$  | 3 ~ 15    |
| 18            | 30    | $(d_p - 8) \sim d_p$  |           |
| 30            | 40    | $(d_p - 12) \sim d_p$ |           |

Remark  $d_p$  is obtained using the following equation for roller pitch circle diameter in millimeters, and changing the unit from millimeters to micrometers.

Roller pitch circle dia. =  $\frac{F_w + E_w}{2}$

Example KT 222814 EG for big end  
Recommended clearance is; 17 ~ 25  $\mu$ m

Table 4 Accuracy of connecting rod, piston pin and crank pin unit:  $\mu$ m

| Range of dia. mm |       | Crank pin diameter $d_1$<br>Piston pin diameter $d_2$ |                   | Big end bore $D_1$<br>Small end bore $D_2$ |                   |
|------------------|-------|-------------------------------------------------------|-------------------|--------------------------------------------|-------------------|
| Over             | Incl. | Circularity MAX.                                      | Cylindricity MAX. | Circularity MAX.                           | Cylindricity MAX. |
| —                | 18    | 1                                                     | 2                 | 2                                          | 3                 |
| 18               | 30    | 2                                                     | 3                 | 3                                          | 4                 |
| 30               | 40    | 3                                                     | 4                 | 4                                          | 5                 |

Remark Refer to Fig. 1 for the dimension symbols.

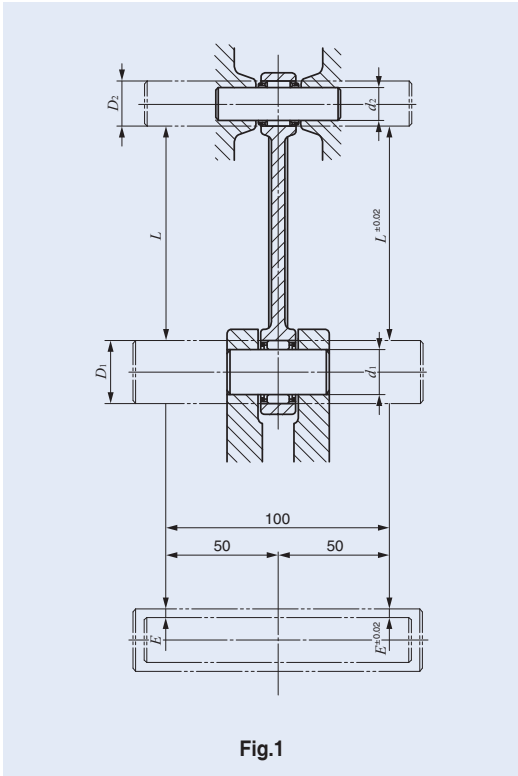
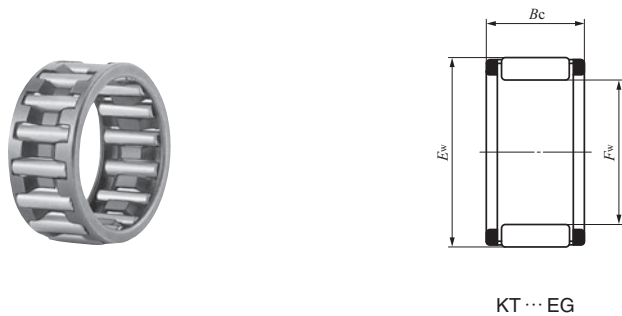


Fig.1

NEEDLE ROLLER CAGES FOR ENGINE CONNECTING RODS

Needle Roller Cages for Big End

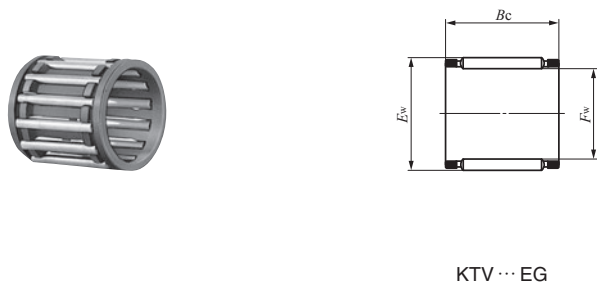


KT...EG

Shaft dia. 8 – 32mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                |                | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|------------------|-----------------------|---------------------|---------------------------|----------------|----------------|----------------------------------------|----------------------------------------------------|
|                  |                       |                     | F <sub>w</sub>            | E <sub>w</sub> | B <sub>c</sub> |                                        |                                                    |
| 8                | KT 8128 EG            | 2.1                 | 8                         | 12             | 8              | 3 280                                  | 2 660                                              |
| 10               | KT 101410 EG          | 3.2                 | 10                        | 14             | 10             | 4 900                                  | 4 680                                              |
| 12               | KT 121610 EG          | 3.8                 | 12                        | 16             | 10             | 5 650                                  | 5 890                                              |
|                  | KT 121710 EG          | 5.3                 | 12                        | 17             | 10             | 6 670                                  | 6 380                                              |
| 14               | KT 14199.7 EG         | 5.7                 | 14                        | 19             | 9.7            | 6 120                                  | 5 880                                              |
|                  | KT 141910 EG          | 5.7                 | 14                        | 19             | 10             | 6 640                                  | 6 530                                              |
| 15               | KT 15199 EG           | 4.2                 | 15                        | 19             | 9              | 5 790                                  | 6 460                                              |
|                  | KT 152010 EG          | 6.1                 | 15                        | 20             | 10             | 7 100                                  | 7 260                                              |
| 16               | KT 162211.5 EG        | 9.5                 | 16                        | 22             | ■11.5          | 9 550                                  | 9 660                                              |
|                  | KT 162212 EG          | 9.7                 | 16                        | 22             | 12             | 10 500                                 | 10 900                                             |
| 18               | KT 182210 EG          | 5.7                 | 18                        | 22             | 10             | 7 500                                  | 9 560                                              |
|                  | KT 182411.6 EG        | 11                  | 18                        | 24             | ■11.6          | 10 600                                 | 11 500                                             |
|                  | KT 182412 EG          | 11                  | 18                        | 24             | 12             | 11 800                                 | 13 100                                             |
| 20               | KT 202612 EG          | 12                  | 20                        | 26             | 12             | 12 400                                 | 14 300                                             |
|                  | KT 202614 EG          | 13.8                | 20                        | 26             | 14             | 13 000                                 | 15 200                                             |
|                  | KT 202814 EG          | 20                  | 20                        | 28             | ●14            | 15 700                                 | 16 100                                             |
| 22               | KT 222814 EG          | 14.9                | 22                        | 28             | 14             | 13 600                                 | 16 600                                             |
|                  | KT 222816 EG          | 17.5                | 22                        | 28             | 16             | 15 700                                 | 19 800                                             |
|                  | KT 222912 EG          | 15.2                | 22                        | 29             | 12             | 12 900                                 | 14 000                                             |
|                  | KT 223215 EG          | 30                  | 22                        | 32             | 15             | 21 300                                 | 21 500                                             |
| 23               | KT 232913 EG          | 14.9                | 23                        | 29             | 13             | 12 800                                 | 15 600                                             |
| 24               | KT 243015 EG          | 17.9                | 24                        | 30             | 15             | 14 200                                 | 18 000                                             |
|                  | KT 243016 EG          | 18.2                | 24                        | 30             | 16             | 16 300                                 | 21 500                                             |
|                  | KT 243120 EG          | 28                  | 24                        | 31             | 20             | 20 800                                 | 26 400                                             |
| 30               | KT 303818 EG          | 35.5                | 30                        | 38             | 18             | 24 900                                 | 32 600                                             |
| 32               | KT 324220 EG          | 54                  | 32                        | 42             | 20             | 31 900                                 | 39 400                                             |

Needle Roller Cages for Small End



KTV...EG

Shaft dia. 9 – 18mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |                |                | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Cage guide type     |
|------------------|-----------------------|---------------------|---------------------------|----------------|----------------|----------------------------------------|----------------------------------------------------|---------------------|
|                  |                       |                     | F <sub>w</sub>            | E <sub>w</sub> | B <sub>c</sub> |                                        |                                                    |                     |
| 9                | KTV 91211.5 EG        | 2.8                 | 9                         | 12             | ●11.5          | 3 900                                  | 4 070                                              | Outer surface guide |
|                  | KTV 91214 EG          | 3.5                 | 9                         | 12             | 14             | 4 440                                  | 4 810                                              | Inner surface guide |
| 10               | KTV 101316 EG         | 4.5                 | 10                        | 13             | 16             | 4 400                                  | 4 880                                              | Inner surface guide |
|                  | KTV 101410 EG         | 3.8                 | 10                        | 14             | 10             | 4 520                                  | 4 220                                              | Inner surface guide |
|                  | KTV 101411 EG         | 4.1                 | 10                        | 14             | 11             | 5 060                                  | 4 880                                              | Outer surface guide |
|                  | KTV 101412.5 EG       | 4.8                 | 10                        | 14             | ●12.5          | 5 590                                  | 5 540                                              | Inner surface guide |
| 10.5             | KTV 10.51415 EG       | 5.1                 | 10.5                      | 14             | 15             | 5 710                                  | 6 270                                              | Outer surface guide |
| 12               | KTV 121514.3 EG       | 4.3                 | 12                        | 15             | ●14.3          | 5 840                                  | 7 390                                              | Outer surface guide |
|                  | KTV 121613 EG         | 5.6                 | 12                        | 16             | 13             | 7 020                                  | 7 800                                              | Outer surface guide |
|                  | KTV 121615.5 EG       | 6.8                 | 12                        | 16             | ●15.5          | 7 600                                  | 8 600                                              | Outer surface guide |
| 14               | KTV 141812 EG         | 6                   | 14                        | 18             | 12             | 6 780                                  | 7 760                                              | Inner surface guide |
|                  | KTV 141816.5 EG       | 8.2                 | 14                        | 18             | 16.5           | 9 180                                  | 11 500                                             | Outer surface guide |
|                  | KTV 141822 EG         | 10.8                | 14                        | 18             | ●22            | 9 950                                  | 12 600                                             | Inner surface guide |
| 16               | KTV 162019 EG         | 10.6                | 16                        | 20             | 19             | 10 800                                 | 14 600                                             | Outer surface guide |
|                  | KTV 162022 EG         | 12.7                | 16                        | 20             | 22             | 11 400                                 | 15 700                                             | Inner surface guide |
| 18               | KTV 182223.5 EG       | 14.9                | 18                        | 22             | ■23.5          | 13 000                                 | 19 300                                             | Inner surface guide |
|                  | KTV 182321 EG         | 16.4                | 18                        | 23             | 21             | 14 400                                 | 18 900                                             | Inner surface guide |

C  
KT...EG  
KTV...EG

# MACHINED TYPE NEEDLE ROLLER BEARINGS

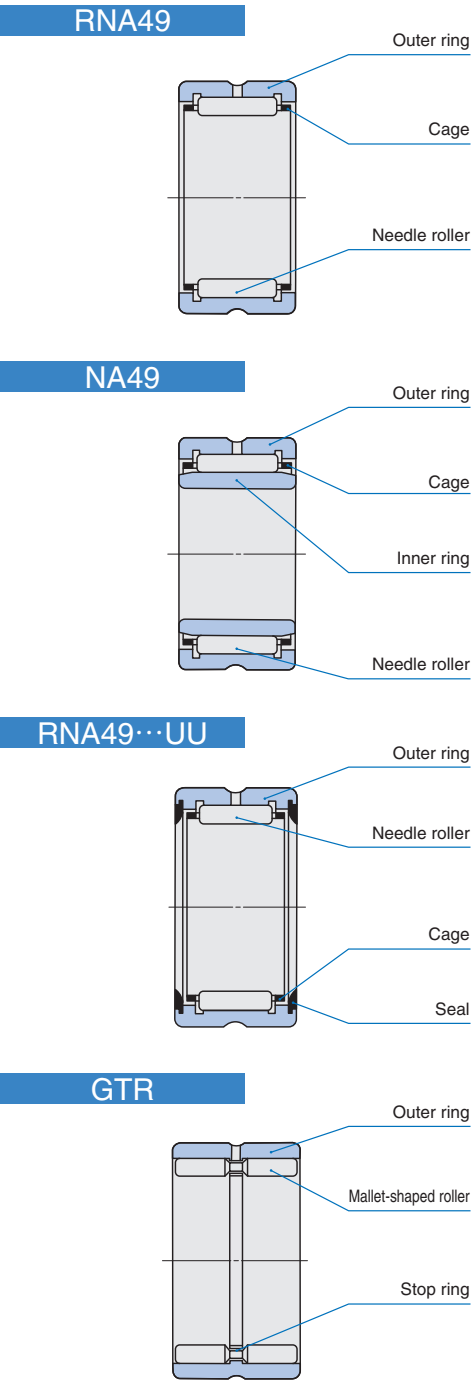
- Machined Type Caged Needle Roller Bearings
- Machined Type Guide Needle Roller Bearings



## Structure and Features

IKO Machined Type Needle Roller Bearings are bearings with a low sectional height and large load ratings. The outer ring has high rigidity and can easily be used even for light alloy housings. These bearings are available in metric series and inch series, both of which have the caged type and the full complement type. It is therefore possible to select a suitable bearing for use under various conditions such as heavy loads and high-speed or low-speed rotations. In addition, there are bearings with and without an inner ring. As the type without inner ring uses a shaft as the raceway surface, a compact design is possible.

### Structures of Machined Type Needle Roller Bearings



Types

Machined Type Needle Roller Bearings are available in various types shown in Table 1.

Table 1.1 Type of bearing (Standard type)

| Type          |                     | Caged Needle Roller Bearings |                 | Guide Needle Roller Bearings |                 |
|---------------|---------------------|------------------------------|-----------------|------------------------------|-----------------|
|               |                     | Without inner ring           | With inner ring | Without inner ring           | With inner ring |
| Metric series | Dimension series 49 | RNA 49                       | NA 49           | GTR                          | GTRI            |
|               | Dimension series 69 | RNA 69                       | NA 69           |                              |                 |
|               | Dimension series 48 | RNA 48                       | NA 48           |                              |                 |
|               | For heavy duty      | TR                           | TRI             |                              |                 |
|               | For light duty      | TAF                          | TAFI            |                              |                 |
| Inch series   |                     | BR                           | BRI             | —                            | —               |

Table 1.2 Type of bearing (With seal)

| Type          |                     | Caged Needle Roller Bearings |                 | Guide Needle Roller Bearings |                 |
|---------------|---------------------|------------------------------|-----------------|------------------------------|-----------------|
|               |                     | Without inner ring           | With inner ring | Without inner ring           | With inner ring |
| Metric series | Dimension series 49 | Two side seals RNA 49···UU   | NA 49···UU      | —                            | —               |
|               | One side seal       | RNA 49···U                   | NA 49···U       |                              |                 |
|               | Dimension series 69 | Two side seals RNA 69···UU   | NA 69···UU      |                              |                 |
|               | One side seal       | RNA 69···U                   | NA 69···U       |                              |                 |
| Inch series   | Two side seals      | BR ···UU                     | BRI ···UU       | —                            | —               |
|               | One side seal       | —                            | —               | —                            | —               |

Caged Needle Roller Bearings

This type of bearing combines a collared outer ring with the IKO's unique lightweight rigid cage and needle rollers. During operation, needle rollers are guided precisely by the cage, and an ideal load distribution is obtained.

The metric series consists of the NA48 and NA49 series of ISO Standard, NA69 and TAFI series which are based on the international dimension series, and the heavy duty TRI series which is widely used in Japan. The TAFI series has a sectional height as low as that of the shell type and is used for light loads.

The inch series or BRI series is based on the specifications of ANSI Standard of USA.

**Caged Needle Roller Bearings without Inner Ring**

As shown in the section "Design of shaft and housing" on page A44, any desired radial clearance can be selected by assembling this type of bearing with a shaft which is heat-treated and finished by grinding.

These bearings are free from the effects on dimensional accuracy caused by assembling an inner ring,

so that the rotational accuracy is improved. Also, the shaft rigidity can be improved as the shaft diameter can be increased by an amount corresponding to the inner ring thickness.

**Caged Needle Roller Bearings with Inner Ring**

This type of bearing is used when the shaft cannot be heat-treated and finished by grinding. The outer and inner rings are separable and a small relief clearance is provided on both sides of the inner ring raceway to facilitate bearing mounting. In the TRI and BRI series, the width of the inner ring is larger than that of the outer ring.

Due to heat expansion during operation or mounting errors, the inner or outer ring may be shifted axially and the whole length of the rollers may not be in contact with the raceway. Therefore, attention should be paid to the allowable axial shift *S* as shown in the table of dimensions.

**Needle Roller Bearings with Seal**

These bearings are sealed types of the NA49, NA69 and BRI series bearings, in which a seal is installed on one side (type with one seal) or both sides (type with two seals) of the bearing. The seal is made of special synthetic rubber and effectively prevents dust penetration and grease leakage.

Guide Needle Roller Bearings

These bearings are full complement type bearings and use mallet-shaped rollers which are guided accurately by the guide rail located at the center of the outer ring raceway and the guide groove of the mallet-shaped roller. This minimizes skewing (tilting of the roller from its rotating axis), which is normally a weak point of full complement bearings, and improves the rotational accuracy. This type of bearing is especially suitable for heavy loads, shock loads and oscillating motions.

Bearings with and without inner rings are available. In bearings with an inner ring, the width of the inner ring is larger than that of the outer ring.

Identification Number

The identification number of Machined Type Needle Roller Bearings consists of a model code, dimensions, any supplemental codes and a classification symbol. Examples are shown below.

Examples of identification number

Example 1

Model code

Dimensions

Supplemental code

Classification symbol

NA 49 05 UU C2 P6

Type of bearing

Dimension series

Bore diameter number

Seal symbol (With seals on both sides)

Clearance symbol (C2 clearance)

Accuracy class (Class 6)

Example 2

Model code

Dimensions

BRI 24 37 16

Type of bearing

Bearing bore diameter (24×<sup>1</sup>/<sub>16</sub>=1½ inches)

Bearing outside diameter (37×<sup>1</sup>/<sub>16</sub>=2<sup>3</sup>/<sub>16</sub> inches)

Outer ring width (16×<sup>1</sup>/<sub>16</sub>=1 inch)

Accuracy

Machined Type Needle Roller Bearings are manufactured based on JIS (See page A31.). The tolerances for the smallest single roller set bore diameter of bearings without inner ring are based on Table 14 on page A33. For BR and BRI series, the accuracy is based on Table 2 and the tolerances for the smallest single roller set bore diameter are based on Table 3.

Table 2 Accuracy of inner and outer rings of inch series BR and BRII

| <i>d</i> or <i>D</i><br>Nominal bearing bore dia.<br>or outside dia.<br>mm |         | $\Delta_{dmp}$<br>Single plane mean<br>bore diameter<br>deviation |      | $\Delta_{Dmp}$<br>Single plane mean<br>outside diameter<br>deviation |      | $\Delta_{Bs}$ ( $\Delta_{Cs}$ )<br>Deviation of a single<br>inner (or outer) ring<br>width |       | $K_{ia}$<br>Radial runout of<br>assembled bearing<br>inner ring | $K_{ea}$<br>Radial runout of<br>assembled bearing<br>outer ring |
|----------------------------------------------------------------------------|---------|-------------------------------------------------------------------|------|----------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------|-----------------------------------------------------------------|
| Over                                                                       | Incl.   | High                                                              | Low  | High                                                                 | Low  | High                                                                                       | Low   | Max.                                                            | Max.                                                            |
| —                                                                          | 19.050  | 0                                                                 | — 10 | —                                                                    | —    | 0                                                                                          | — 130 | 10                                                              | —                                                               |
| 19.050                                                                     | 30.162  | 0                                                                 | — 13 | 0                                                                    | — 13 | 0                                                                                          | — 130 | 13                                                              | 15                                                              |
| 30.162                                                                     | 50.800  | 0                                                                 | — 13 | 0                                                                    | — 13 | 0                                                                                          | — 130 | 15                                                              | 20                                                              |
| 50.800                                                                     | 82.550  | 0                                                                 | — 15 | 0                                                                    | — 15 | 0                                                                                          | — 130 | 20                                                              | 25                                                              |
| 82.550                                                                     | 120.650 | 0                                                                 | — 20 | 0                                                                    | — 20 | 0                                                                                          | — 130 | 25                                                              | 35                                                              |
| 120.650                                                                    | 184.150 | —                                                                 | —    | 0                                                                    | — 25 | 0                                                                                          | — 130 | 30                                                              | 45                                                              |

Remark *d* for  $\Delta_{dmp}$ ,  $\Delta_{Bs}$ ,  $\Delta_{Cs}$  and  $K_{ia}$ , and *D* for  $\Delta_{Dmp}$  and  $K_{ea}$

D3

1N=0.102kgf=0.2248lbs.  
1mm=0.03937inch

D4

Table 3 Tolerances for smallest single roller set bore diameter  $F_{ws\ min}$  of inch series BR unit:  $\mu\ m$

| $F_w$<br>Nominal roller set bore diameter<br>mm |         | $\Delta F_{ws\ min}$<br>Deviation of smallest single roller<br>set bore diameter |      |
|-------------------------------------------------|---------|----------------------------------------------------------------------------------|------|
| Over                                            | Incl.   | High                                                                             | Low  |
| —                                               | 18.034  | + 43                                                                             | + 20 |
| 18.034                                          | 30.226  | + 46                                                                             | + 23 |
| 30.226                                          | 41.910  | + 48                                                                             | + 25 |
| 41.910                                          | 50.038  | + 51                                                                             | + 25 |
| 50.038                                          | 70.104  | + 53                                                                             | + 28 |
| 70.104                                          | 80.010  | + 58                                                                             | + 28 |
| 80.010                                          | 102.108 | + 61                                                                             | + 31 |

Clearance

Radial internal clearances of Machined Type Needle Roller Bearings are made to the CN clearance shown in Table 18 on page A37. Radial internal clearances of BRI series are based on Table 4.

Table 4 Radial internal clearance of inch series BRI unit:  $\mu\ m$

| $F_w$<br>Nominal roller set bore diameter<br>mm |         | Radial internal clearance |      |
|-------------------------------------------------|---------|---------------------------|------|
| Over                                            | Incl.   | Min.                      | Max. |
| —                                               | 18.034  | 33                        | 66   |
| 18.034                                          | 25.908  | 41                        | 76   |
| 25.908                                          | 30.226  | 46                        | 82   |
| 30.226                                          | 35.052  | 48                        | 86   |
| 35.052                                          | 41.910  | 50                        | 89   |
| 41.910                                          | 50.038  | 50                        | 92   |
| 50.038                                          | 70.104  | 56                        | 99   |
| 70.104                                          | 80.010  | 56                        | 104  |
| 80.010                                          | 100.076 | 63                        | 117  |
| 100.076                                         | 102.108 | 68                        | 127  |

Table 6.1 Number of oil holes of the outer ring

| Bearing type                              |               |           | Number of oil holes of the outer ring |                          |                         |
|-------------------------------------------|---------------|-----------|---------------------------------------|--------------------------|-------------------------|
| Nominal roller set bore diameter $F_w$ mm |               |           | Standard type                         | With seals on both sides | With a seal on one side |
| Caged Needle Roller Bearings              | Metric series | RNA, NA   | 1                                     | 1                        | 1                       |
|                                           |               | TR, TRI   | 1                                     | —                        | —                       |
|                                           |               | TAF, TAFI | 0                                     | —                        | —                       |
|                                           | Inch series   | BR, BRI   | 1                                     | 1                        | —                       |
|                                           |               |           | 2                                     | 1                        | —                       |
| Guide Needle Roller Bearings              | Metric series | GTR, GTRI | 1                                     | —                        | —                       |

Remark The type with an oil hole(s) is provided with an oil groove.

Fit

The recommended fits for Machined Type Needle Roller Bearings are shown in Tables 22 to 24 on pages A41 and A42.

Lubrication

Bearings with prepacked grease are shown in Table 5. ALVANIA GREASE S2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease. In the case of bearings without prepacked grease, perform proper lubrication. Operating them without lubrication will increase the wear of the rolling contact surfaces and shorten their lives.

Table 5 Bearings with prepacked grease O : With prepacked grease X : Without prepacked grease

| Bearing type                 |               |                   | Standard type | With seals on both sides | With a seal on one side |
|------------------------------|---------------|-------------------|---------------|--------------------------|-------------------------|
| Caged Needle Roller Bearings | Metric series | RNA, NA           | ×             | ○                        | ×                       |
|                              |               | TR, TRI           | ×             | —                        | —                       |
|                              |               | TAF, TAFI, TAF/SG | ×             | —                        | —                       |
| Guide Needle Roller Bearings | Metric series | BR, BRI           | ×             | ○                        | —                       |
|                              |               | GTR, GTRI         | ×             | —                        | —                       |

Oil Hole

Table 6.1 shows the number of oil holes of the outer ring and Table 6.2 shows the number of oil holes of the inner ring. When an outer ring with an oil hole is especially required for the type without an oil hole, add "—OH" before the clearance symbol in the identification number. When an outer ring with an oil hole and an oil groove is required for the type without an oil hole, attach "—OG" before the clearance symbol. Example: TAFI 203216 — OH C2 P6 When an outer ring with multiple oil holes or an inner ring with an oil hole(s) is required, please consult IKO.

Table 6.2 Number of oil holes of the inner ring

| Bearing type                         |               |      |                 | Number of oil holes of the inner ring |                          |                         |
|--------------------------------------|---------------|------|-----------------|---------------------------------------|--------------------------|-------------------------|
| Nominal bearing bore diameter $d$ mm |               |      |                 | Standard type                         | With seals on both sides | With a seal on one side |
| Caged Needle Roller Bearings         | Metric series | NA   |                 | 0                                     | 0                        | 0                       |
|                                      |               | TRI  |                 | 0                                     | 0                        | 0                       |
|                                      |               | TAFI |                 | 0                                     | —                        | —                       |
|                                      | Inch series   | BRI  | $d \leq 76.200$ | 1                                     | 1                        | —                       |
|                                      |               |      | $76.200 < d$    | 2                                     | 1                        | —                       |
| Guide Needle Roller Bearings         | Metric series | GTRI |                 | 0                                     | —                        | —                       |

Remark The type with an oil hole(s) is provided with an oil groove.

Matched Set Bearings

When using two or more Machined Type Needle Roller Bearings adjacent to each other on the same shaft, it is necessary to obtain an even load distribution. On request, a set of bearings is available, in which bearings are matched to obtain an even load distribution.

Mounting

Mounting dimensions for Machined Type Needle Roller Bearings are shown in the table of dimensions.

Extended Life Specification Machined Type Needle Roller Bearings

Extended Life Specification Machined Type Needle Roller Bearings are treated with a newly developed special heat treatment that enhances the bearing's surface hardness and toughness, and suppresses the generation and growth of damage on the surface. Significant life extension can be achieved under high load or under the condition of lubrication contaminated with foreign substances. In a life comparison test, as shown in Figure 1, IKO's special heat treated Extended Life Specification products lasted 5 times longer than standard heat-treated products. Extended Life Specification Machined Type Needle Roller Bearings, available according to the "Applicable Production Size" shown in Table 7, are made to order upon request.

Table 7 Applicable Production Size

| With inner ring<br>$d=10 \sim 75\text{mm}$ | Without inner ring<br>$F_w=14 \sim 85\text{mm}$ |
|--------------------------------------------|-------------------------------------------------|
| NA 4900 ~ 4915                             | RNA 4900 ~ 4915                                 |
| NA 6901 ~ 6915                             | RNA 6901 ~ 6915                                 |
| TAFI 102216 ~ 7510535                      | TAF 142216 ~ 8510535                            |
| TRI 153320 ~ 7510845                       | TR 203320 ~ 8310845                             |

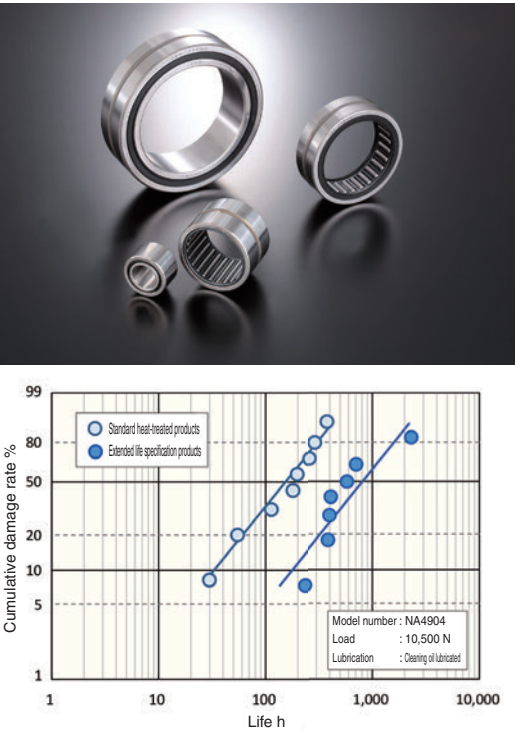


Fig. 1 Life Test Result

Remark This table shows the result of life testing under load conditions at 50% of the basic dynamic rating. The Extended Life Specification with special heat treatment lasted 5 times longer or more in L10 life compared to the standard heat-treated products.

MACHINED TYPE NEEDLE ROLLER BEARINGS

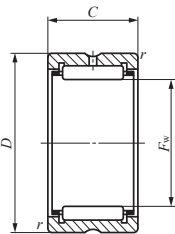
Without Inner Ring



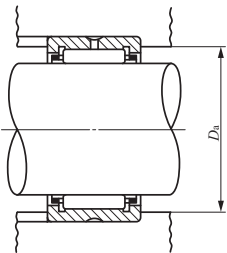
Shaft dia. 5 – 15mm

| Shaft dia.<br>mm | Identification number |        |        |            |    |     | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|--------|--------|------------|----|-----|---------------------|
|                  | RNA 49                | RNA 69 | RNA 48 | TAF        | TR | GTR |                     |
| 5                | —                     | —      | —      | TAF 51010  | —  | —   | 3.4                 |
|                  | —                     | —      | —      | TAF 51012  | —  | —   | 4.2                 |
|                  | RNA 493               | —      | —      | —          | —  | —   | 4.6                 |
| 6                | RNA 494               | —      | —      | —          | —  | —   | 5.3                 |
|                  | —                     | —      | —      | TAF 61212  | —  | —   | 6.4                 |
| 7                | RNA 495               | —      | —      | —          | —  | —   | 5.9                 |
|                  | —                     | —      | —      | TAF 71410  | —  | —   | 6.9                 |
|                  | —                     | —      | —      | TAF 71412  | —  | —   | 8.3                 |
| 8                | RNA 496               | —      | —      | —          | —  | —   | 7.4                 |
|                  | —                     | —      | —      | TAF 81512  | —  | —   | 9.1                 |
|                  | —                     | —      | —      | TAF 81516  | —  | —   | 12.9                |
| 9                | —                     | —      | —      | TAF 91612  | —  | —   | 9.8                 |
|                  | —                     | —      | —      | TAF 91616  | —  | —   | 13.2                |
|                  | RNA 497               | —      | —      | —          | —  | —   | 9.3                 |
| 10               | —                     | —      | —      | TAF 101712 | —  | —   | 10.7                |
|                  | —                     | —      | —      | TAF 101716 | —  | —   | 14.3                |
|                  | RNA 498               | —      | —      | —          | —  | —   | 12.6                |
| 12               | —                     | —      | —      | TAF 121912 | —  | —   | 12.2                |
|                  | —                     | —      | —      | TAF 121916 | —  | —   | 16.3                |
|                  | RNA 499               | —      | —      | —          | —  | —   | 13.6                |
| 14               | RNA 4900              | —      | —      | —          | —  | —   | 16.5                |
|                  | —                     | —      | —      | TAF 142216 | —  | —   | 21                  |
|                  | —                     | —      | —      | TAF 142220 | —  | —   | 26.5                |
| 15               | —                     | —      | —      | TAF 152316 | —  | —   | 22.5                |
|                  | —                     | —      | —      | TAF 152320 | —  | —   | 28                  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. TAF series with a roller set bore diameter  $F_w$  of 26 mm or less have no oil hole. In others, the outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF  
RNA69 ( $F_w \leq 35$ )



| Boundary dimensions mm |     |     |                 | Standard mounting dimension | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|-----|-----|-----------------|-----------------------------|---------------------------|--------------------------|-------------------------------------------|
| $F_w$                  | $D$ | $C$ | $r_s^{(1)}$ min | $D_a$ Max. mm               | $C$ N                     | $C_0$ N                  | min <sup>-1</sup>                         |
| 5                      | 10  | 10  | 0.2             | 8.4                         | 2 420                     | 1 950                    | 80 000                                    |
| 5                      | 10  | 12  | 0.2             | 8.4                         | 3 080                     | 2 660                    | 80 000                                    |
| 5                      | 11  | 10  | 0.15            | 9.8                         | 2 420                     | 1 950                    | 80 000                                    |
| 6                      | 12  | 10  | 0.15            | 10.8                        | 2 700                     | 2 320                    | 70 000                                    |
| 6                      | 12  | 12  | 0.2             | 10.4                        | 3 440                     | 3 170                    | 70 000                                    |
| 7                      | 13  | 10  | 0.15            | 11.8                        | 2 960                     | 2 690                    | 60 000                                    |
| 7                      | 14  | 10  | 0.2             | 12.4                        | 3 600                     | 2 960                    | 60 000                                    |
| 7                      | 14  | 12  | 0.2             | 12.4                        | 4 610                     | 4 050                    | 60 000                                    |
| 8                      | 15  | 10  | 0.15            | 13.8                        | 3 960                     | 3 420                    | 50 000                                    |
| 8                      | 15  | 12  | 0.2             | 13.4                        | 5 060                     | 4 690                    | 50 000                                    |
| 8                      | 15  | 16  | 0.2             | 13.4                        | 7 080                     | 7 220                    | 50 000                                    |
| 9                      | 16  | 12  | 0.2             | 14.4                        | 5 490                     | 5 330                    | 45 000                                    |
| 9                      | 16  | 16  | 0.2             | 14.4                        | 7 680                     | 8 210                    | 45 000                                    |
| 9                      | 17  | 10  | 0.15            | 15.8                        | 4 530                     | 3 650                    | 45 000                                    |
| 10                     | 17  | 12  | 0.2             | 15.4                        | 5 880                     | 5 970                    | 40 000                                    |
| 10                     | 17  | 16  | 0.2             | 15.4                        | 8 230                     | 9 190                    | 40 000                                    |
| 10                     | 19  | 11  | 0.2             | 17.4                        | 6 180                     | 5 030                    | 40 000                                    |
| 12                     | 19  | 12  | 0.3             | 17                          | 6 610                     | 7 260                    | 35 000                                    |
| 12                     | 19  | 16  | 0.3             | 17                          | 9 250                     | 11 200                   | 35 000                                    |
| 12                     | 20  | 11  | 0.3             | 18                          | 6 600                     | 6 310                    | 35 000                                    |
| 14                     | 22  | 13  | 0.3             | 20                          | 9 230                     | 10 100                   | 30 000                                    |
| 14                     | 22  | 16  | 0.3             | 20                          | 11 700                    | 13 700                   | 30 000                                    |
| 14                     | 22  | 20  | 0.3             | 20                          | 14 800                    | 18 600                   | 30 000                                    |
| 15                     | 23  | 16  | 0.3             | 21                          | 12 300                    | 14 900                   | 30 000                                    |
| 15                     | 23  | 20  | 0.3             | 21                          | 15 600                    | 20 200                   | 30 000                                    |

MACHINED TYPE NEEDLE ROLLER BEARINGS

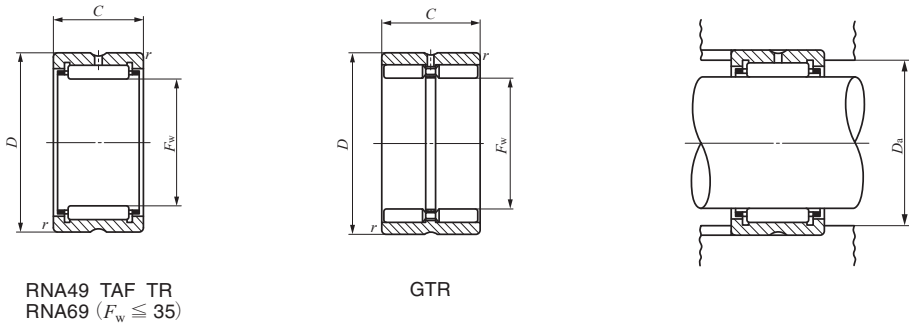
Without Inner Ring



Shaft dia. 16 – 22mm

| Shaft dia.<br>mm | Identification number |          |        |            |           |            | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|----------|--------|------------|-----------|------------|---------------------|
|                  | RNA 49                | RNA 69   | RNA 48 | TAF        | TR        | GTR        |                     |
| 16               | RNA 4901              | —        | —      | —          | —         | —          | 18.1                |
|                  | —                     | —        | —      | TAF 162416 | —         | —          | 23                  |
|                  | —                     | —        | —      | TAF 162420 | —         | —          | 29                  |
|                  | —                     | RNA 6901 | —      | —          | —         | —          | 30                  |
| 17               | —                     | —        | —      | TAF 172516 | —         | —          | 24.5                |
|                  | —                     | —        | —      | TAF 172520 | —         | —          | 30.5                |
| 18               | RNA 49/14             | —        | —      | —          | —         | —          | 19.9                |
|                  | —                     | —        | —      | TAF 182616 | —         | —          | 25.5                |
|                  | —                     | —        | —      | TAF 182620 | —         | —          | 32                  |
| 19               | —                     | —        | —      | TAF 192716 | —         | —          | 27                  |
|                  | —                     | —        | —      | TAF 192720 | —         | —          | 34                  |
| 20               | RNA 4902              | —        | —      | —          | —         | —          | 21.5                |
|                  | —                     | —        | —      | TAF 202816 | —         | —          | 27.5                |
|                  | —                     | —        | —      | TAF 202820 | —         | —          | 35.5                |
|                  | —                     | RNA 6902 | —      | —          | —         | —          | 37                  |
|                  | —                     | —        | —      | —          | TR 203320 | —          | 59.5                |
|                  | —                     | —        | —      | —          | —         | GTR 203320 | 69                  |
| 21               | —                     | —        | —      | TAF 212916 | —         | —          | 29                  |
|                  | —                     | —        | —      | TAF 212920 | —         | —          | 36                  |
| 22               | RNA 4903              | —        | —      | —          | —         | —          | 23.5                |
|                  | —                     | —        | —      | TAF 223016 | —         | —          | 30                  |
|                  | —                     | —        | —      | TAF 223020 | —         | —          | 37.5                |
|                  | —                     | RNA 6903 | —      | —          | —         | —          | 40.5                |
|                  | —                     | —        | —      | —          | TR 223425 | —          | 73.5                |
|                  | —                     | —        | —      | —          | —         | GTR 223425 | 87                  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. TAF series with a roller set bore diameter  $F_w$  of 26 mm or less have no oil hole. In others, the outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR  
RNA69 ( $F_w \leq 35$ )

GTR

| Boundary dimensions mm |     |     |                 | Standard mounting dimension | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|-----|-----|-----------------|-----------------------------|---------------------------|--------------------------|-------------------------------------------|
| $F_w$                  | $D$ | $C$ | $r_s^{(1)}$ min | $D_a$ Max. mm               | $C$ N                     | $C_0$ N                  | min <sup>-1</sup>                         |
| 16                     | 24  | 13  | 0.3             | 22                          | 9 660                     | 11 100                   | 25 000                                    |
| 16                     | 24  | 16  | 0.3             | 22                          | 12 300                    | 15 100                   | 25 000                                    |
| 16                     | 24  | 20  | 0.3             | 22                          | 15 500                    | 20 400                   | 25 000                                    |
| 16                     | 24  | 22  | 0.3             | 22                          | 17 100                    | 23 000                   | 25 000                                    |
| 17                     | 25  | 16  | 0.3             | 23                          | 12 900                    | 16 300                   | 25 000                                    |
| 17                     | 25  | 20  | 0.3             | 23                          | 16 300                    | 22 000                   | 25 000                                    |
| 18                     | 26  | 13  | 0.3             | 24                          | 10 600                    | 12 800                   | 20 000                                    |
| 18                     | 26  | 16  | 0.3             | 24                          | 13 400                    | 17 500                   | 20 000                                    |
| 18                     | 26  | 20  | 0.3             | 24                          | 17 000                    | 23 600                   | 20 000                                    |
| 19                     | 27  | 16  | 0.3             | 25                          | 14 000                    | 18 700                   | 20 000                                    |
| 19                     | 27  | 20  | 0.3             | 25                          | 17 700                    | 25 300                   | 20 000                                    |
| 20                     | 28  | 13  | 0.3             | 26                          | 10 900                    | 13 800                   | 20 000                                    |
| 20                     | 28  | 16  | 0.3             | 26                          | 13 900                    | 18 800                   | 20 000                                    |
| 20                     | 28  | 20  | 0.3             | 26                          | 17 600                    | 25 400                   | 20 000                                    |
| 20                     | 28  | 23  | 0.3             | 26                          | 19 300                    | 28 800                   | 20 000                                    |
| 20                     | 33  | 20  | 0.3             | 31                          | 24 300                    | 26 500                   | 20 000                                    |
| 20                     | 33  | 20  | 0.3             | 31                          | 29 200                    | 37 200                   | 7 500                                     |
| 21                     | 29  | 16  | 0.3             | 27                          | 14 400                    | 20 000                   | 19 000                                    |
| 21                     | 29  | 20  | 0.3             | 27                          | 18 200                    | 27 100                   | 19 000                                    |
| 22                     | 30  | 13  | 0.3             | 28                          | 11 700                    | 15 600                   | 18 000                                    |
| 22                     | 30  | 16  | 0.3             | 28                          | 14 900                    | 21 200                   | 18 000                                    |
| 22                     | 30  | 20  | 0.3             | 28                          | 18 900                    | 28 700                   | 18 000                                    |
| 22                     | 30  | 23  | 0.3             | 28                          | 20 800                    | 32 500                   | 18 000                                    |
| 22                     | 34  | 25  | 0.3             | 32                          | 29 100                    | 36 800                   | 18 000                                    |
| 22                     | 34  | 25  | 0.3             | 32                          | 37 900                    | 57 800                   | 7 000                                     |

MACHINED TYPE NEEDLE ROLLER BEARINGS

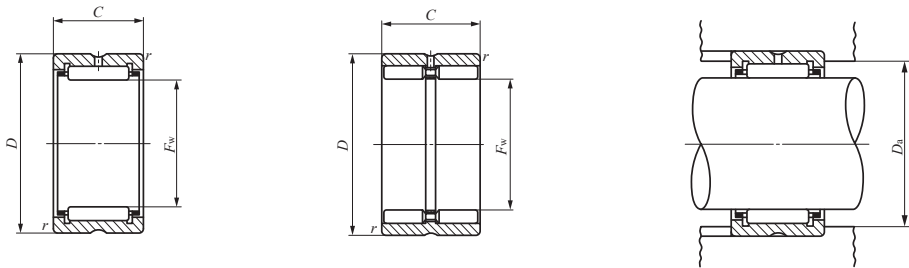
Without Inner Ring



Shaft dia. 24 – 30mm

| Shaft dia.<br>mm | Identification number |           |        |            |           |            | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|-----------|--------|------------|-----------|------------|---------------------|
|                  | RNA 49                | RNA 69    | RNA 48 | TAF        | TR        | GTR        |                     |
| 24               | —                     | —         | —      | TAF 243216 | —         | —          | 32                  |
|                  | —                     | —         | —      | TAF 243220 | —         | —          | 40.5                |
| 25               | —                     | —         | —      | TAF 253316 | —         | —          | 33.5                |
|                  | —                     | —         | —      | TAF 253320 | —         | —          | 42                  |
|                  | RNA 4904              | —         | —      | —          | —         | —          | 55.5                |
|                  | —                     | RNA 6904  | —      | —          | —         | —          | 95.5                |
|                  | —                     | —         | —      | —          | TR 253820 | —          | 71                  |
|                  | —                     | —         | —      | —          | TR 253825 | —          | 89                  |
|                  | —                     | —         | —      | —          | —         | GTR 253820 | 81.5                |
|                  | —                     | —         | —      | —          | —         | GTR 253825 | 104                 |
| 26               | —                     | —         | —      | TAF 263416 | —         | —          | 34.5                |
|                  | —                     | —         | —      | TAF 263420 | —         | —          | 43.5                |
| 28               | —                     | —         | —      | TAF 283720 | —         | —          | 51.5                |
|                  | —                     | —         | —      | TAF 283730 | —         | —          | 83.5                |
|                  | RNA 49/22             | —         | —      | —          | —         | —          | 56.5                |
|                  | —                     | RNA 69/22 | —      | —          | —         | —          | 97.5                |
| 29               | —                     | —         | —      | TAF 293820 | —         | —          | 57                  |
|                  | —                     | —         | —      | TAF 293830 | —         | —          | 85                  |
| 30               | —                     | —         | —      | TAF 304020 | —         | —          | 64.5                |
|                  | —                     | —         | —      | TAF 304030 | —         | —          | 97.5                |
|                  | RNA 4905              | —         | —      | —          | —         | —          | 64                  |
|                  | —                     | RNA 6905  | —      | —          | —         | —          | 111                 |
|                  | —                     | —         | —      | —          | TR 304425 | —          | 115                 |
|                  | —                     | —         | —      | —          | —         | GTR 304425 | 133                 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. TAF series with a roller set bore diameter  $F_w$  of 26 mm or less have no oil hole. In others, the outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR  
RNA69 ( $F_w \leq 35$ )

GTR

| Boundary dimensions mm |     |     |                 | Standard mounting dimension | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|-----|-----|-----------------|-----------------------------|---------------------------|--------------------------|-------------------------------------------|
| $F_w$                  | $D$ | $C$ | $r_s^{(1)}$ min | $D_a$ Max. mm               | $C$ N                     | $C_0$ N                  | min <sup>-1</sup>                         |
| 24                     | 32  | 16  | 0.3             | 30                          | 15 300                    | 22 500                   | 17 000                                    |
| 24                     | 32  | 20  | 0.3             | 30                          | 19 400                    | 30 500                   | 17 000                                    |
| 25                     | 33  | 16  | 0.3             | 31                          | 15 800                    | 23 700                   | 16 000                                    |
| 25                     | 33  | 20  | 0.3             | 31                          | 20 000                    | 32 100                   | 16 000                                    |
| 25                     | 37  | 17  | 0.3             | 35                          | 21 000                    | 25 000                   | 16 000                                    |
| 25                     | 37  | 30  | 0.3             | 35                          | 35 400                    | 48 900                   | 16 000                                    |
| 25                     | 38  | 20  | 0.3             | 36                          | 28 900                    | 35 000                   | 16 000                                    |
| 25                     | 38  | 25  | 0.3             | 36                          | 34 800                    | 44 400                   | 16 000                                    |
| 25                     | 38  | 20  | 0.3             | 36                          | 33 300                    | 46 500                   | 6 000                                     |
| 25                     | 38  | 25  | 0.3             | 36                          | 42 400                    | 63 700                   | 6 000                                     |
| 26                     | 34  | 16  | 0.3             | 32                          | 16 300                    | 24 900                   | 15 000                                    |
| 26                     | 34  | 20  | 0.3             | 32                          | 20 600                    | 33 800                   | 15 000                                    |
| 28                     | 37  | 20  | 0.3             | 35                          | 21 700                    | 37 100                   | 14 000                                    |
| 28                     | 37  | 30  | 0.3             | 35                          | 31 100                    | 58 900                   | 14 000                                    |
| 28                     | 39  | 17  | 0.3             | 37                          | 21 400                    | 28 900                   | 14 000                                    |
| 28                     | 39  | 30  | 0.3             | 37                          | 36 300                    | 56 900                   | 14 000                                    |
| 29                     | 38  | 20  | 0.3             | 36                          | 21 600                    | 37 200                   | 14 000                                    |
| 29                     | 38  | 30  | 0.3             | 36                          | 30 900                    | 59 100                   | 14 000                                    |
| 30                     | 40  | 20  | 0.3             | 38                          | 25 100                    | 40 100                   | 13 000                                    |
| 30                     | 40  | 30  | 0.3             | 38                          | 36 000                    | 63 900                   | 13 000                                    |
| 30                     | 42  | 17  | 0.3             | 40                          | 23 700                    | 30 700                   | 13 000                                    |
| 30                     | 42  | 30  | 0.3             | 40                          | 42 100                    | 64 300                   | 13 000                                    |
| 30                     | 44  | 25  | 0.3             | 42                          | 37 900                    | 52 100                   | 13 000                                    |
| 30                     | 44  | 25  | 0.3             | 42                          | 47 000                    | 76 500                   | 5 000                                     |

MACHINED TYPE NEEDLE ROLLER BEARINGS

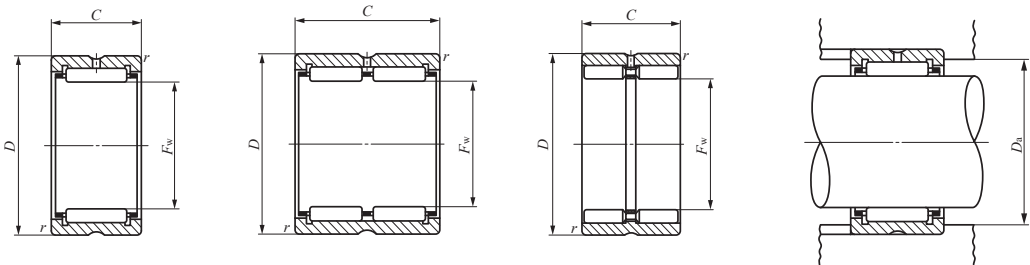
Without Inner Ring



Shaft dia. 32 – 40mm

| Shaft dia.<br>mm | Identification number |           |        |            |           |            | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|-----------|--------|------------|-----------|------------|---------------------|
|                  | RNA 49                | RNA 69    | RNA 48 | TAF        | TR        | GTR        |                     |
| 32               | —                     | —         | —      | TAF 324220 | —         | —          | 68                  |
|                  | —                     | —         | —      | TAF 324230 | —         | —          | 102                 |
|                  | RNA 49/28             | —         | —      | —          | —         | —          | 76.5                |
|                  | —                     | RNA 69/28 | —      | —          | —         | —          | 133                 |
|                  | —                     | —         | —      | —          | —         | GTR 324530 | 152                 |
| 35               | —                     | —         | —      | TAF 354520 | —         | —          | 73.5                |
|                  | —                     | —         | —      | TAF 354530 | —         | —          | 112                 |
|                  | RNA 4906              | —         | —      | —          | —         | —          | 72.5                |
|                  | —                     | RNA 6906  | —      | —          | —         | —          | 125                 |
|                  | —                     | —         | —      | —          | TR 354830 | —          | 139                 |
| 37               | —                     | —         | —      | —          | —         | GTR 354830 | 163                 |
|                  | —                     | —         | —      | TAF 374720 | —         | —          | 77.5                |
|                  | —                     | —         | —      | TAF 374730 | —         | —          | 117                 |
|                  | —                     | —         | —      | TAF 384820 | —         | —          | 79                  |
|                  | —                     | —         | —      | TAF 384830 | —         | —          | 119                 |
| 38               | —                     | —         | —      | —          | TR 385230 | —          | 168                 |
|                  | —                     | —         | —      | —          | —         | GTR 385230 | 195                 |
| 40               | —                     | —         | —      | TAF 405020 | —         | —          | 83                  |
|                  | —                     | —         | —      | TAF 405030 | —         | —          | 125                 |
|                  | RNA 49/32             | —         | —      | —          | —         | —          | 96                  |
|                  | —                     | RNA 69/32 | —      | —          | —         | —          | 172                 |
|                  | —                     | —         | —      | —          | TR 405520 | —          | 129                 |
|                  | —                     | —         | —      | —          | —         | GTR 405520 | 144                 |
|                  | —                     | —         | —      | —          | —         | —          | —                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR  
RNA69 (*F<sub>w</sub>* ≤ 35)

RNA69

GTR

| Boundary dimensions  |          |          |                          | mm             | Standard mounting dimension     | Basic dynamic load rating | Basic static load rating  | Allowable rotational speed <sup>(2)</sup> |
|----------------------|----------|----------|--------------------------|----------------|---------------------------------|---------------------------|---------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i> | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> min | <sup>(1)</sup> | <i>D<sub>a</sub></i><br>Max. mm | <i>C</i><br>N             | <i>C<sub>0</sub></i><br>N | min <sup>-1</sup>                         |
| 32                   | 42       | 20       | 0.3                      |                | 40                              | 25 700                    | 42 200                    | 12 000                                    |
| 32                   | 42       | 30       | 0.3                      |                | 40                              | 36 800                    | 67 200                    | 12 000                                    |
| 32                   | 45       | 17       | 0.3                      |                | 43                              | 24 500                    | 32 700                    | 12 000                                    |
| 32                   | 45       | 30       | 0.3                      |                | 43                              | 41 800                    | 64 800                    | 12 000                                    |
| 32                   | 45       | 30       | 0.3                      |                | 43                              | 58 000                    | 101 000                   | 4 500                                     |
| 35                   | 45       | 20       | 0.3                      |                | 43                              | 26 900                    | 46 200                    | 11 000                                    |
| 35                   | 45       | 30       | 0.3                      |                | 43                              | 38 600                    | 73 600                    | 11 000                                    |
| 35                   | 47       | 17       | 0.3                      |                | 45                              | 25 200                    | 34 700                    | 11 000                                    |
| 35                   | 47       | 30       | 0.3                      |                | 45                              | 43 000                    | 69 000                    | 11 000                                    |
| 35                   | 48       | 30       | 0.3                      |                | 46                              | 47 400                    | 72 300                    | 11 000                                    |
| 35                   | 48       | 30       | 0.3                      |                | 46                              | 61 100                    | 110 000                   | 4 500                                     |
| 37                   | 47       | 20       | 0.3                      |                | 45                              | 28 200                    | 50 100                    | 11 000                                    |
| 37                   | 47       | 30       | 0.3                      |                | 45                              | 40 500                    | 79 800                    | 11 000                                    |
| 38                   | 48       | 20       | 0.3                      |                | 46                              | 28 100                    | 50 200                    | 11 000                                    |
| 38                   | 48       | 30       | 0.3                      |                | 46                              | 40 300                    | 80 000                    | 11 000                                    |
| 38                   | 52       | 30       | 0.6                      |                | 48                              | 50 800                    | 81 100                    | 11 000                                    |
| 38                   | 52       | 30       | 0.6                      |                | 48                              | 64 200                    | 121 000                   | 4 000                                     |
| 40                   | 50       | 20       | 0.3                      |                | 48                              | 29 400                    | 54 100                    | 10 000                                    |
| 40                   | 50       | 30       | 0.3                      |                | 48                              | 42 300                    | 86 200                    | 10 000                                    |
| 40                   | 52       | 20       | 0.6                      |                | 48                              | 31 200                    | 47 800                    | 10 000                                    |
| 40                   | 52       | 36       | 0.6                      |                | 48                              | 53 500                    | 95 700                    | 10 000                                    |
| 40                   | 55       | 20       | 0.6                      |                | 51                              | 37 400                    | 55 700                    | 10 000                                    |
| 40                   | 55       | 20       | 0.6                      |                | 51                              | 44 300                    | 73 600                    | 3 500                                     |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

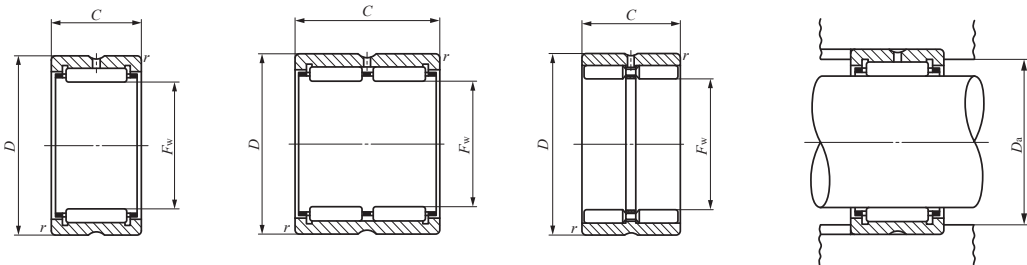
Without Inner Ring



Shaft dia. 42 – 50mm

| Shaft dia.<br>mm | Identification number |          |        |            |           |            | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|----------|--------|------------|-----------|------------|---------------------|
|                  | RNA 49                | RNA 69   | RNA 48 | TAF        | TR        | GTR        |                     |
| 42               | —                     | —        | —      | TAF 425220 | —         | —          | 86.5                |
|                  | —                     | —        | —      | TAF 425230 | —         | —          | 130                 |
|                  | RNA 4907              | —        | —      | —          | —         | —          | 113                 |
|                  | —                     | RNA 6907 | —      | —          | —         | —          | 200                 |
|                  | —                     | —        | —      | —          | TR 425630 | —          | 183                 |
|                  | —                     | —        | —      | —          | —         | GTR 425630 | 210                 |
| 43               | —                     | —        | —      | TAF 435320 | —         | —          | 88.5                |
|                  | —                     | —        | —      | TAF 435330 | —         | —          | 133                 |
| 45               | —                     | —        | —      | TAF 455520 | —         | —          | 92                  |
|                  | —                     | —        | —      | TAF 455530 | —         | —          | 138                 |
|                  | RNA 49/38             | —        | —      | —          | —         | —          | 120                 |
|                  | —                     | —        | —      | —          | TR 455930 | —          | 193                 |
|                  | —                     | —        | —      | —          | —         | GTR 455930 | 225                 |
|                  | —                     | —        | —      | —          | —         | —          | —                   |
| 47               | —                     | —        | —      | TAF 475720 | —         | —          | 95                  |
|                  | —                     | —        | —      | TAF 475730 | —         | —          | 144                 |
| 48               | RNA 4908              | —        | —      | —          | —         | —          | 152                 |
|                  | —                     | —        | —      | —          | TR 486230 | —          | 205                 |
|                  | —                     | RNA 6908 | —      | —          | —         | —          | 275                 |
|                  | —                     | —        | —      | —          | —         | GTR 486230 | 240                 |
|                  | —                     | —        | —      | —          | —         | —          | —                   |
|                  | —                     | —        | —      | —          | —         | —          | —                   |
| 50               | —                     | —        | —      | TAF 506225 | —         | —          | 159                 |
|                  | —                     | —        | —      | TAF 506235 | —         | —          | 225                 |
|                  | —                     | —        | —      | —          | TR 506430 | —          | 210                 |
|                  | RNA 49/42             | —        | —      | —          | —         | —          | 174                 |
|                  | —                     | —        | —      | —          | —         | GTR 506430 | 245                 |
|                  | —                     | —        | —      | —          | —         | —          | —                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR

RNA69

GTR

| Boundary dimensions mm |     |     |                 | Standard mounting dimension | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|-----|-----|-----------------|-----------------------------|---------------------------|--------------------------|-------------------------------------------|
| $F_w$                  | $D$ | $C$ | $r_s^{(1)}$ min | $D_a$ Max. mm               | $C$ N                     | $C_0$ N                  | min <sup>-1</sup>                         |
| 42                     | 52  | 20  | 0.3             | 50                          | 29 900                    | 56 200                   | 9 500                                     |
| 42                     | 52  | 30  | 0.3             | 50                          | 43 000                    | 89 400                   | 9 500                                     |
| 42                     | 55  | 20  | 0.6             | 51                          | 32 000                    | 50 100                   | 9 500                                     |
| 42                     | 55  | 36  | 0.6             | 51                          | 54 900                    | 100 000                  | 9 500                                     |
| 42                     | 56  | 30  | 0.6             | 52                          | 53 800                    | 90 100                   | 9 500                                     |
| 42                     | 56  | 30  | 0.6             | 52                          | 67 500                    | 133 000                  | 3 500                                     |
| 43                     | 53  | 20  | 0.3             | 51                          | 30 500                    | 58 200                   | 9 500                                     |
| 43                     | 53  | 30  | 0.3             | 51                          | 43 800                    | 92 600                   | 9 500                                     |
| 45                     | 55  | 20  | 0.3             | 53                          | 31 000                    | 60 200                   | 9 000                                     |
| 45                     | 55  | 30  | 0.3             | 53                          | 44 600                    | 95 800                   | 9 000                                     |
| 45                     | 58  | 20  | 0.6             | 54                          | 33 600                    | 54 600                   | 9 000                                     |
| 45                     | 59  | 30  | 0.6             | 55                          | 55 100                    | 94 800                   | 9 000                                     |
| 45                     | 59  | 30  | 0.6             | 55                          | 70 300                    | 142 000                  | 3 500                                     |
| 47                     | 57  | 20  | 0.3             | 55                          | 31 500                    | 62 200                   | 8 500                                     |
| 47                     | 57  | 30  | 0.3             | 55                          | 45 200                    | 99 100                   | 8 500                                     |
| 48                     | 62  | 22  | 0.6             | 58                          | 41 600                    | 67 400                   | 8 500                                     |
| 48                     | 62  | 30  | 0.6             | 58                          | 56 300                    | 99 500                   | 8 500                                     |
| 48                     | 62  | 40  | 0.6             | 58                          | 71 300                    | 135 000                  | 8 500                                     |
| 48                     | 62  | 30  | 0.6             | 58                          | 72 700                    | 154 000                  | 3 000                                     |
| 50                     | 62  | 25  | 0.3             | 60                          | 43 000                    | 85 300                   | 8 000                                     |
| 50                     | 62  | 35  | 0.3             | 60                          | 58 000                    | 125 000                  | 8 000                                     |
| 50                     | 64  | 30  | 0.6             | 60                          | 57 700                    | 104 000                  | 8 000                                     |
| 50                     | 65  | 22  | 0.6             | 61                          | 42 500                    | 70 300                   | 8 000                                     |
| 50                     | 64  | 30  | 0.6             | 60                          | 74 600                    | 158 000                  | 3 000                                     |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

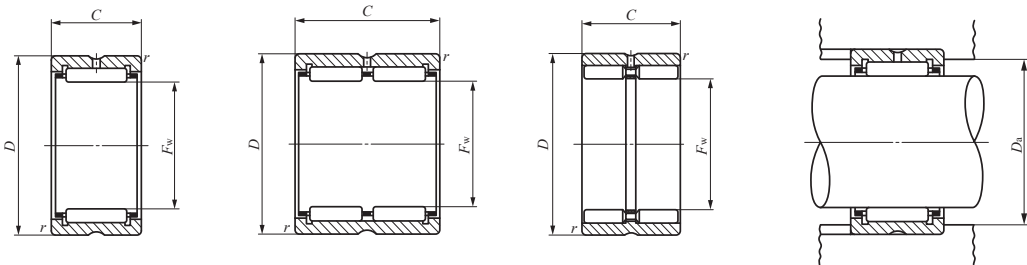
Without Inner Ring



Shaft dia. 52 – 68mm

| Shaft dia.<br>mm | Identification number |          |        |            |           |            | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|----------|--------|------------|-----------|------------|---------------------|
|                  | RNA 49                | RNA 69   | RNA 48 | TAF        | TR        | GTR        |                     |
| 52               | RNA 4909              | —        | —      | —          | —         | —          | 197                 |
|                  | —                     | RNA 6909 | —      | —          | —         | —          | 355                 |
| 55               | —                     | —        | —      | TAF 556825 | —         | —          | 193                 |
|                  | —                     | —        | —      | TAF 556835 | —         | —          | 255                 |
|                  | RNA 49/48             | —        | —      | —          | —         | —          | 188                 |
| 58               | RNA 4910              | —        | —      | —          | —         | —          | 179                 |
|                  | —                     | RNA 6910 | —      | —          | —         | —          | 320                 |
|                  | —                     | —        | —      | —          | TR 587745 | —          | 515                 |
| 60               | —                     | —        | —      | TAF 607225 | —         | —          | 187                 |
|                  | —                     | —        | —      | TAF 607235 | —         | —          | 260                 |
|                  | RNA 49/52             | —        | —      | —          | —         | —          | 205                 |
| 62               | —                     | —        | —      | —          | TR 628138 | —          | 460                 |
|                  | —                     | —        | —      | —          | —         | GTR 628138 | 520                 |
| 63               | RNA 4911              | —        | —      | —          | —         | —          | 265                 |
|                  | —                     | RNA 6911 | —      | —          | —         | —          | 475                 |
| 65               | —                     | —        | —      | TAF 657825 | —         | —          | 225                 |
|                  | —                     | —        | —      | TAF 657835 | —         | —          | 315                 |
|                  | RNA 49/58             | —        | —      | —          | —         | —          | 275                 |
| 68               | —                     | —        | —      | TAF 688225 | —         | —          | 250                 |
|                  | —                     | —        | —      | TAF 688235 | —         | —          | 350                 |
|                  | RNA 4912              | —        | —      | —          | —         | —          | 285                 |
|                  | —                     | RNA 6912 | —      | —          | —         | —          | 510                 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR

RNA69

GTR

| Boundary dimensions  |          |          |                          | mm             | Standard mounting dimension  | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|----------------------|----------|----------|--------------------------|----------------|------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i> | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> min | <sup>(1)</sup> | <i>D<sub>a</sub></i> Max. mm | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 52                   | 68       | 22       | 0.6                      |                | 64                           | 43 500                    | 73 300                   | 7 500                                     |
| 52                   | 68       | 40       | 0.6                      |                | 64                           | 74 600                    | 147 000                  | 7 500                                     |
| 55                   | 68       | 25       | 0.3                      |                | 66                           | 45 400                    | 94 000                   | 7 500                                     |
| 55                   | 68       | 35       | 0.3                      |                | 66                           | 61 200                    | 138 000                  | 7 500                                     |
| 55                   | 70       | 22       | 0.6                      |                | 66                           | 44 300                    | 76 300                   | 7 500                                     |
| 58                   | 72       | 22       | 0.6                      |                | 68                           | 46 200                    | 82 100                   | 7 000                                     |
| 58                   | 72       | 40       | 0.6                      |                | 68                           | 79 200                    | 164 000                  | 7 000                                     |
| 58                   | 77       | 45       | 1                        |                | 72                           | 104 000                   | 191 000                  | 7 000                                     |
| 58                   | 77       | 45       | 1                        |                | 72                           | 135 000                   | 280 000                  | 2 500                                     |
| 60                   | 72       | 25       | 0.3                      |                | 70                           | 47 500                    | 103 000                  | 6 500                                     |
| 60                   | 72       | 35       | 0.3                      |                | 70                           | 64 100                    | 151 000                  | 6 500                                     |
| 60                   | 75       | 22       | 0.6                      |                | 71                           | 47 100                    | 85 100                   | 6 500                                     |
| 62                   | 81       | 38       | 1                        |                | 76                           | 92 000                    | 166 000                  | 6 500                                     |
| 62                   | 81       | 38       | 1                        |                | 76                           | 118 000                   | 241 000                  | 2 500                                     |
| 63                   | 80       | 25       | 1                        |                | 75                           | 57 600                    | 97 200                   | 6 500                                     |
| 63                   | 80       | 45       | 1                        |                | 75                           | 98 700                    | 194 000                  | 6 500                                     |
| 65                   | 78       | 25       | 0.6                      |                | 74                           | 49 600                    | 112 000                  | 6 000                                     |
| 65                   | 78       | 35       | 0.6                      |                | 74                           | 67 000                    | 164 000                  | 6 000                                     |
| 65                   | 82       | 25       | 1                        |                | 77                           | 58 900                    | 101 000                  | 6 000                                     |
| 68                   | 82       | 25       | 0.6                      |                | 78                           | 54 800                    | 117 000                  | 6 000                                     |
| 68                   | 82       | 35       | 0.6                      |                | 78                           | 72 000                    | 166 000                  | 6 000                                     |
| 68                   | 85       | 25       | 1                        |                | 80                           | 60 200                    | 105 000                  | 6 000                                     |
| 68                   | 85       | 45       | 1                        |                | 80                           | 103 000                   | 211 000                  | 6 000                                     |

MACHINED TYPE NEEDLE ROLLER BEARINGS

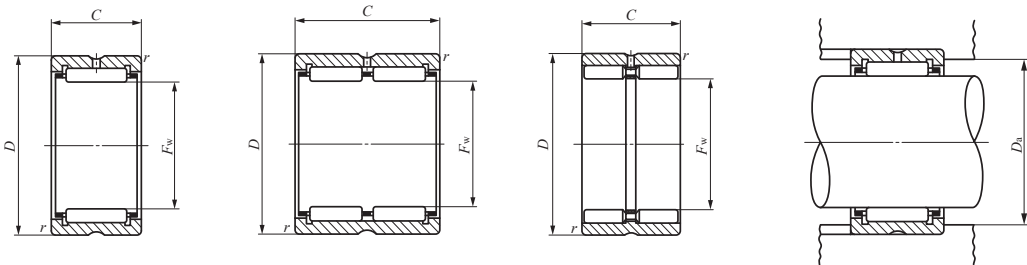
Without Inner Ring



Shaft dia. 70 – 85mm

| Shaft dia.<br>mm | Identification number |          |        |             |            |             | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|----------|--------|-------------|------------|-------------|---------------------|
|                  | RNA 49                | RNA 69   | RNA 48 | TAF         | TR         | GTR         |                     |
| 70               | —                     | —        | —      | TAF 708525  | —          | —           | 280                 |
|                  | —                     | —        | —      | TAF 708535  | —          | —           | 395                 |
|                  | RNA 49/62             | —        | —      | —           | —          | —           | 320                 |
|                  | —                     | —        | —      | —           | TR 708945  | —           | 605                 |
| 72               | —                     | —        | —      | —           | —          | GTR 708945  | 690                 |
|                  | RNA 4913              | RNA 6913 | —      | —           | —          | —           | 325                 |
| 73               | —                     | —        | —      | —           | —          | —           | 585                 |
|                  | —                     | —        | —      | TAF 739025  | —          | —           | 335                 |
| 75               | —                     | —        | —      | TAF 739035  | —          | —           | 475                 |
|                  | —                     | —        | —      | TAF 759225  | —          | —           | 345                 |
|                  | —                     | —        | —      | TAF 759235  | —          | —           | 485                 |
|                  | RNA 49/68             | —        | —      | —           | —          | —           | 470                 |
| 80               | —                     | —        | —      | TAF 809525  | —          | —           | 315                 |
|                  | —                     | —        | —      | TAF 809535  | —          | —           | 445                 |
|                  | RNA 4914              | —        | —      | —           | —          | —           | 495                 |
|                  | —                     | RNA 6914 | —      | —           | —          | —           | 910                 |
| 83               | —                     | —        | —      | —           | TR 8310845 | —           | 995                 |
|                  | —                     | —        | —      | —           | —          | GTR 8310845 | 1 090               |
| 85               | —                     | —        | —      | TAF 8510525 | —          | —           | 435                 |
|                  | RNA 4915              | —        | —      | —           | —          | —           | 525                 |
|                  | —                     | —        | —      | TAF 8510535 | —          | —           | 610                 |
|                  | —                     | RNA 6915 | —      | —           | —          | —           | 960                 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR      RNA69      GTR

| Boundary dimensions mm |          |          |                                         | Standard mounting dimension  | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|-----------------------------------------|------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i>   | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> min <sup>(1)</sup> | <i>D<sub>a</sub></i> Max. mm | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 70                     | 85       | 25       | 0.6                                     | 81                           | 55 500                    | 120 000                  | 5 500                                     |
| 70                     | 85       | 35       | 0.6                                     | 81                           | 73 000                    | 171 000                  | 5 500                                     |
| 70                     | 88       | 25       | 1                                       | 83                           | 61 500                    | 109 000                  | 5 500                                     |
| 70                     | 89       | 45       | 1                                       | 84                           | 114 000                   | 228 000                  | 5 500                                     |
| 70                     | 89       | 45       | 1                                       | 84                           | 147 000                   | 336 000                  | 2 000                                     |
| 72                     | 90       | 25       | 1                                       | 85                           | 62 700                    | 113 000                  | 5 500                                     |
| 72                     | 90       | 45       | 1                                       | 85                           | 108 000                   | 227 000                  | 5 500                                     |
| 73                     | 90       | 25       | 1                                       | 85                           | 61 100                    | 127 000                  | 5 500                                     |
| 73                     | 90       | 35       | 1                                       | 85                           | 80 400                    | 181 000                  | 5 500                                     |
| 75                     | 92       | 25       | 1                                       | 87                           | 62 100                    | 131 000                  | 5 500                                     |
| 75                     | 92       | 35       | 1                                       | 87                           | 81 700                    | 186 000                  | 5 500                                     |
| 75                     | 95       | 30       | 1                                       | 90                           | 79 900                    | 147 000                  | 5 500                                     |
| 80                     | 95       | 25       | 1                                       | 90                           | 59 400                    | 137 000                  | 5 000                                     |
| 80                     | 95       | 35       | 1                                       | 90                           | 78 100                    | 195 000                  | 5 000                                     |
| 80                     | 100      | 30       | 1                                       | 95                           | 83 200                    | 158 000                  | 5 000                                     |
| 80                     | 100      | 54       | 1                                       | 95                           | 134 000                   | 311 000                  | 5 000                                     |
| 83                     | 108      | 45       | 1                                       | 103                          | 146 000                   | 270 000                  | 5 000                                     |
| 83                     | 108      | 45       | 1                                       | 103                          | 190 000                   | 396 000                  | 1 800                                     |
| 85                     | 105      | 25       | 1                                       | 100                          | 76 300                    | 145 000                  | 4 500                                     |
| 85                     | 105      | 30       | 1                                       | 100                          | 86 200                    | 169 000                  | 4 500                                     |
| 85                     | 105      | 35       | 1                                       | 100                          | 102 000                   | 210 000                  | 4 500                                     |
| 85                     | 105      | 54       | 1                                       | 100                          | 138 000                   | 331 000                  | 4 500                                     |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

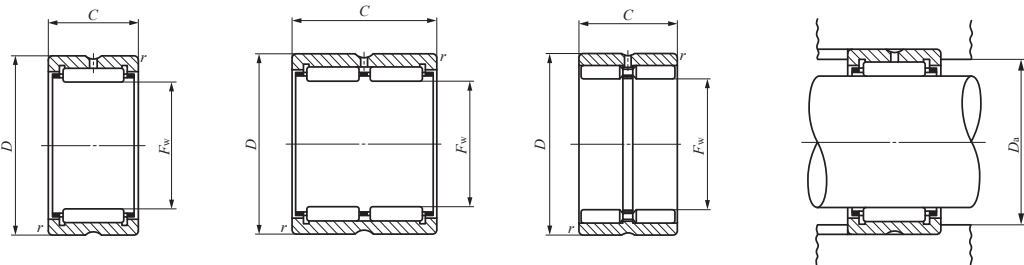
Without Inner Ring



Shaft dia. 90 – 105mm

| Shaft dia.<br>mm | Identification number |          |        |              |             |              | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|----------|--------|--------------|-------------|--------------|---------------------|
|                  | RNA 49                | RNA 69   | RNA 48 | TAF          | TR          | GTR          |                     |
| 90               | —                     | —        | —      | TAF 9011025  | —           | —            | 455                 |
|                  | RNA 4916              | —        | —      | —            | —           | —            | 550                 |
|                  | —                     | —        | —      | TAF 9011035  | —           | —            | 640                 |
|                  | —                     | RNA 6916 | —      | —            | —           | —            | 1 010               |
| 93               | —                     | —        | —      | —            | TR 9311850  | —            | 1 210               |
|                  | —                     | —        | —      | —            | —           | GTR 9311850  | 1 340               |
| 95               | —                     | —        | —      | TAF 9511526  | —           | —            | 495                 |
|                  | RNA 49/82             | —        | —      | —            | —           | —            | 575                 |
|                  | —                     | —        | —      | TAF 9511536  | —           | —            | 690                 |
|                  | —                     | —        | —      | —            | TR 9512045  | —            | 1 120               |
| 100              | —                     | —        | —      | —            | —           | GTR 9512045  | 1 230               |
|                  | —                     | —        | —      | TAF 10012026 | —           | —            | 525                 |
|                  | RNA 4917              | —        | —      | —            | —           | —            | 705                 |
|                  | —                     | —        | —      | TAF 10012036 | —           | —            | 725                 |
| 105              | —                     | —        | —      | —            | TR 10012550 | —            | 1 290               |
|                  | —                     | —        | —      | —            | —           | GTR 10012550 | 1 440               |
|                  | —                     | —        | —      | TAF 10512526 | —           | —            | 545                 |
|                  | RNA 4918              | —        | —      | —            | —           | —            | 740                 |
| 105              | —                     | —        | —      | TAF 10512536 | —           | —            | 760                 |
|                  | —                     | —        | —      | —            | —           | —            | 1 360               |
|                  | —                     | RNA 6918 | —      | —            | —           | —            | 760                 |
|                  | —                     | —        | —      | —            | —           | —            | 1 360               |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 TAF TR      RNA69      GTR

| Boundary dimensions    mm |          |          |                                         | Standard mounting dimension  | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|---------------------------|----------|----------|-----------------------------------------|------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i>      | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> min <sup>(1)</sup> | <i>D<sub>a</sub></i> Max. mm | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 90                        | 110      | 25       | 1                                       | 105                          | 77 300                    | 150 000                  | 4 500                                     |
| 90                        | 110      | 30       | 1                                       | 105                          | 87 300                    | 175 000                  | 4 500                                     |
| 90                        | 110      | 35       | 1                                       | 105                          | 103 000                   | 217 000                  | 4 500                                     |
| 90                        | 110      | 54       | 1                                       | 105                          | 143 000                   | 351 000                  | 4 500                                     |
| 93                        | 118      | 50       | 1                                       | 113                          | 165 000                   | 329 000                  | 4 500                                     |
| 93                        | 118      | 50       | 1                                       | 113                          | 224 000                   | 509 000                  | 1 600                                     |
| 95                        | 115      | 26       | 1                                       | 110                          | 79 700                    | 159 000                  | 4 000                                     |
| 95                        | 115      | 30       | 1                                       | 110                          | 90 000                    | 186 000                  | 4 000                                     |
| 95                        | 115      | 36       | 1                                       | 110                          | 106 000                   | 231 000                  | 4 000                                     |
| 95                        | 120      | 45       | 1.5                                     | 112                          | 155 000                   | 305 000                  | 4 000                                     |
| 95                        | 120      | 45       | 1.5                                     | 112                          | 204 000                   | 455 000                  | 1 600                                     |
| 100                       | 120      | 26       | 1                                       | 115                          | 82 400                    | 168 000                  | 4 000                                     |
| 100                       | 120      | 35       | 1.1                                     | 113.5                        | 110 000                   | 244 000                  | 4 000                                     |
| 100                       | 120      | 36       | 1                                       | 115                          | 110 000                   | 244 000                  | 4 000                                     |
| 100                       | 120      | 63       | 1.1                                     | 113.5                        | 173 000                   | 467 000                  | 4 000                                     |
| 100                       | 125      | 50       | 1.5                                     | 117                          | 172 000                   | 355 000                  | 4 000                                     |
| 100                       | 125      | 50       | 1.5                                     | 117                          | 234 000                   | 549 000                  | 1 500                                     |
| 105                       | 125      | 26       | 1                                       | 120                          | 84 700                    | 178 000                  | 4 000                                     |
| 105                       | 125      | 35       | 1.1                                     | 118.5                        | 113 000                   | 258 000                  | 4 000                                     |
| 105                       | 125      | 36       | 1                                       | 120                          | 113 000                   | 258 000                  | 4 000                                     |
| 105                       | 125      | 63       | 1.1                                     | 118.5                        | 178 000                   | 490 000                  | 4 000                                     |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

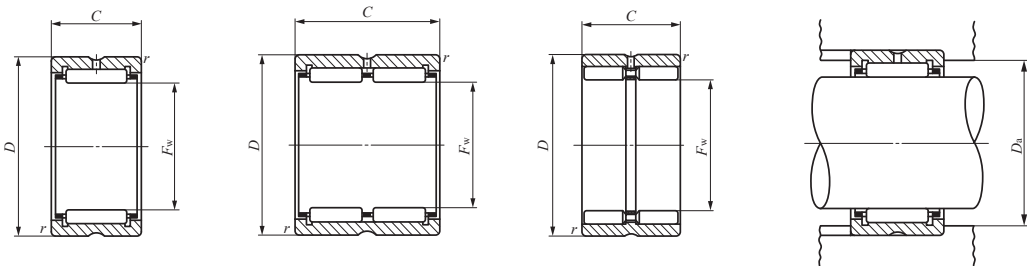
Without Inner Ring



Shaft dia. 110 – 170mm

| Shaft dia.<br>mm | Identification number |                 |                 |                     |                    |                     | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|-----------------|-----------------|---------------------|--------------------|---------------------|---------------------|
|                  | RNA 49                | RNA 69          | RNA 48          | TAF                 | TR                 | GTR                 |                     |
| 110              | —                     | —               | —               | <b>TAF 11013030</b> | —                  | —                   | 660                 |
|                  | <b>RNA 4919</b>       | —               | —               | —                   | —                  | —                   | 770                 |
|                  | —                     | —               | —               | <b>TAF 11013040</b> | —                  | —                   | 880                 |
|                  | —                     | <b>RNA 6919</b> | —               | —                   | —                  | —                   | 1 420               |
|                  | —                     | —               | —               | —                   | <b>TR 11013550</b> | —                   | 1 400               |
| 115              | —                     | —               | —               | —                   | —                  | <b>GTR 11013550</b> | 1 560               |
|                  | <b>RNA 4920</b>       | —               | —               | —                   | —                  | —                   | 1 190               |
|                  | —                     | —               | —               | —                   | <b>TR 11515350</b> | —                   | 2 350               |
| 120              | —                     | —               | <b>RNA 4822</b> | —                   | —                  | —                   | 2 600               |
| 125              | <b>RNA 4922</b>       | —               | —               | —                   | —                  | —                   | 790                 |
| 130              | —                     | —               | <b>RNA 4824</b> | —                   | —                  | —                   | 1 280               |
| 135              | <b>RNA 4924</b>       | —               | —               | —                   | —                  | —                   | 850                 |
| 140              | —                     | —               | —               | —                   | <b>TR 14017860</b> | —                   | 1 930               |
| 145              | —                     | —               | —               | —                   | —                  | <b>GTR 14017860</b> | 3 320               |
| 150              | <b>RNA 4926</b>       | —               | —               | —                   | —                  | —                   | 3 730               |
| 155              | —                     | —               | <b>RNA 4826</b> | —                   | —                  | —                   | 1 100               |
| 160              | —                     | —               | —               | —                   | —                  | —                   | 2 360               |
| 165              | —                     | —               | —               | —                   | <b>TR 15018860</b> | —                   | 3 540               |
| 170              | <b>RNA 4928</b>       | —               | —               | —                   | —                  | <b>GTR 15018860</b> | 3 970               |
| 175              | —                     | —               | <b>RNA 4828</b> | —                   | —                  | —                   | 1 170               |
| 180              | <b>RNA 4930</b>       | —               | —               | —                   | —                  | —                   | 2 500               |
| 185              | —                     | —               | —               | —                   | —                  | —                   | 1 750               |
| 190              | —                     | —               | <b>RNA 4830</b> | —                   | —                  | —                   | 4 090               |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 RNA48  
TAF TR

RNA69

GTR

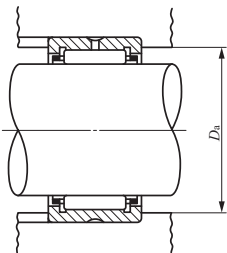
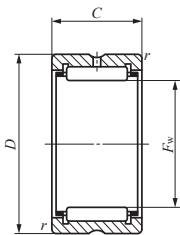
| Boundary dimensions mm |          |          |                                         | Standard mounting dimension  | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|-----------------------------------------|------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i>   | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> min <sup>(1)</sup> | <i>D<sub>a</sub></i> Max. mm | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 110                    | 130      | 30       | 1                                       | 125                          | 106 000                   | 240 000                  | 3 500                                     |
| 110                    | 130      | 35       | 1.1                                     | 123.5                        | 116 000                   | 271 000                  | 3 500                                     |
| 110                    | 130      | 40       | 1                                       | 125                          | 134 000                   | 324 000                  | 3 500                                     |
| 110                    | 130      | 63       | 1.1                                     | 123.5                        | 182 000                   | 514 000                  | 3 500                                     |
| 110                    | 135      | 50       | 1.5                                     | 127                          | 183 000                   | 395 000                  | 3 500                                     |
| 110                    | 135      | 50       | 1.5                                     | 127                          | 245 000                   | 603 000                  | 1 400                                     |
| 115                    | 140      | 40       | 1.1                                     | 133.5                        | 145 000                   | 329 000                  | 3 500                                     |
| 115                    | 153      | 50       | 1.5                                     | 145                          | 233 000                   | 414 000                  | 3 500                                     |
| 115                    | 153      | 50       | 1.5                                     | 145                          | 315 000                   | 614 000                  | 1 300                                     |
| 120                    | 140      | 30       | 1                                       | 135                          | 93 200                    | 239 000                  | 3 500                                     |
| 125                    | 150      | 40       | 1.1                                     | 143.5                        | 152 000                   | 357 000                  | 3 000                                     |
| 130                    | 150      | 30       | 1                                       | 145                          | 96 900                    | 259 000                  | 3 000                                     |
| 135                    | 165      | 45       | 1.1                                     | 158.5                        | 187 000                   | 435 000                  | 3 000                                     |
| 140                    | 178      | 60       | 1.5                                     | 170                          | 307 000                   | 625 000                  | 3 000                                     |
| 140                    | 178      | 60       | 1.5                                     | 170                          | 409 000                   | 923 000                  | 1 100                                     |
| 145                    | 165      | 35       | 1.1                                     | 158.5                        | 116 000                   | 340 000                  | 3 000                                     |
| 150                    | 180      | 50       | 1.5                                     | 172                          | 215 000                   | 540 000                  | 2 500                                     |
| 150                    | 188      | 60       | 1.5                                     | 180                          | 320 000                   | 675 000                  | 2 500                                     |
| 150                    | 188      | 60       | 1.5                                     | 180                          | 423 000                   | 989 000                  | 1 000                                     |
| 155                    | 175      | 35       | 1.1                                     | 168.5                        | 120 000                   | 363 000                  | 2 500                                     |
| 160                    | 190      | 50       | 1.5                                     | 182                          | 224 000                   | 580 000                  | 2 500                                     |
| 165                    | 190      | 40       | 1.1                                     | 183.5                        | 168 000                   | 446 000                  | 2 500                                     |
| 170                    | 210      | 60       | 2                                       | 201                          | 324 000                   | 712 000                  | 2 500                                     |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring



RNA49 RNA48

Shaft dia. 175 – 350mm

| Shaft dia.<br>mm | Identification number |        |          |     |    |     | Mass<br>(Ref.)<br>g |
|------------------|-----------------------|--------|----------|-----|----|-----|---------------------|
|                  | RNA 49                | RNA 69 | RNA 48   | TAF | TR | GTR |                     |
| 175              | —                     | —      | RNA 4832 | —   | —  | —   | 1 850               |
| 180              | RNA 4932              | —      | —        | —   | —  | —   | 4 310               |
| 185              | —                     | —      | RNA 4834 | —   | —  | —   | 2 700               |
| 190              | RNA 4934              | —      | —        | —   | —  | —   | 4 530               |
| 195              | —                     | —      | RNA 4836 | —   | —  | —   | 2 840               |
| 205              | RNA 4936              | —      | —        | —   | —  | —   | 6 250               |
| 210              | —                     | —      | RNA 4838 | —   | —  | —   | 3 380               |
| 215              | RNA 4938              | —      | —        | —   | —  | —   | 6 500               |
| 220              | —                     | —      | RNA 4840 | —   | —  | —   | 3 520               |
| 225              | RNA 4940              | —      | —        | —   | —  | —   | 10 400              |
| 240              | —                     | —      | RNA 4844 | —   | —  | —   | 3 820               |
| 245              | RNA 4944              | —      | —        | —   | —  | —   | 11 200              |
| 265              | —                     | —      | RNA 4848 | —   | —  | —   | 5 670               |
|                  | RNA 4948              | —      | —        | —   | —  | —   | 12 000              |
| 285              | —                     | —      | RNA 4852 | —   | —  | —   | 6 070               |
| 290              | RNA 4952              | —      | —        | —   | —  | —   | 21 200              |
| 305              | —                     | —      | RNA 4856 | —   | —  | —   | 9 750               |
| 310              | RNA 4956              | —      | —        | —   | —  | —   | 22 500              |
| 330              | —                     | —      | RNA 4860 | —   | —  | —   | 13 200              |
| 340              | RNA 4960              | —      | —        | —   | —  | —   | 33 400              |
| 350              | —                     | —      | RNA 4864 | —   | —  | —   | 14 100              |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

| Boundary dimensions mm |          |          |                                         | Standard mounting dimension  | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|-----------------------------------------|------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>F<sub>w</sub></i>   | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> <sup>(1)</sup> min | <i>D<sub>a</sub></i> Max. mm | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 175                    | 200      | 40       | 1.1                                     | 193.5                        | 173 000                   | 474 000                  | 2 500                                     |
| 180                    | 220      | 60       | 2                                       | 211                          | 337 000                   | 761 000                  | 1 900                                     |
| 185                    | 215      | 45       | 1.1                                     | 208.5                        | 211 000                   | 567 000                  | 1 900                                     |
| 190                    | 230      | 60       | 2                                       | 221                          | 347 000                   | 810 000                  | 1 900                                     |
| 195                    | 225      | 45       | 1.1                                     | 218.5                        | 218 000                   | 602 000                  | 1 900                                     |
| 205                    | 250      | 69       | 2                                       | 241                          | 434 000                   | 989 000                  | 1 900                                     |
| 210                    | 240      | 50       | 1.5                                     | 232                          | 249 000                   | 726 000                  | 1 800                                     |
| 215                    | 260      | 69       | 2                                       | 251                          | 440 000                   | 1 020 000                | 1 700                                     |
| 220                    | 250      | 50       | 1.5                                     | 242                          | 255 000                   | 766 000                  | 1 600                                     |
| 225                    | 280      | 80       | 2.1                                     | 269                          | 518 000                   | 1 120 000                | 1 600                                     |
| 240                    | 270      | 50       | 1.5                                     | 262                          | 266 000                   | 833 000                  | 1 500                                     |
| 245                    | 300      | 80       | 2.1                                     | 289                          | 536 000                   | 1 200 000                | 1 400                                     |
| 265                    | 300      | 60       | 2                                       | 291                          | 345 000                   | 1 150 000                | 1 300                                     |
| 265                    | 320      | 80       | 2.1                                     | 309                          | 565 000                   | 1 320 000                | 1 300                                     |
| 285                    | 320      | 60       | 2                                       | 311                          | 354 000                   | 1 220 000                | 1 100                                     |
| 290                    | 360      | 100      | 2.1                                     | 349                          | 847 000                   | 1 900 000                | 1 100                                     |
| 305                    | 350      | 69       | 2                                       | 341                          | 486 000                   | 1 550 000                | 950                                       |
| 310                    | 380      | 100      | 2.1                                     | 369                          | 877 000                   | 2 040 000                | 950                                       |
| 330                    | 380      | 80       | 2.1                                     | 369                          | 610 000                   | 1 900 000                | 900                                       |
| 340                    | 420      | 118      | 3                                       | 407                          | 1 130 000                 | 2 650 000                | 850                                       |
| 350                    | 400      | 80       | 2.1                                     | 389                          | 635 000                   | 2 040 000                | 750                                       |

MACHINED TYPE NEEDLE ROLLER BEARINGS

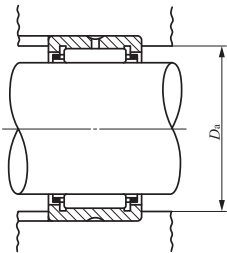
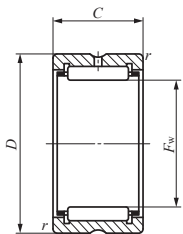
Without Inner Ring



Shaft dia. 360 – 490mm

| Shaft<br>dia.<br>mm | Identification number |        |          |     |    |     | Mass<br>(Ref.)<br>g |
|---------------------|-----------------------|--------|----------|-----|----|-----|---------------------|
|                     | RNA 49                | RNA 69 | RNA 48   | TAF | TR | GTR |                     |
| 360                 | RNA 4964              | —      | —        | —   | —  | —   | 35 200              |
| 370                 | —                     | —      | RNA 4868 | —   | —  | —   | 14 800              |
| 380                 | RNA 4968              | —      | —        | —   | —  | —   | 37 000              |
| 390                 | —                     | —      | RNA 4872 | —   | —  | —   | 15 600              |
| 400                 | RNA 4972              | —      | —        | —   | —  | —   | 38 700              |
| 415                 | —                     | —      | RNA 4876 | —   | —  | —   | 27 900              |
| 430                 | RNA 4976              | —      | —        | —   | —  | —   | 56 400              |
| 450                 | RNA 4980              | —      | —        | —   | —  | —   | 58 800              |
| 470                 | RNA 4984              | —      | —        | —   | —  | —   | 61 200              |
| 490                 | RNA 4988              | —      | —        | —   | —  | —   | 86 900              |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



RNA49 RNA48

| Boundary dimensions mm |          |          |                                            | Standard mounting<br>dimension     | Basic dynamic<br>load rating | Basic static<br>load rating | Allowable<br>rotational<br>speed <sup>(2)</sup> |
|------------------------|----------|----------|--------------------------------------------|------------------------------------|------------------------------|-----------------------------|-------------------------------------------------|
| <i>F<sub>w</sub></i>   | <i>D</i> | <i>C</i> | <i>r<sub>s</sub></i> <sup>(1)</sup><br>min | <i>D<sub>a</sub></i><br>Max.<br>mm | <i>C</i><br>N                | <i>C<sub>0</sub></i><br>N   | min <sup>-1</sup>                               |
| 360                    | 440      | 118      | 3                                          | 427                                | 1 170 000                    | 2 830 000                   | 750                                             |
| 370                    | 420      | 80       | 2.1                                        | 409                                | 651 000                      | 2 140 000                   | 700                                             |
| 380                    | 460      | 118      | 3                                          | 447                                | 1 220 000                    | 3 020 000                   | 700                                             |
| 390                    | 440      | 80       | 2.1                                        | 429                                | 680 000                      | 2 320 000                   | 650                                             |
| 400                    | 480      | 118      | 3                                          | 467                                | 1 260 000                    | 3 200 000                   | 600                                             |
| 415                    | 480      | 100      | 2.1                                        | 469                                | 951 000                      | 2 860 000                   | 600                                             |
| 430                    | 520      | 140      | 4                                          | 504                                | 1 540 000                    | 4 030 000                   | 500                                             |
| 450                    | 540      | 140      | 4                                          | 524                                | 1 590 000                    | 4 270 000                   | 500                                             |
| 470                    | 560      | 140      | 4                                          | 544                                | 1 640 000                    | 4 510 000                   | 500                                             |
| 490                    | 600      | 160      | 4                                          | 584                                | 1 910 000                    | 5 140 000                   | 400                                             |

MACHINED TYPE NEEDLE ROLLER BEARINGS

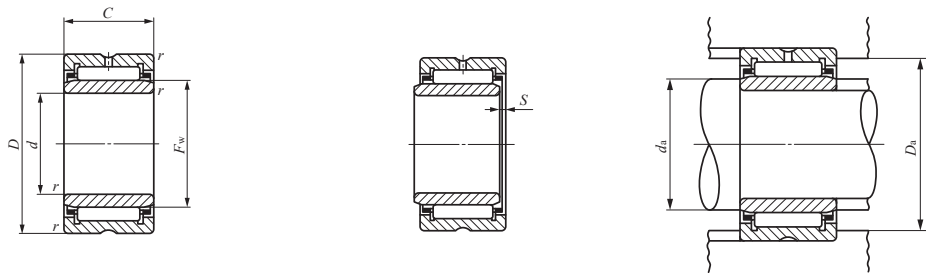
With Inner Ring



Shaft dia. 5 – 12mm

| Shaft dia.<br>mm | Identification number |         |       |             |     |      | Mass<br>(Ref.)<br>g | d  |
|------------------|-----------------------|---------|-------|-------------|-----|------|---------------------|----|
|                  | NA 49                 | NA 69   | NA 48 | TAFI        | TRI | GTRI |                     |    |
| 5                | NA 495                | —       | —     | —           | —   | —    | 7.3                 | 5  |
|                  | —                     | —       | —     | TAFI 51512  | —   | —    | 11.9                | 5  |
|                  | —                     | —       | —     | TAFI 51516  | —   | —    | 16.7                | 5  |
| 6                | NA 496                | —       | —     | —           | —   | —    | 9.1                 | 6  |
|                  | —                     | —       | —     | TAFI 61612  | —   | —    | 13                  | 6  |
|                  | —                     | —       | —     | TAFI 61616  | —   | —    | 17.5                | 6  |
| 7                | NA 497                | —       | —     | —           | —   | —    | 11.2                | 7  |
|                  | —                     | —       | —     | TAFI 71712  | —   | —    | 14.3                | 7  |
|                  | —                     | —       | —     | TAFI 71716  | —   | —    | 19.2                | 7  |
| 8                | NA 498                | —       | —     | —           | —   | —    | 15                  | 8  |
| 9                | —                     | —       | —     | TAFI 91912  | —   | —    | 16.7                | 9  |
|                  | —                     | —       | —     | TAFI 91916  | —   | —    | 22.5                | 9  |
|                  | NA 499                | —       | —     | —           | —   | —    | 16.7                | 9  |
| 10               | NA 4900               | —       | —     | —           | —   | —    | 24                  | 10 |
|                  | —                     | —       | —     | TAFI 102216 | —   | —    | 30                  | 10 |
|                  | —                     | —       | —     | TAFI 102220 | —   | —    | 38                  | 10 |
| 12               | NA 4901               | —       | —     | —           | —   | —    | 26.5                | 12 |
|                  | —                     | —       | —     | TAFI 122416 | —   | —    | 33.5                | 12 |
|                  | —                     | —       | —     | TAFI 122420 | —   | —    | 42.5                | 12 |
|                  | —                     | NA 6901 | —     | —           | —   | —    | 44.5                | 12 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. TAFI series with a bore diameter *d* of 22 mm or less have no oil hole. In others, the outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



NA49 TAFI  
NA69 (*d* ≤ 30)

| Boundary dimensions mm |          |          |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating       | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |        |
|------------------------|----------|----------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|--------------------------------|-------------------------------------------|----------------------|--------|
| <i>D</i>               | <i>C</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br><br>N         | <i>C</i> <sub>0</sub><br><br>N | min <sup>-1</sup>                         |                      |        |
| 13                     | 10       | —        | 0.15                                        | 7                     | 0.5                        | 6.2                             | 6.7                        | 11.8                       | 2 960                     | 2 690                          | 60 000                                    | LRT                  | 5710   |
| 15                     | 12       | —        | 0.2                                         | 8                     | 0.5                        | 6.6                             | 7.7                        | 13.4                       | 5 060                     | 4 690                          | 50 000                                    | LRT                  | 5812   |
| 15                     | 16       | —        | 0.2                                         | 8                     | 0.5                        | 6.6                             | 7.7                        | 13.4                       | 7 080                     | 7 220                          | 50 000                                    | LRT                  | 5816   |
| 15                     | 10       | —        | 0.15                                        | 8                     | 0.5                        | 7.2                             | 7.7                        | 13.8                       | 3 960                     | 3 420                          | 50 000                                    | LRT                  | 6810   |
| 16                     | 12       | —        | 0.2                                         | 9                     | 0.5                        | 7.6                             | 8.7                        | 14.4                       | 5 490                     | 5 330                          | 45 000                                    | LRT                  | 6912   |
| 16                     | 16       | —        | 0.2                                         | 9                     | 0.5                        | 7.6                             | 8.7                        | 14.4                       | 7 680                     | 8 210                          | 45 000                                    | LRT                  | 6916   |
| 17                     | 10       | —        | 0.15                                        | 9                     | 0.5                        | 8.2                             | 8.7                        | 15.8                       | 4 530                     | 3 650                          | 45 000                                    | LRT                  | 7910   |
| 17                     | 12       | —        | 0.2                                         | 10                    | 0.5                        | 8.6                             | 9.7                        | 15.4                       | 5 880                     | 5 970                          | 40 000                                    | LRT                  | 71012  |
| 17                     | 16       | —        | 0.2                                         | 10                    | 0.5                        | 8.6                             | 9.7                        | 15.4                       | 8 230                     | 9 190                          | 40 000                                    | LRT                  | 71016  |
| 19                     | 11       | —        | 0.2                                         | 10                    | 0.5                        | 9.6                             | 9.9                        | 17.4                       | 6 180                     | 5 030                          | 40 000                                    | LRT                  | 81011  |
| 19                     | 12       | —        | 0.3                                         | 12                    | 0.5                        | 11                              | 11.5                       | 17                         | 6 610                     | 7 260                          | 35 000                                    | LRT                  | 91212  |
| 19                     | 16       | —        | 0.3                                         | 12                    | 0.5                        | 11                              | 11.5                       | 17                         | 9 250                     | 11 200                         | 35 000                                    | LRT                  | 91216  |
| 20                     | 11       | —        | 0.3                                         | 12                    | 0.5                        | 11                              | 11.5                       | 18                         | 6 600                     | 6 310                          | 35 000                                    | LRT                  | 91211  |
| 22                     | 13       | —        | 0.3                                         | 14                    | 0.5                        | 12                              | 13                         | 20                         | 9 230                     | 10 100                         | 30 000                                    | LRT                  | 101413 |
| 22                     | 16       | —        | 0.3                                         | 14                    | 0.5                        | 12                              | 13                         | 20                         | 11 700                    | 13 700                         | 30 000                                    | LRT                  | 101416 |
| 22                     | 20       | —        | 0.3                                         | 14                    | 0.5                        | 12                              | 13                         | 20                         | 14 800                    | 18 600                         | 30 000                                    | LRT                  | 101420 |
| 24                     | 13       | —        | 0.3                                         | 16                    | 0.5                        | 14                              | 15                         | 22                         | 9 660                     | 11 100                         | 25 000                                    | LRT                  | 121613 |
| 24                     | 16       | —        | 0.3                                         | 16                    | 0.5                        | 14                              | 15                         | 22                         | 12 300                    | 15 100                         | 25 000                                    | LRT                  | 121616 |
| 24                     | 20       | —        | 0.3                                         | 16                    | 0.5                        | 14                              | 15                         | 22                         | 15 500                    | 20 400                         | 25 000                                    | LRT                  | 121620 |
| 24                     | 22       | —        | 0.3                                         | 16                    | 0.5                        | 14                              | 15                         | 22                         | 17 100                    | 23 000                         | 25 000                                    | LRT                  | 121622 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

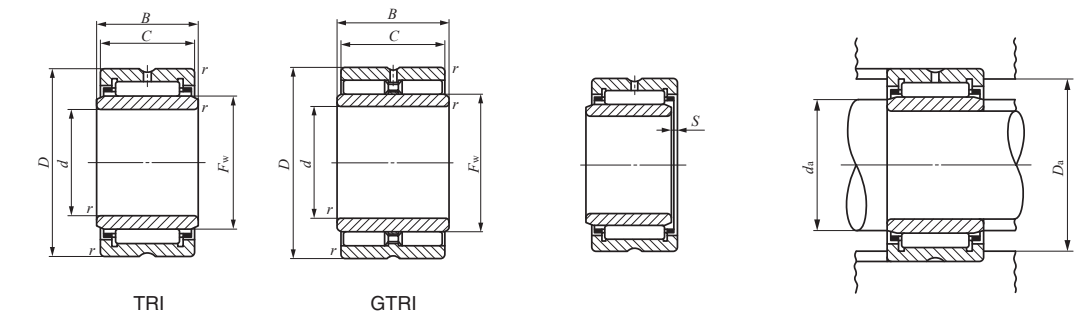
With Inner Ring



Shaft dia. 15 – 22mm

| Shaft dia.<br>mm | Identification number |          |       |             |            |             | Mass<br>(Ref.) | d  |
|------------------|-----------------------|----------|-------|-------------|------------|-------------|----------------|----|
|                  | NA 49                 | NA 69    | NA 48 | TAFI        | TRI        | GTRI        | g              |    |
| 15               | —                     | —        | —     | TAFI 152716 | —          | —           | 39.5           | 15 |
|                  | —                     | —        | —     | TAFI 152720 | —          | —           | 50             | 15 |
|                  | NA 4902               | —        | —     | —           | —          | —           | 35             | 15 |
|                  | —                     | NA 6902  | —     | —           | —          | —           | 61             | 15 |
|                  | —                     | —        | —     | —           | TRI 153320 | —           | 81             | 15 |
|                  | —                     | —        | —     | —           | —          | GTRI 153320 | 90.5           | 15 |
| 17               | —                     | —        | —     | TAFI 172916 | —          | —           | 43.5           | 17 |
|                  | —                     | —        | —     | TAFI 172920 | —          | —           | 54             | 17 |
|                  | NA 4903               | —        | —     | —           | —          | —           | 39             | 17 |
|                  | —                     | NA 6903  | —     | —           | —          | —           | 67             | 17 |
|                  | —                     | —        | —     | —           | TRI 173425 | —           | 104            | 17 |
|                  | —                     | —        | —     | —           | —          | GTRI 173425 | 117            | 17 |
| 20               | —                     | —        | —     | TAFI 203216 | —          | —           | 48.5           | 20 |
|                  | —                     | —        | —     | TAFI 203220 | —          | —           | 61             | 20 |
|                  | NA 4904               | —        | —     | —           | —          | —           | 78.5           | 20 |
|                  | —                     | NA 6904  | —     | —           | —          | —           | 136            | 20 |
|                  | —                     | —        | —     | —           | TRI 203820 | —           | 99             | 20 |
|                  | —                     | —        | —     | —           | TRI 203825 | —           | 124            | 20 |
| 22               | —                     | —        | —     | —           | —          | GTRI 203820 | 110            | 20 |
|                  | —                     | —        | —     | —           | —          | GTRI 203825 | 138            | 20 |
|                  | —                     | —        | —     | TAFI 223416 | —          | —           | 52             | 22 |
|                  | —                     | —        | —     | TAFI 223420 | —          | —           | 67.5           | 22 |
|                  | NA 49/22              | —        | —     | —           | —          | —           | 87             | 22 |
|                  | —                     | NA 69/22 | —     | —           | —          | —           | 152            | 22 |

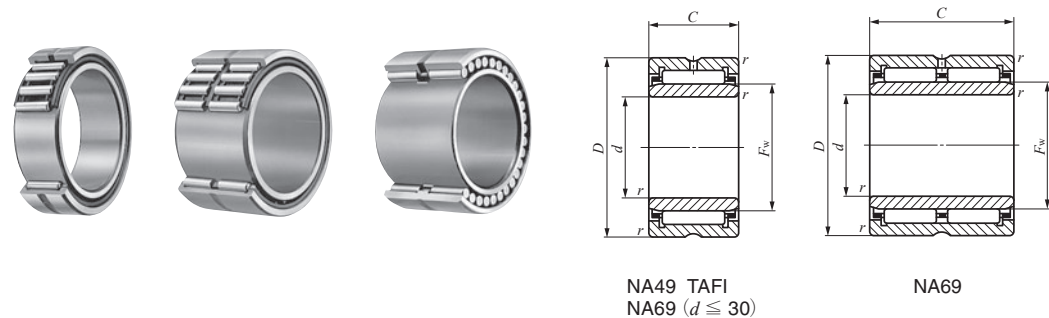
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. TAFI series with a bore diameter *d* of 22 mm or less have no oil hole. In others, the outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



| Boundary dimensions mm |    |      |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |
|------------------------|----|------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |
| 27                     | 16 | —    | 0.3                                         | 19                    | 0.5                        | 17                              | 18                         | 25                         | 14 000                    | 18 700                     | 20 000                                    | LRT 151916           |
| 27                     | 20 | —    | 0.3                                         | 19                    | 0.5                        | 17                              | 18                         | 25                         | 17 700                    | 25 300                     | 20 000                                    | LRT 151920           |
| 28                     | 13 | —    | 0.3                                         | 20                    | 0.3                        | 17                              | 19                         | 26                         | 10 900                    | 13 800                     | 20 000                                    | LRT 152013           |
| 28                     | 23 | —    | 0.3                                         | 20                    | 0.3                        | 17                              | 19                         | 26                         | 19 300                    | 28 800                     | 20 000                                    | LRT 152023           |
| 33                     | 20 | 20.5 | 0.3                                         | 20                    | 0.3                        | 17                              | 19                         | 31                         | 24 300                    | 26 500                     | 20 000                                    | LRT 152020           |
| 33                     | 20 | 20.5 | 0.3                                         | 20                    | —                          | 17                              | 19                         | 31                         | 29 200                    | 37 200                     | 7 500                                     | LRTZ 152020          |
| 29                     | 16 | —    | 0.3                                         | 21                    | 0.5                        | 19                              | 20                         | 27                         | 14 400                    | 20 000                     | 19 000                                    | LRT 172116           |
| 29                     | 20 | —    | 0.3                                         | 21                    | 0.5                        | 19                              | 20                         | 27                         | 18 200                    | 27 100                     | 19 000                                    | LRT 172120           |
| 30                     | 13 | —    | 0.3                                         | 22                    | 0.3                        | 19                              | 21                         | 28                         | 11 700                    | 15 600                     | 18 000                                    | LRT 172213           |
| 30                     | 23 | —    | 0.3                                         | 22                    | 0.3                        | 19                              | 21                         | 28                         | 20 800                    | 32 500                     | 18 000                                    | LRT 172223           |
| 34                     | 25 | 25.5 | 0.3                                         | 22                    | 0.5                        | 19                              | 21                         | 32                         | 29 100                    | 36 800                     | 18 000                                    | LRT 172225           |
| 34                     | 25 | 25.5 | 0.3                                         | 22                    | —                          | 19                              | 21                         | 32                         | 37 900                    | 57 800                     | 7 000                                     | LRTZ 172225          |
| 32                     | 16 | —    | 0.3                                         | 24                    | 0.5                        | 22                              | 23                         | 30                         | 15 300                    | 22 500                     | 17 000                                    | LRT 202416           |
| 32                     | 20 | —    | 0.3                                         | 24                    | 0.5                        | 22                              | 23                         | 30                         | 19 400                    | 30 500                     | 17 000                                    | LRT 202420           |
| 37                     | 17 | —    | 0.3                                         | 25                    | 0.5                        | 22                              | 24                         | 35                         | 21 000                    | 25 000                     | 16 000                                    | LRT 202517           |
| 37                     | 30 | —    | 0.3                                         | 25                    | 0.5                        | 22                              | 24                         | 35                         | 35 400                    | 48 900                     | 16 000                                    | LRT 202530           |
| 38                     | 20 | 20.5 | 0.3                                         | 25                    | 0.3                        | 22                              | 24                         | 36                         | 28 900                    | 35 000                     | 16 000                                    | LRT 202520           |
| 38                     | 25 | 25.5 | 0.3                                         | 25                    | 0.5                        | 22                              | 24                         | 36                         | 34 800                    | 44 400                     | 16 000                                    | LRT 202525           |
| 38                     | 20 | 20.5 | 0.3                                         | 25                    | —                          | 22                              | 24                         | 36                         | 33 300                    | 46 500                     | 6 000                                     | LRTZ 202520          |
| 38                     | 25 | 25.5 | 0.3                                         | 25                    | —                          | 22                              | 24                         | 36                         | 42 400                    | 63 700                     | 6 000                                     | LRTZ 202525          |
| 34                     | 16 | —    | 0.3                                         | 26                    | 0.5                        | 24                              | 25                         | 32                         | 16 300                    | 24 900                     | 15 000                                    | LRT 222616           |
| 34                     | 20 | —    | 0.3                                         | 26                    | 0.5                        | 24                              | 25                         | 32                         | 20 600                    | 33 800                     | 15 000                                    | LRT 222620           |
| 39                     | 17 | —    | 0.3                                         | 28                    | 1                          | 24                              | 27                         | 37                         | 21 400                    | 28 900                     | 14 000                                    | LRT 222817           |
| 39                     | 30 | —    | 0.3                                         | 28                    | 0.5                        | 24                              | 27                         | 37                         | 36 300                    | 56 900                     | 14 000                                    | LRT 222830           |

MACHINED TYPE NEEDLE ROLLER BEARINGS

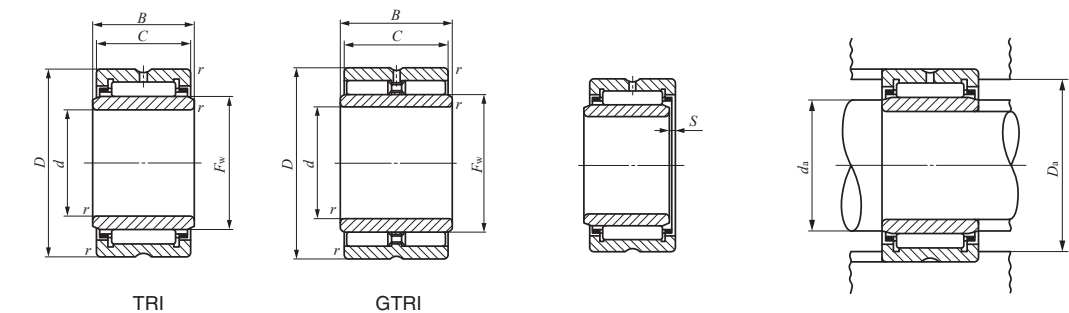
With Inner Ring



Shaft dia. 25 – 32mm

| Shaft dia.<br>mm | Identification number |          |       |             |            |             | Mass<br>(Ref.) | d  |
|------------------|-----------------------|----------|-------|-------------|------------|-------------|----------------|----|
|                  | NA 49                 | NA 69    | NA 48 | TAFI        | TRI        | GTRI        | g              |    |
| 25               | —                     | —        | —     | TAFI 253820 | —          | —           | 82             | 25 |
|                  | —                     | —        | —     | TAFI 253830 | —          | —           | 123            | 25 |
|                  | NA 4905               | —        | —     | —           | —          | —           | 92.5           | 25 |
|                  | —                     | NA 6905  | —     | —           | —          | —           | 160            | 25 |
|                  | —                     | —        | —     | —           | TRI 254425 | —           | 157            | 25 |
| 28               | —                     | —        | —     | —           | —          | GTRI 254425 | 175            | 25 |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
| 30               | —                     | —        | —     | TAFI 284220 | —          | —           | 96.5           | 28 |
|                  | —                     | —        | —     | TAFI 284230 | —          | —           | 145            | 28 |
|                  | NA 49/28              | —        | —     | —           | —          | —           | 101            | 28 |
|                  | —                     | NA 69/28 | —     | —           | —          | —           | 176            | 28 |
|                  | —                     | —        | —     | —           | —          | GTRI 284530 | 196            | 28 |
| 32               | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
| 30               | —                     | —        | —     | TAFI 304520 | —          | —           | 112            | 30 |
|                  | —                     | —        | —     | TAFI 304530 | —          | —           | 171            | 30 |
|                  | NA 4906               | —        | —     | —           | —          | —           | 106            | 30 |
|                  | —                     | NA 6906  | —     | —           | —          | —           | 184            | 30 |
|                  | —                     | —        | —     | —           | TRI 304830 | —           | 199            | 30 |
| 32               | —                     | —        | —     | —           | —          | GTRI 304830 | 225            | 30 |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
| 32               | —                     | —        | —     | TAFI 324720 | —          | —           | 121            | 32 |
|                  | —                     | —        | —     | TAFI 324730 | —          | —           | 180            | 32 |
|                  | NA 49/32              | —        | —     | —           | —          | —           | 165            | 32 |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |
|                  | —                     | NA 69/32 | —     | —           | —          | —           | 245            | 32 |
| 32               | —                     | —        | —     | —           | —          | —           | 295            | 32 |
|                  | —                     | —        | —     | —           | —          | —           | 270            | 32 |
|                  | —                     | —        | —     | —           | —          | —           | —              | —  |

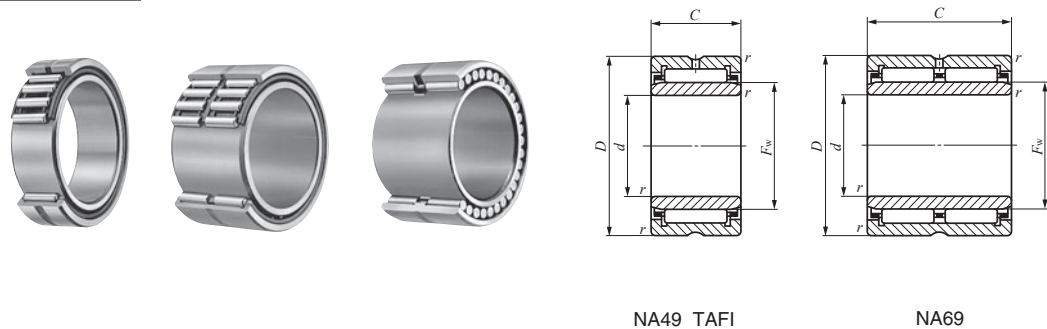
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



| Boundary dimensions mm |    |      |                                             |                                         |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |
|------------------------|----|------|---------------------------------------------|-----------------------------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <sup>(2)</sup><br><i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |
| 38                     | 20 | —    | 0.3                                         | 29                                      | 0.5                        | 27                              | 28                         | 36                         | 21 600                    | 37 200                     | 14 000                                    | LRT 252920           |
| 38                     | 30 | —    | 0.3                                         | 29                                      | 1                          | 27                              | 28                         | 36                         | 30 900                    | 59 100                     | 14 000                                    | LRT 252930           |
| 42                     | 17 | —    | 0.3                                         | 30                                      | 0.5                        | 27                              | 29                         | 40                         | 23 700                    | 30 700                     | 13 000                                    | LRT 253017           |
| 42                     | 30 | —    | 0.3                                         | 30                                      | 0.5                        | 27                              | 29                         | 40                         | 42 100                    | 64 300                     | 13 000                                    | LRT 253030           |
| 44                     | 25 | 25.5 | 0.3                                         | 30                                      | 0.5                        | 27                              | 29                         | 42                         | 37 900                    | 52 100                     | 13 000                                    | LRT 253025           |
| 44                     | 25 | 25.5 | 0.3                                         | 30                                      | —                          | 27                              | 29                         | 42                         | 47 000                    | 76 500                     | 5 000                                     | LRTZ 253025          |
| 42                     | 20 | —    | 0.3                                         | 32                                      | 0.5                        | 30                              | 31                         | 40                         | 25 700                    | 42 200                     | 12 000                                    | LRT 283220           |
| 42                     | 30 | —    | 0.3                                         | 32                                      | 1                          | 30                              | 31                         | 40                         | 36 800                    | 67 200                     | 12 000                                    | LRT 283230           |
| 45                     | 17 | —    | 0.3                                         | 32                                      | 1                          | 30                              | 31                         | 43                         | 24 500                    | 32 700                     | 12 000                                    | LRT 283217           |
| 45                     | 30 | —    | 0.3                                         | 32                                      | 1                          | 30                              | 31                         | 43                         | 41 800                    | 64 800                     | 12 000                                    | LRT 283230           |
| 45                     | 30 | 30.5 | 0.3                                         | 32                                      | —                          | 30                              | 31                         | 43                         | 58 000                    | 101 000                    | 4 500                                     | LRTZ 283230          |
| 45                     | 20 | —    | 0.3                                         | 35                                      | 0.3                        | 32                              | 34                         | 43                         | 26 900                    | 46 200                     | 11 000                                    | LRT 303520           |
| 45                     | 30 | —    | 0.3                                         | 35                                      | 0.5                        | 32                              | 34                         | 43                         | 38 600                    | 73 600                     | 11 000                                    | LRT 303530           |
| 47                     | 17 | —    | 0.3                                         | 35                                      | 0.5                        | 32                              | 34                         | 45                         | 25 200                    | 34 700                     | 11 000                                    | LRT 303517           |
| 47                     | 30 | —    | 0.3                                         | 35                                      | 0.5                        | 32                              | 34                         | 45                         | 43 000                    | 69 000                     | 11 000                                    | LRT 303530           |
| 48                     | 30 | 30.5 | 0.3                                         | 35                                      | 1                          | 32                              | 34                         | 46                         | 47 400                    | 72 300                     | 11 000                                    | LRT 303530-1         |
| 48                     | 30 | 30.5 | 0.3                                         | 35                                      | —                          | 32                              | 34                         | 46                         | 61 100                    | 110 000                    | 4 500                                     | LRTZ 303530          |
| 47                     | 20 | —    | 0.3                                         | 37                                      | 0.3                        | 34                              | 36                         | 45                         | 28 200                    | 50 100                     | 11 000                                    | LRT 323720           |
| 47                     | 30 | —    | 0.3                                         | 37                                      | 0.5                        | 34                              | 36                         | 45                         | 40 500                    | 79 800                     | 11 000                                    | LRT 323730           |
| 52                     | 20 | —    | 0.6                                         | 40                                      | 0.5                        | 36                              | 39                         | 48                         | 31 200                    | 47 800                     | 10 000                                    | LRT 324020           |
| 52                     | 30 | 30.5 | 0.6                                         | 38                                      | 0.5                        | 36                              | 37                         | 48                         | 50 800                    | 81 100                     | 11 000                                    | LRT 323830           |
| 52                     | 36 | —    | 0.6                                         | 40                                      | 0.3                        | 36                              | 39                         | 48                         | 53 500                    | 95 700                     | 10 000                                    | LRT 324036           |
| 52                     | 30 | 30.5 | 0.6                                         | 38                                      | —                          | 36                              | 37                         | 48                         | 64 200                    | 121 000                    | 4 000                                     | LRTZ 323830          |

MACHINED TYPE NEEDLE ROLLER BEARINGS

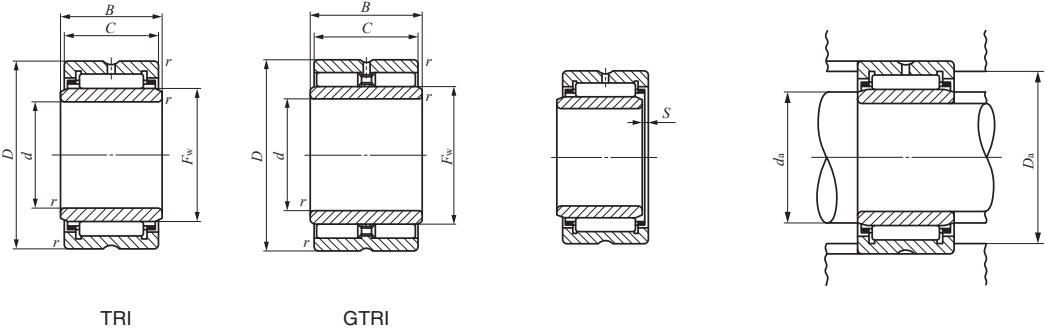
With Inner Ring



Shaft dia. 35 — 45mm

| Shaft dia.<br>mm | Identification number |         |       |             |            |             | Mass<br>(Ref.) | d  |
|------------------|-----------------------|---------|-------|-------------|------------|-------------|----------------|----|
|                  | NA 49                 | NA 69   | NA 48 | TAFI        | TRI        | GTRI        | g              |    |
| 35               | —                     | —       | —     | TAFI 355020 | —          | —           | 129            | 35 |
|                  | —                     | —       | —     | TAFI 355030 | —          | —           | 192            | 35 |
|                  | NA 4907               | —       | —     | —           | —          | —           | 178            | 35 |
|                  | —                     | NA 6907 | —     | —           | —          | —           | 320            | 35 |
|                  | —                     | —       | —     | —           | TRI 355630 | —           | 280            | 35 |
| 38               | —                     | —       | —     | —           | —          | GTRI 355520 | 191            | 35 |
|                  | —                     | —       | —     | —           | —          | GTRI 355630 | 310            | 35 |
|                  | —                     | —       | —     | TAFI 385320 | —          | —           | 136            | 38 |
|                  | —                     | —       | —     | TAFI 385330 | —          | —           | 205            | 38 |
|                  | —                     | —       | —     | —           | —          | —           | —              | —  |
| 40               | —                     | —       | —     | TAFI 405520 | —          | —           | 143            | 40 |
|                  | —                     | —       | —     | TAFI 405530 | —          | —           | 215            | 40 |
|                  | —                     | —       | —     | —           | TRI 405930 | —           | 270            | 40 |
|                  | NA 4908               | —       | —     | —           | —          | —           | 245            | 40 |
|                  | —                     | NA 6908 | —     | —           | —          | —           | 440            | 40 |
| 42               | —                     | —       | —     | —           | —          | GTRI 405930 | 300            | 40 |
|                  | —                     | —       | —     | TAFI 425720 | —          | —           | 149            | 42 |
|                  | —                     | —       | —     | TAFI 425730 | —          | —           | 225            | 42 |
|                  | —                     | —       | —     | —           | TRI 426230 | —           | 305            | 42 |
|                  | —                     | —       | —     | —           | —          | GTRI 426230 | 340            | 42 |
| 45               | —                     | —       | —     | TAFI 456225 | —          | —           | 230            | 45 |
|                  | —                     | —       | —     | TAFI 456235 | —          | —           | 320            | 45 |
|                  | —                     | —       | —     | —           | TRI 456430 | —           | 300            | 45 |
|                  | NA 4909               | —       | —     | —           | —          | —           | 285            | 45 |
|                  | —                     | NA 6909 | —     | —           | —          | —           | 520            | 45 |
| 45               | —                     | —       | —     | —           | —          | GTRI 456430 | 335            | 45 |
|                  | —                     | —       | —     | —           | —          | —           | —              | —  |

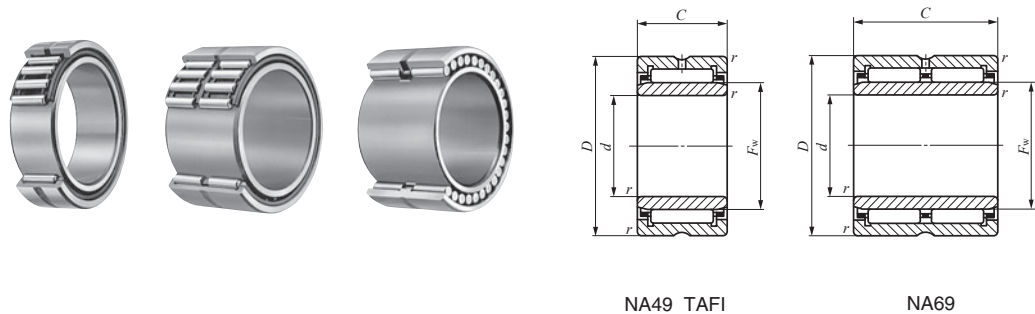
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



| Boundary dimensions mm |    |      |                                             |                       |                            |                       | Standard mounting dimensions mm |      | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |
|------------------------|----|------|---------------------------------------------|-----------------------|----------------------------|-----------------------|---------------------------------|------|---------------------------|----------------------------|-------------------------------------------|----------------------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | <i>d</i> <sub>a</sub> | Min.                            | Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |
| 50                     | 20 | —    | 0.3                                         | 40                    | 0.3                        | 37                    | 39                              | 48   | 29 400                    | 54 100                     | 10 000                                    | LRT 354020           |
| 50                     | 30 | —    | 0.3                                         | 40                    | 0.5                        | 37                    | 39                              | 48   | 42 300                    | 86 200                     | 10 000                                    | LRT 354030           |
| 55                     | 20 | —    | 0.6                                         | 42                    | 0.5                        | 39                    | 41                              | 51   | 32 000                    | 50 100                     | 9 500                                     | LRT 354220           |
| 55                     | 36 | —    | 0.6                                         | 42                    | 0.3                        | 39                    | 41                              | 51   | 54 900                    | 100 000                    | 9 500                                     | LRT 354236           |
| 56                     | 30 | 30.5 | 0.6                                         | 42                    | 0.5                        | 39                    | 41                              | 52   | 53 800                    | 90 100                     | 9 500                                     | LRT 354230           |
| 55                     | 20 | 20.5 | 0.6                                         | 40                    | —                          | 39                    | 39.5                            | 51   | 44 300                    | 73 600                     | 3 500                                     | LRTZ 354020          |
| 56                     | 30 | 30.5 | 0.6                                         | 42                    | —                          | 39                    | 41                              | 52   | 67 500                    | 133 000                    | 3 500                                     | LRTZ 354230          |
| 53                     | 20 | —    | 0.3                                         | 43                    | 0.3                        | 40                    | 42                              | 51   | 30 500                    | 58 200                     | 9 500                                     | LRT 384320           |
| 53                     | 30 | —    | 0.3                                         | 43                    | 0.5                        | 40                    | 42                              | 51   | 43 800                    | 92 600                     | 9 500                                     | LRT 384330           |
| 55                     | 20 | —    | 0.3                                         | 45                    | 0.3                        | 42                    | 44                              | 53   | 31 000                    | 60 200                     | 9 000                                     | LRT 404520           |
| 55                     | 30 | —    | 0.3                                         | 45                    | 0.5                        | 42                    | 44                              | 53   | 44 600                    | 95 800                     | 9 000                                     | LRT 404530           |
| 59                     | 30 | 30.5 | 0.6                                         | 45                    | 1                          | 44                    | 44.5                            | 55   | 55 100                    | 94 800                     | 9 000                                     | LRT 404530-1         |
| 62                     | 22 | —    | 0.6                                         | 48                    | 0.5                        | 44                    | 47                              | 58   | 41 600                    | 67 400                     | 8 500                                     | LRT 404822           |
| 62                     | 40 | —    | 0.6                                         | 48                    | 0.3                        | 44                    | 47                              | 58   | 71 300                    | 135 000                    | 8 500                                     | LRT 404840           |
| 59                     | 30 | 30.5 | 0.6                                         | 45                    | —                          | 44                    | 44.5                            | 55   | 70 300                    | 142 000                    | 3 500                                     | LRTZ 404530          |
| 57                     | 20 | —    | 0.3                                         | 47                    | 0.3                        | 44                    | 46                              | 55   | 31 500                    | 62 200                     | 8 500                                     | LRT 424720           |
| 57                     | 30 | —    | 0.3                                         | 47                    | 0.5                        | 44                    | 46                              | 55   | 45 200                    | 99 100                     | 8 500                                     | LRT 424730           |
| 62                     | 30 | 30.5 | 0.6                                         | 48                    | 0.5                        | 46                    | 47                              | 58   | 56 300                    | 99 500                     | 8 500                                     | LRT 424830           |
| 62                     | 30 | 30.5 | 0.6                                         | 48                    | —                          | 46                    | 47                              | 58   | 72 700                    | 154 000                    | 3 000                                     | LRTZ 424830          |
| 62                     | 25 | —    | 0.3                                         | 50                    | 0.5                        | 47                    | 49                              | 60   | 43 000                    | 85 300                     | 8 000                                     | LRT 455025           |
| 62                     | 35 | —    | 0.3                                         | 50                    | 1                          | 47                    | 49                              | 60   | 58 000                    | 125 000                    | 8 000                                     | LRT 455035           |
| 64                     | 30 | 30.5 | 0.6                                         | 50                    | 1                          | 49                    | 49.5                            | 60   | 57 700                    | 104 000                    | 8 000                                     | LRT 455030           |
| 68                     | 22 | —    | 0.6                                         | 52                    | 0.5                        | 49                    | 51                              | 64   | 43 500                    | 73 300                     | 7 500                                     | LRT 455222           |
| 68                     | 40 | —    | 0.6                                         | 52                    | 0.3                        | 49                    | 51                              | 64   | 74 600                    | 147 000                    | 7 500                                     | LRT 455240           |
| 64                     | 30 | 30.5 | 0.6                                         | 50                    | —                          | 49                    | 49.5                            | 60   | 74 600                    | 158 000                    | 3 000                                     | LRTZ 455030          |

MACHINED TYPE NEEDLE ROLLER BEARINGS

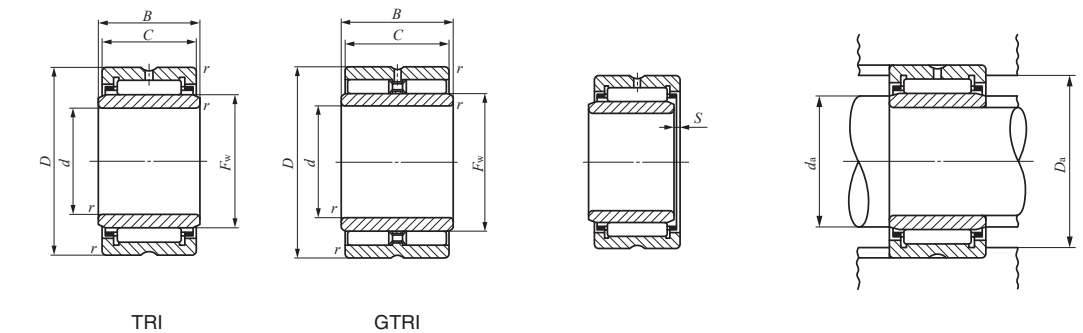
With Inner Ring



Shaft dia. 50 – 70mm

| Shaft dia.<br>mm | Identification number |         |       |             |            |             | Mass<br>(Ref.) | d  |
|------------------|-----------------------|---------|-------|-------------|------------|-------------|----------------|----|
|                  | NA 49                 | NA 69   | NA 48 | TAFI        | TRI        | GTRI        | g              |    |
| 50               | —                     | —       | —     | TAFI 506825 | —          | —           | 270            | 50 |
|                  | —                     | —       | —     | TAFI 506835 | —          | —           | 365            | 50 |
|                  | NA 4910               | —       | —     | —           | —          | —           | 295            | 50 |
|                  | —                     | NA 6910 | —     | —           | —          | —           | 530            | 50 |
|                  | —                     | —       | —     | —           | TRI 507745 | —           | 755            | 50 |
|                  | —                     | —       | —     | —           | —          | GTRI 507745 | 825            | 50 |
| 55               | —                     | —       | —     | TAFI 557225 | —          | —           | 275            | 55 |
|                  | —                     | —       | —     | TAFI 557235 | —          | —           | 380            | 55 |
|                  | NA 4911               | —       | —     | —           | —          | —           | 410            | 55 |
|                  | —                     | NA 6911 | —     | —           | —          | —           | 730            | 55 |
|                  | —                     | —       | —     | —           | TRI 558138 | —           | 650            | 55 |
|                  | —                     | —       | —     | —           | —          | GTRI 558138 | 710            | 55 |
| 60               | —                     | —       | —     | TAFI 608225 | —          | —           | 395            | 60 |
|                  | —                     | —       | —     | TAFI 608235 | —          | —           | 560            | 60 |
|                  | NA 4912               | —       | —     | —           | —          | —           | 440            | 60 |
|                  | —                     | NA 6912 | —     | —           | —          | —           | 785            | 60 |
|                  | —                     | —       | —     | —           | TRI 608945 | —           | 960            | 60 |
|                  | —                     | —       | —     | —           | —          | GTRI 608945 | 1 050          | 60 |
| 65               | NA 4913               | —       | —     | —           | —          | —           | 470            | 65 |
|                  | —                     | —       | —     | TAFI 659035 | —          | —           | 710            | 65 |
|                  | —                     | NA 6913 | —     | —           | —          | —           | 840            | 65 |
| 70               | —                     | —       | —     | TAFI 709525 | —          | —           | 540            | 70 |
|                  | —                     | —       | —     | TAFI 709535 | —          | —           | 755            | 70 |
|                  | NA 4914               | —       | —     | —           | —          | —           | 765            | 70 |
|                  | —                     | —       | —     | —           | —          | —           | 1 400          | 70 |
|                  | —                     | NA 6914 | —     | —           | —          | —           |                | 70 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

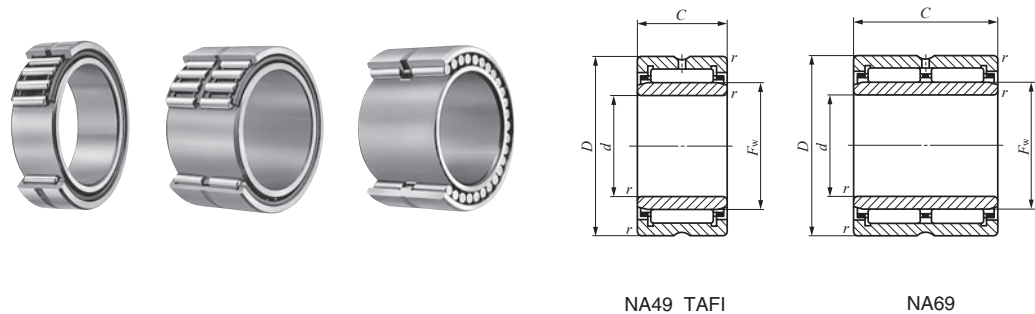


| Boundary dimensions mm |    |      |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |
|------------------------|----|------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |
| 68                     | 25 | —    | 0.3                                         | 55                    | 0.5                        | 52                              | 54                         | 66                         | 45 400                    | 94 000                     | 7 500                                     | LRT 505525           |
| 68                     | 35 | —    | 0.3                                         | 55                    | 1                          | 52                              | 54                         | 66                         | 61 200                    | 138 000                    | 7 500                                     | LRT 505535           |
| 72                     | 22 | —    | 0.6                                         | 58                    | 0.5                        | 54                              | 57                         | 68                         | 46 200                    | 82 100                     | 7 000                                     | LRT 505822           |
| 72                     | 40 | —    | 0.6                                         | 58                    | 0.3                        | 54                              | 57                         | 68                         | 79 200                    | 164 000                    | 7 000                                     | LRT 505840           |
| 77                     | 45 | 45.5 | 1                                           | 58                    | 2                          | 55                              | 57                         | 72                         | 104 000                   | 191 000                    | 7 000                                     | LRT 505845           |
| 77                     | 45 | 45.5 | 1                                           | 58                    | —                          | 55                              | 57                         | 72                         | 135 000                   | 280 000                    | 2 500                                     | LRTZ 505845          |
| 72                     | 25 | —    | 0.3                                         | 60                    | 0.5                        | 57                              | 59                         | 70                         | 47 500                    | 103 000                    | 6 500                                     | LRT 556025           |
| 72                     | 35 | —    | 0.3                                         | 60                    | 1                          | 57                              | 59                         | 70                         | 64 100                    | 151 000                    | 6 500                                     | LRT 556035           |
| 80                     | 25 | —    | 1                                           | 63                    | 1                          | 60                              | 61                         | 75                         | 57 600                    | 97 200                     | 6 500                                     | LRT 556325           |
| 80                     | 45 | —    | 1                                           | 63                    | 0.5                        | 60                              | 61                         | 75                         | 98 700                    | 194 000                    | 6 500                                     | LRT 556345           |
| 81                     | 38 | 38.5 | 1                                           | 62                    | 1.5                        | 60                              | 60.5                       | 76                         | 92 000                    | 166 000                    | 6 500                                     | LRT 556238           |
| 81                     | 38 | 38.5 | 1                                           | 62                    | —                          | 60                              | 60.5                       | 76                         | 118 000                   | 241 000                    | 2 500                                     | LRTZ 556238          |
| 82                     | 25 | —    | 0.6                                         | 68                    | 0.3                        | 64                              | 66                         | 78                         | 54 800                    | 117 000                    | 6 000                                     | LRT 606825           |
| 82                     | 35 | —    | 0.6                                         | 68                    | 1                          | 64                              | 66                         | 78                         | 72 000                    | 166 000                    | 6 000                                     | LRT 606835           |
| 85                     | 25 | —    | 1                                           | 68                    | 1                          | 65                              | 66                         | 80                         | 60 200                    | 105 000                    | 6 000                                     | LRT 606825-1         |
| 85                     | 45 | —    | 1                                           | 68                    | 0.5                        | 65                              | 66                         | 80                         | 103 000                   | 211 000                    | 6 000                                     | LRT 606845           |
| 89                     | 45 | 45.5 | 1                                           | 70                    | 2                          | 65                              | 68                         | 84                         | 114 000                   | 228 000                    | 5 500                                     | LRT 607045           |
| 89                     | 45 | 45.5 | 1                                           | 70                    | —                          | 65                              | 68                         | 84                         | 147 000                   | 336 000                    | 2 000                                     | LRTZ 607045          |
| 90                     | 25 | —    | 1                                           | 72                    | 1                          | 70                              | 70.5                       | 85                         | 62 700                    | 113 000                    | 5 500                                     | LRT 657225           |
| 90                     | 35 | —    | 1                                           | 73                    | 1                          | 70                              | 71                         | 85                         | 80 400                    | 181 000                    | 5 500                                     | LRT 657335           |
| 90                     | 45 | —    | 1                                           | 72                    | 0.5                        | 70                              | 70.5                       | 85                         | 108 000                   | 227 000                    | 5 500                                     | LRT 657245           |
| 95                     | 25 | —    | 1                                           | 80                    | 0.3                        | 75                              | 78                         | 90                         | 59 400                    | 137 000                    | 5 000                                     | LRT 708025           |
| 95                     | 35 | —    | 1                                           | 80                    | 1                          | 75                              | 78                         | 90                         | 78 100                    | 195 000                    | 5 000                                     | LRT 708035           |
| 100                    | 30 | —    | 1                                           | 80                    | 1.5                        | 75                              | 78                         | 95                         | 83 200                    | 158 000                    | 5 000                                     | LRT 708030           |
| 100                    | 54 | —    | 1                                           | 80                    | 1                          | 75                              | 78                         | 95                         | 134 000                   | 311 000                    | 5 000                                     | LRT 708054           |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

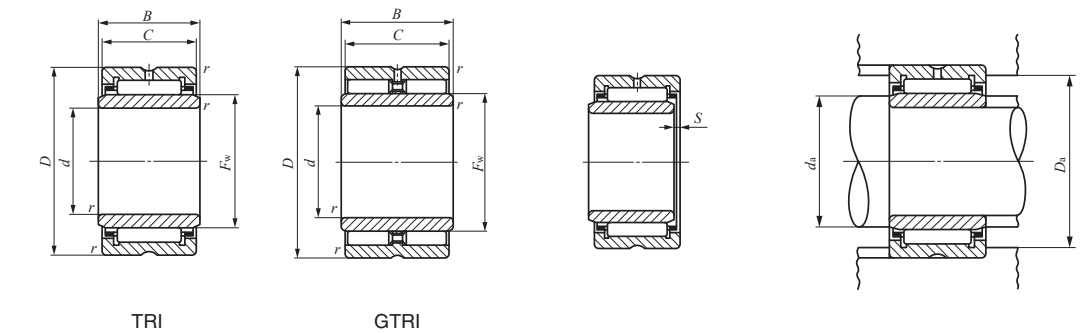
With Inner Ring



Shaft dia. 75 – 90mm

| Shaft dia.<br>mm | Identification number |         |       |              |             |              | Mass<br>(Ref.) | d  |
|------------------|-----------------------|---------|-------|--------------|-------------|--------------|----------------|----|
|                  | NA 49                 | NA 69   | NA 48 | TAFI         | TRI         | GTRI         | g              |    |
| 75               | —                     | —       | —     | TAFI 7510525 | —           | —            | 675            | 75 |
|                  | NA 4915               | —       | —     | —            | —           | —            | 810            | 75 |
|                  | —                     | —       | —     | TAFI 7510535 | —           | —            | 945            | 75 |
|                  | —                     | NA 6915 | —     | —            | —           | —            | 1 480          | 75 |
|                  | —                     | —       | —     | —            | TRI 7510845 | —            | 1 340          | 75 |
|                  | —                     | —       | —     | —            | —           | GTRI 7510845 | 1 440          | 75 |
| 80               | —                     | —       | —     | TAFI 8011025 | —           | —            | 710            | 80 |
|                  | NA 4916               | —       | —     | —            | —           | —            | 855            | 80 |
|                  | —                     | —       | —     | TAFI 8011035 | —           | —            | 995            | 80 |
|                  | —                     | NA 6916 | —     | —            | —           | —            | 1 560          | 80 |
| 85               | —                     | —       | —     | TAFI 8511526 | —           | —            | 775            | 85 |
|                  | —                     | —       | —     | TAFI 8511536 | —           | —            | 1 080          | 85 |
|                  | NA 4917               | —       | —     | —            | —           | —            | 1 280          | 85 |
|                  | —                     | NA 6917 | —     | —            | —           | —            | 2 340          | 85 |
|                  | —                     | —       | —     | —            | TRI 8511850 | —            | 1 640          | 85 |
|                  | —                     | —       | —     | —            | TRI 8512045 | —            | 1 610          | 85 |
|                  | —                     | —       | —     | —            | —           | GTRI 8511850 | 1 780          | 85 |
|                  | —                     | —       | —     | —            | —           | GTRI 8512045 | 1 720          | 85 |
| 90               | —                     | —       | —     | TAFI 9012026 | —           | —            | 820            | 90 |
|                  | —                     | —       | —     | TAFI 9012036 | —           | —            | 1 140          | 90 |
|                  | NA 4918               | —       | —     | —            | —           | —            | 1 350          | 90 |
|                  | —                     | —       | —     | —            | TRI 9012550 | —            | 1 870          | 90 |
|                  | —                     | NA 6918 | —     | —            | —           | —            | 2 460          | 90 |
|                  | —                     | —       | —     | —            | —           | GTRI 9012550 | 2 020          | 90 |

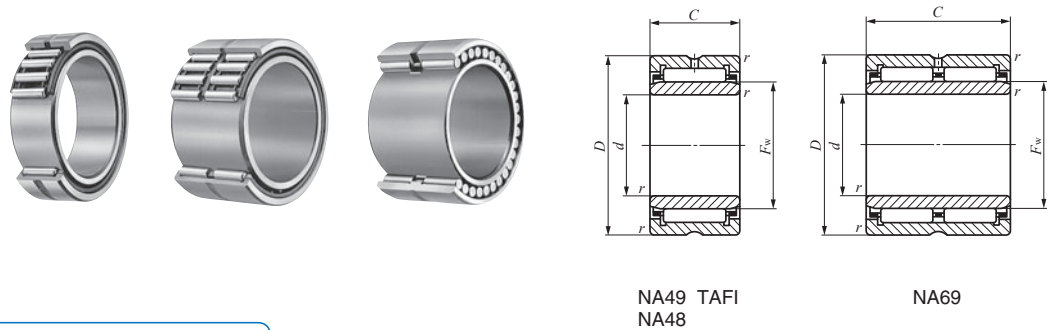
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



| Boundary dimensions mm |    |      |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |         |
|------------------------|----|------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|---------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |         |
| 105                    | 25 | —    | 1                                           | 85                    | 0.5                        | 80                              | 83                         | 100                        | 76 300                    | 145 000                    | 4 500                                     | LRT                  | 758525  |
| 105                    | 30 | —    | 1                                           | 85                    | 1.5                        | 80                              | 83                         | 100                        | 86 200                    | 169 000                    | 4 500                                     | LRT                  | 758530  |
| 105                    | 35 | —    | 1                                           | 85                    | 1.5                        | 80                              | 83                         | 100                        | 102 000                   | 210 000                    | 4 500                                     | LRT                  | 758535  |
| 105                    | 54 | —    | 1                                           | 85                    | 1                          | 80                              | 83                         | 100                        | 138 000                   | 331 000                    | 4 500                                     | LRT                  | 758554  |
| 108                    | 45 | 45.5 | 1                                           | 83                    | 2.5                        | 80                              | 81                         | 103                        | 146 000                   | 270 000                    | 5 000                                     | LRT                  | 758345  |
| 108                    | 45 | 45.5 | 1                                           | 83                    | —                          | 80                              | 81                         | 103                        | 190 000                   | 396 000                    | 1 800                                     | LRTZ                 | 758345  |
| 110                    | 25 | —    | 1                                           | 90                    | 0.5                        | 85                              | 88                         | 105                        | 77 300                    | 150 000                    | 4 500                                     | LRT                  | 809025  |
| 110                    | 30 | —    | 1                                           | 90                    | 1.5                        | 85                              | 88                         | 105                        | 87 300                    | 175 000                    | 4 500                                     | LRT                  | 809030  |
| 110                    | 35 | —    | 1                                           | 90                    | 1.5                        | 85                              | 88                         | 105                        | 103 000                   | 217 000                    | 4 500                                     | LRT                  | 809035  |
| 110                    | 54 | —    | 1                                           | 90                    | 1                          | 85                              | 88                         | 105                        | 143 000                   | 351 000                    | 4 500                                     | LRT                  | 809054  |
| 115                    | 26 | —    | 1                                           | 95                    | 1                          | 90                              | 93                         | 110                        | 79 700                    | 159 000                    | 4 000                                     | LRT                  | 859526  |
| 115                    | 36 | —    | 1                                           | 95                    | 2                          | 90                              | 93                         | 110                        | 106 000                   | 231 000                    | 4 000                                     | LRT                  | 859536  |
| 120                    | 35 | —    | 1.1                                         | 100                   | 1                          | 91.5                            | 98                         | 113.5                      | 110 000                   | 244 000                    | 4 000                                     | LRT                  | 8510035 |
| 120                    | 63 | —    | 1.1                                         | 100                   | 0.5                        | 91.5                            | 98                         | 113.5                      | 173 000                   | 467 000                    | 4 000                                     | LRT                  | 8510063 |
| 118                    | 50 | 50.5 | 1                                           | 93                    | 3                          | 90                              | 91                         | 113                        | 165 000                   | 329 000                    | 4 500                                     | LRT                  | 859350  |
| 120                    | 45 | 45.5 | 1.5                                         | 95                    | 2.5                        | 93                              | 93.5                       | 112                        | 155 000                   | 305 000                    | 4 000                                     | LRT                  | 859545  |
| 118                    | 50 | 50.5 | 1                                           | 93                    | —                          | 90                              | 91                         | 113                        | 224 000                   | 509 000                    | 1 600                                     | LRTZ                 | 859350  |
| 120                    | 45 | 45.5 | 1.5                                         | 95                    | —                          | 93                              | 93.5                       | 112                        | 204 000                   | 455 000                    | 1 600                                     | LRTZ                 | 859545  |
| 120                    | 26 | —    | 1                                           | 100                   | 1                          | 95                              | 98                         | 115                        | 82 400                    | 168 000                    | 4 000                                     | LRT                  | 9010026 |
| 120                    | 36 | —    | 1                                           | 100                   | 2                          | 95                              | 98                         | 115                        | 110 000                   | 244 000                    | 4 000                                     | LRT                  | 9010036 |
| 125                    | 35 | —    | 1.1                                         | 105                   | 1                          | 96.5                            | 103                        | 118.5                      | 113 000                   | 258 000                    | 4 000                                     | LRT                  | 9010535 |
| 125                    | 50 | 50.5 | 1.5                                         | 100                   | 3                          | 98                              | 98.5                       | 117                        | 172 000                   | 355 000                    | 4 000                                     | LRT                  | 9010050 |
| 125                    | 63 | —    | 1.1                                         | 105                   | 0.5                        | 96.5                            | 103                        | 118.5                      | 178 000                   | 490 000                    | 4 000                                     | LRT                  | 9010563 |
| 125                    | 50 | 50.5 | 1.5                                         | 100                   | —                          | 98                              | 98.5                       | 117                        | 234 000                   | 549 000                    | 1 500                                     | LRTZ                 | 9010050 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

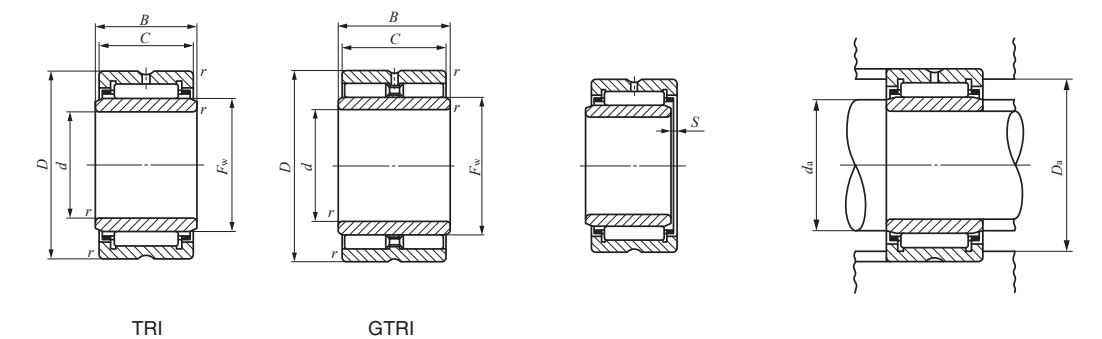
With Inner Ring



Shaft dia. 95 – 150mm

| Shaft dia.<br>mm | Identification number |         |         |               |              |               | Mass<br>(Ref.) | d   |
|------------------|-----------------------|---------|---------|---------------|--------------|---------------|----------------|-----|
|                  | NA 49                 | NA 69   | NA 48   | TAFI          | TRI          | GTRI          | g              |     |
| 95               | —                     | —       | —       | TAFI 9512526  | —            | —             | 860            | 95  |
|                  | —                     | —       | —       | TAFI 9512536  | —            | —             | 1 190          | 95  |
|                  | NA 4919               | —       | —       | —             | —            | —             | 1 420          | 95  |
|                  | —                     | NA 6919 | —       | —             | —            | —             | 2 580          | 95  |
| 100              | —                     | —       | —       | TAFI 10013030 | —            | —             | 1 040          | 100 |
|                  | —                     | —       | —       | TAFI 10013040 | —            | —             | 1 380          | 100 |
|                  | NA 4920               | —       | —       | —             | TRI 10013550 | —             | 2 040          | 100 |
|                  | —                     | —       | —       | —             | —            | GTRI 10013550 | 1 960          | 100 |
| 105              | —                     | —       | —       | —             | TRI 10515350 | —             | 3 020          | 105 |
|                  | —                     | —       | —       | —             | —            | GTRI 10515350 | 3 270          | 105 |
| 110              | NA 4922               | —       | NA 4822 | —             | —            | —             | 1 200          | 110 |
|                  | —                     | —       | —       | —             | —            | —             | 2 120          | 110 |
| 120              | NA 4924               | —       | NA 4824 | —             | —            | —             | 1 300          | 120 |
|                  | —                     | —       | —       | —             | —            | —             | 2 960          | 120 |
| 125              | —                     | —       | —       | —             | TRI 12517860 | —             | 4 780          | 125 |
|                  | —                     | —       | —       | —             | —            | GTRI 12517860 | 5 180          | 125 |
| 130              | NA 4926               | —       | NA 4826 | —             | —            | —             | 1 960          | 130 |
|                  | —                     | —       | —       | —             | —            | —             | 4 030          | 130 |
| 135              | —                     | —       | —       | —             | TRI 13518860 | —             | 5 100          | 135 |
|                  | —                     | —       | —       | —             | —            | GTRI 13518860 | 5 530          | 135 |
| 140              | NA 4928               | —       | NA 4828 | —             | —            | —             | 2 100          | 140 |
|                  | —                     | —       | —       | —             | —            | —             | 4 290          | 140 |
| 150              | NA 4930               | —       | NA 4830 | —             | —            | —             | 2 880          | 150 |
|                  | —                     | —       | —       | —             | —            | —             | 6 380          | 150 |

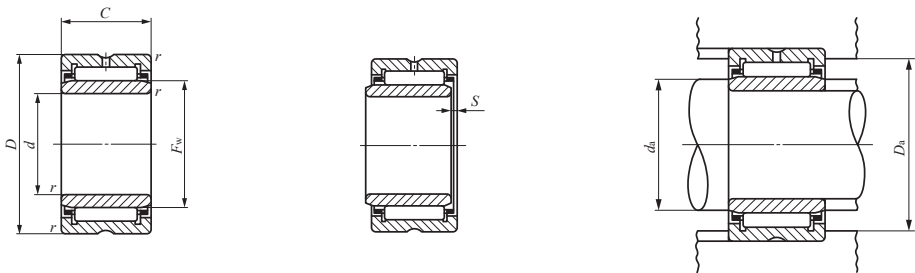
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



| Boundary dimensions mm |    |      |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |          |
|------------------------|----|------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|----------|
| D                      | C  | B    | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |          |
| 125                    | 26 | —    | 1                                           | 105                   | 1                          | 100                             | 103                        | 120                        | 84 700                    | 178 000                    | 4 000                                     | LRT                  | 9510526  |
| 125                    | 36 | —    | 1                                           | 105                   | 2                          | 100                             | 103                        | 120                        | 113 000                   | 258 000                    | 4 000                                     | LRT                  | 9510536  |
| 130                    | 35 | —    | 1.1                                         | 110                   | 1                          | 101.5                           | 108                        | 123.5                      | 116 000                   | 271 000                    | 3 500                                     | LRT                  | 9511035  |
| 130                    | 63 | —    | 1.1                                         | 110                   | 0.5                        | 101.5                           | 108                        | 123.5                      | 182 000                   | 514 000                    | 3 500                                     | LRT                  | 9511063  |
| 130                    | 30 | —    | 1                                           | 110                   | 0.5                        | 105                             | 108                        | 125                        | 106 000                   | 240 000                    | 3 500                                     | LRT                  | 10011030 |
| 130                    | 40 | —    | 1                                           | 110                   | 1.5                        | 105                             | 108                        | 125                        | 134 000                   | 324 000                    | 3 500                                     | LRT                  | 10011040 |
| 135                    | 50 | 50.5 | 1.5                                         | 110                   | 3                          | 108                             | 108.5                      | 127                        | 183 000                   | 395 000                    | 3 500                                     | LRT                  | 10011050 |
| 140                    | 40 | —    | 1.1                                         | 115                   | 1                          | 106.5                           | 113                        | 133.5                      | 145 000                   | 329 000                    | 3 500                                     | LRT                  | 10011540 |
| 135                    | 50 | 50.5 | 1.5                                         | 110                   | —                          | 108                             | 108.5                      | 127                        | 245 000                   | 603 000                    | 1 400                                     | LRTZ                 | 10011050 |
| 153                    | 50 | 50.5 | 1.5                                         | 115                   | 3                          | 113                             | 113.5                      | 145                        | 233 000                   | 414 000                    | 3 500                                     | LRT                  | 10511550 |
| 153                    | 50 | 50.5 | 1.5                                         | 115                   | —                          | 113                             | 113.5                      | 145                        | 315 000                   | 614 000                    | 1 300                                     | LRTZ                 | 10511550 |
| 140                    | 30 | —    | 1                                           | 120                   | 1                          | 115                             | 118                        | 135                        | 93 200                    | 239 000                    | 3 500                                     | LRT                  | 11012030 |
| 150                    | 40 | —    | 1.1                                         | 125                   | 1                          | 116.5                           | 123                        | 143.5                      | 152 000                   | 357 000                    | 3 000                                     | LRT                  | 11012540 |
| 150                    | 30 | —    | 1                                           | 130                   | 1                          | 125                             | 128                        | 145                        | 96 900                    | 259 000                    | 3 000                                     | LRT                  | 12013030 |
| 165                    | 45 | —    | 1.1                                         | 135                   | 2                          | 126.5                           | 133                        | 158.5                      | 187 000                   | 435 000                    | 3 000                                     | LRT                  | 12013545 |
| 178                    | 60 | 60.5 | 1.5                                         | 140                   | 2.5                        | 133                             | 138                        | 170                        | 307 000                   | 625 000                    | 3 000                                     | LRT                  | 12514060 |
| 178                    | 60 | 60.5 | 1.5                                         | 140                   | —                          | 133                             | 138                        | 170                        | 409 000                   | 923 000                    | 1 100                                     | LRTZ                 | 12514060 |
| 165                    | 35 | —    | 1.1                                         | 145                   | 1                          | 136.5                           | 143                        | 158.5                      | 116 000                   | 340 000                    | 3 000                                     | LRT                  | 13014535 |
| 180                    | 50 | —    | 1.5                                         | 150                   | 2.5                        | 138                             | 148                        | 172                        | 215 000                   | 540 000                    | 2 500                                     | LRT                  | 13015050 |
| 188                    | 60 | 60.5 | 1.5                                         | 150                   | 2.5                        | 143                             | 148                        | 180                        | 320 000                   | 675 000                    | 2 500                                     | LRT                  | 13515060 |
| 188                    | 60 | 60.5 | 1.5                                         | 150                   | —                          | 143                             | 148                        | 180                        | 423 000                   | 989 000                    | 1 000                                     | LRTZ                 | 13515060 |
| 175                    | 35 | —    | 1.1                                         | 155                   | 1                          | 146.5                           | 153                        | 168.5                      | 120 000                   | 363 000                    | 2 500                                     | LRT                  | 14015535 |
| 190                    | 50 | —    | 1.5                                         | 160                   | 2.5                        | 148                             | 158                        | 182                        | 224 000                   | 580 000                    | 2 500                                     | LRT                  | 14016050 |
| 190                    | 40 | —    | 1.1                                         | 165                   | 1.5                        | 156.5                           | 163                        | 183.5                      | 168 000                   | 446 000                    | 2 500                                     | LRT                  | 15016540 |
| 210                    | 60 | —    | 2                                           | 170                   | 3                          | 159                             | 168                        | 201                        | 324 000                   | 712 000                    | 2 500                                     | LRT                  | 15017060 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring



NA49 NA48

Shaft dia. 160 – 340mm

| Shaft dia.<br>mm | Identification number |       |         |      |     |      | Mass<br>(Ref.) | d   |
|------------------|-----------------------|-------|---------|------|-----|------|----------------|-----|
|                  | NA 49                 | NA 69 | NA 48   | TAFI | TRI | GTRI | g              |     |
| 160              | —                     | —     | NA 4832 | —    | —   | —    | 3 050          | 160 |
|                  | NA 4932               | —     | —       | —    | —   | —    | 6 750          | 160 |
| 170              | —                     | —     | NA 4834 | —    | —   | —    | 4 120          | 170 |
|                  | NA 4934               | —     | —       | —    | —   | —    | 7 110          | 170 |
| 180              | —                     | —     | NA 4836 | —    | —   | —    | 4 340          | 180 |
|                  | NA 4936               | —     | —       | —    | —   | —    | 10 200         | 180 |
| 190              | —                     | —     | NA 4838 | —    | —   | —    | 5 760          | 190 |
|                  | NA 4938               | —     | —       | —    | —   | —    | 10 700         | 190 |
| 200              | —                     | —     | NA 4840 | —    | —   | —    | 6 040          | 200 |
|                  | NA 4940               | —     | —       | —    | —   | —    | 15 400         | 200 |
| 220              | —                     | —     | NA 4844 | —    | —   | —    | 6 570          | 220 |
|                  | NA 4944               | —     | —       | —    | —   | —    | 16 700         | 220 |
| 240              | —                     | —     | NA 4848 | —    | —   | —    | 10 200         | 240 |
|                  | NA 4948               | —     | —       | —    | —   | —    | 18 000         | 240 |
| 260              | —                     | —     | NA 4852 | —    | —   | —    | 11 000         | 260 |
|                  | NA 4952               | —     | —       | —    | —   | —    | 31 100         | 260 |
| 280              | —                     | —     | NA 4856 | —    | —   | —    | 15 800         | 280 |
|                  | NA 4956               | —     | —       | —    | —   | —    | 33 100         | 280 |
| 300              | —                     | —     | NA 4860 | —    | —   | —    | 22 300         | 300 |
|                  | NA 4960               | —     | —       | —    | —   | —    | 51 400         | 300 |
| 320              | —                     | —     | NA 4864 | —    | —   | —    | 23 700         | 320 |
|                  | NA 4964               | —     | —       | —    | —   | —    | 54 400         | 320 |
| 340              | —                     | —     | NA 4868 | —    | —   | —    | 25 000         | 340 |
|                  | NA 4968               | —     | —       | —    | —   | —    | 57 300         | 340 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

| Boundary dimensions mm |     |   |                                             |                                         |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring |
|------------------------|-----|---|---------------------------------------------|-----------------------------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------|
| D                      | C   | B | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <sup>(2)</sup><br><i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                      |
| 200                    | 40  | — | 1.1                                         | 175                                     | 1.5                        | 166.5                           | 173                        | 193.5                      | 173 000                   | 474 000                    | 2 500                                     | LRT 16017540         |
| 220                    | 60  | — | 2                                           | 180                                     | 3                          | 169                             | 178                        | 211                        | 337 000                   | 761 000                    | 1 900                                     | LRT 16018060         |
| 215                    | 45  | — | 1.1                                         | 185                                     | 1.5                        | 176.5                           | 183                        | 208.5                      | 211 000                   | 567 000                    | 1 900                                     | LRT 17018545         |
| 230                    | 60  | — | 2                                           | 190                                     | 3                          | 179                             | 188                        | 221                        | 347 000                   | 810 000                    | 1 900                                     | LRT 17019060         |
| 225                    | 45  | — | 1.1                                         | 195                                     | 1.5                        | 186.5                           | 193                        | 218.5                      | 218 000                   | 602 000                    | 1 900                                     | LRT 18019545         |
| 250                    | 69  | — | 2                                           | 205                                     | 3                          | 189                             | 203                        | 241                        | 434 000                   | 989 000                    | 1 900                                     | LRT 18020569         |
| 240                    | 50  | — | 1.5                                         | 210                                     | 1.5                        | 198                             | 208                        | 232                        | 249 000                   | 726 000                    | 1 800                                     | LRT 19021050         |
| 260                    | 69  | — | 2                                           | 215                                     | 3                          | 199                             | 213                        | 251                        | 440 000                   | 1 020 000                  | 1 700                                     | LRT 19021569         |
| 250                    | 50  | — | 1.5                                         | 220                                     | 1.5                        | 208                             | 218                        | 242                        | 255 000                   | 766 000                    | 1 600                                     | LRT 20022050         |
| 280                    | 80  | — | 2.1                                         | 225                                     | 4                          | 211                             | 223                        | 269                        | 518 000                   | 1 120 000                  | 1 600                                     | LRT 20022580         |
| 270                    | 50  | — | 1.5                                         | 240                                     | 1.5                        | 228                             | 238                        | 262                        | 266 000                   | 833 000                    | 1 500                                     | LRT 22024050         |
| 300                    | 80  | — | 2.1                                         | 245                                     | 4                          | 231                             | 243                        | 289                        | 536 000                   | 1 200 000                  | 1 400                                     | LRT 22024580         |
| 300                    | 60  | — | 2                                           | 265                                     | 2                          | 249                             | 262                        | 291                        | 345 000                   | 1 150 000                  | 1 300                                     | LRT 24026560         |
| 320                    | 80  | — | 2.1                                         | 265                                     | 4                          | 251                             | 262                        | 309                        | 565 000                   | 1 320 000                  | 1 300                                     | LRT 24026580         |
| 320                    | 60  | — | 2                                           | 285                                     | 2                          | 269                             | 282                        | 311                        | 354 000                   | 1 220 000                  | 1 100                                     | LRT 26028560         |
| 360                    | 100 | — | 2.1                                         | 290                                     | 4                          | 271                             | 287                        | 349                        | 847 000                   | 1 900 000                  | 1 100                                     | LRT 260290100        |
| 350                    | 69  | — | 2                                           | 305                                     | 2.5                        | 289                             | 302                        | 341                        | 486 000                   | 1 550 000                  | 950                                       | LRT 28030569         |
| 380                    | 100 | — | 2.1                                         | 310                                     | 4                          | 291                             | 307                        | 369                        | 877 000                   | 2 040 000                  | 950                                       | LRT 280310100        |
| 380                    | 80  | — | 2.1                                         | 330                                     | 2.5                        | 311                             | 327                        | 369                        | 610 000                   | 1 900 000                  | 900                                       | LRT 30033080         |
| 420                    | 118 | — | 3                                           | 340                                     | 4                          | 313                             | 337                        | 407                        | 1 130 000                 | 2 650 000                  | 850                                       | LRT 300340118        |
| 400                    | 80  | — | 2.1                                         | 350                                     | 2.5                        | 331                             | 347                        | 389                        | 635 000                   | 2 040 000                  | 750                                       | LRT 32035080         |
| 440                    | 118 | — | 3                                           | 360                                     | 4                          | 333                             | 357                        | 427                        | 1 170 000                 | 2 830 000                  | 750                                       | LRT 320360118        |
| 420                    | 80  | — | 2.1                                         | 370                                     | 2.5                        | 351                             | 367                        | 409                        | 651 000                   | 2 140 000                  | 700                                       | LRT 34037080         |
| 460                    | 118 | — | 3                                           | 380                                     | 4                          | 353                             | 377                        | 447                        | 1 220 000                 | 3 020 000                  | 700                                       | LRT 340380118        |

MACHINED TYPE NEEDLE ROLLER BEARINGS

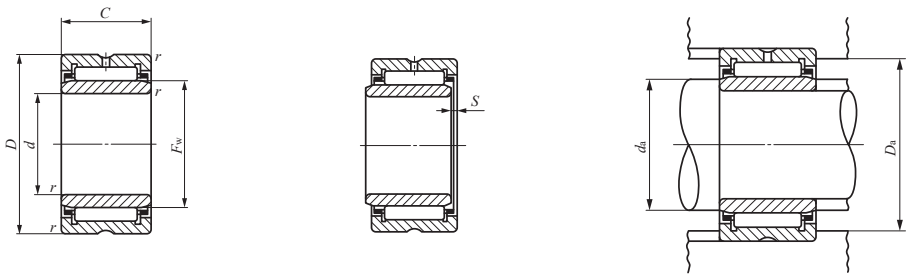
With Inner Ring



Shaft dia. 360 – 440mm

| Shaft dia.<br>mm | Identification number |       |         |      |     |      | Mass<br>(Ref.)<br>g | <i>d</i> |
|------------------|-----------------------|-------|---------|------|-----|------|---------------------|----------|
|                  | NA 49                 | NA 69 | NA 48   | TAFI | TRI | GTRI |                     |          |
| 360              | —                     | —     | NA 4872 | —    | —   | —    | 26 400              | 360      |
|                  | NA 4972               | —     | —       | —    | —   | —    | 60 200              | 360      |
| 380              | —                     | —     | NA 4876 | —    | —   | —    | 44 600              | 380      |
|                  | NA 4976               | —     | —       | —    | —   | —    | 90 300              | 380      |
| 400              | NA 4980               | —     | —       | —    | —   | —    | 94 400              | 400      |
| 420              | NA 4984               | —     | —       | —    | —   | —    | 98 500              | 420      |
| 440              | NA 4988               | —     | —       | —    | —   | —    | 131 000             | 440      |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



NA49 NA48

| Boundary dimensions mm |            |          |                                             |                       |                            | Standard mounting dimensions mm |                            |                            | Basic dynamic load rating | Basic static load rating   | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring                         |
|------------------------|------------|----------|---------------------------------------------|-----------------------|----------------------------|---------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-------------------------------------------|----------------------------------------------|
| <i>D</i>               | <i>C</i>   | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>F</i> <sub>w</sub> | <sup>(2)</sup><br><i>S</i> | Min.                            | <i>d</i> <sub>a</sub> Max. | <i>D</i> <sub>a</sub> Max. | <i>C</i><br>N             | <i>C</i> <sub>0</sub><br>N | min <sup>-1</sup>                         |                                              |
| 440<br>480             | 80<br>118  | —<br>—   | 2.1<br>3                                    | 390<br>400            | 2.5<br>4                   | 371<br>373                      | 387<br>397                 | 429<br>467                 | 680 000<br>1 260 000      | 2 320 000<br>3 200 000     | 650<br>600                                | <b>LRT 36039080</b><br><b>LRT 360400118</b>  |
| 480<br>520             | 100<br>140 | —<br>—   | 2.1<br>4                                    | 415<br>430            | 3<br>5                     | 391<br>396                      | 412<br>427                 | 469<br>504                 | 951 000<br>1 540 000      | 2 860 000<br>4 030 000     | 600<br>500                                | <b>LRT 380415100</b><br><b>LRT 380430140</b> |
| 540                    | 140        | —        | 4                                           | 450                   | 5                          | 416                             | 447                        | 524                        | 1 590 000                 | 4 270 000                  | 500                                       | <b>LRT 400450140</b>                         |
| 560                    | 140        | —        | 4                                           | 470                   | 5                          | 436                             | 467                        | 544                        | 1 640 000                 | 4 510 000                  | 500                                       | <b>LRT 420470140</b>                         |
| 600                    | 160        | —        | 4                                           | 490                   | 5                          | 456                             | 487                        | 584                        | 1 910 000                 | 5 140 000                  | 400                                       | <b>LRT 440490160</b>                         |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |
|                        |            |          |                                             |                       |                            |                                 |                            |                            |                           |                            |                                           |                                              |

MACHINED TYPE NEEDLE ROLLER BEARINGS

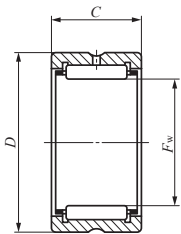
Without Inner Ring, Inch Series



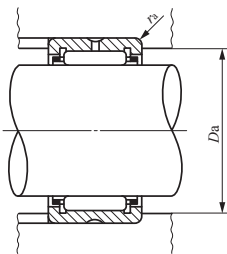
Shaft dia. 15.875 — 47.625mm

| Shaft dia.<br>mm<br>(inch) | Identification<br>number | Mass<br>(Ref.)<br><br>g | Boundary dimensions mm(inch) |                  |                 | Standard mounting<br>dimensions mm |                     |
|----------------------------|--------------------------|-------------------------|------------------------------|------------------|-----------------|------------------------------------|---------------------|
|                            |                          |                         | $F_w$                        | $D$              | $C$             | $D_a$<br>Max.                      | $r_{as\ max}^{(1)}$ |
| 15.875<br>(5/8)            | BR 101812                | 49                      | 15.875 ( 5/8 )               | 28.575 (1 1/8 )  | 19.050 ( 3/4 )  | 24.5                               | 0.6                 |
| 19.050<br>(3/4)            | BR 122012                | 56                      | 19.050 ( 3/4 )               | 31.750 (1 1/4 )  | 19.050 ( 3/4 )  | 26.5                               | 1                   |
|                            | BR 122016                | 75                      | 19.050 ( 3/4 )               | 31.750 (1 1/4 )  | 25.400 (1 )     | 26.5                               | 1                   |
| 22.225<br>(7/8)            | BR 142212                | 63                      | 22.225 ( 7/8 )               | 34.925 (1 3/8 )  | 19.050 ( 3/4 )  | 29.7                               | 1                   |
|                            | BR 142216                | 84.5                    | 22.225 ( 7/8 )               | 34.925 (1 3/8 )  | 25.400 (1 )     | 29.7                               | 1                   |
| 25.400<br>(1)              | BR 162412                | 69                      | 25.400 (1 )                  | 38.100 (1 1/2 )  | 19.050 ( 3/4 )  | 32.9                               | 1                   |
|                            | BR 162416                | 92.5                    | 25.400 (1 )                  | 38.100 (1 1/2 )  | 25.400 (1 )     | 32.9                               | 1                   |
| 28.575<br>(1 1/8)          | BR 182616                | 102                     | 28.575 (1 1/8 )              | 41.275 (1 5/8 )  | 25.400 (1 )     | 36                                 | 1                   |
|                            | BR 182620                | 128                     | 28.575 (1 1/8 )              | 41.275 (1 5/8 )  | 31.750 (1 1/4 ) | 36                                 | 1                   |
| 31.750<br>(1 1/4)          | BR 202816                | 110                     | 31.750 (1 1/4 )              | 44.450 (1 3/4 )  | 25.400 (1 )     | 39.2                               | 1                   |
|                            | BR 202820                | 138                     | 31.750 (1 1/4 )              | 44.450 (1 3/4 )  | 31.750 (1 1/4 ) | 39.2                               | 1                   |
| 34.925<br>(1 3/8)          | BR 223016                | 119                     | 34.925 (1 3/8 )              | 47.625 (1 7/8 )  | 25.400 (1 )     | 42.4                               | 1                   |
|                            | BR 223020                | 149                     | 34.925 (1 3/8 )              | 47.625 (1 7/8 )  | 31.750 (1 1/4 ) | 42.4                               | 1                   |
| 38.100<br>(1 1/2)          | BR 243316                | 149                     | 38.100 (1 1/2 )              | 52.388 (2 1/16 ) | 25.400 (1 )     | 45.1                               | 1.5                 |
|                            | BR 243320                | 187                     | 38.100 (1 1/2 )              | 52.388 (2 1/16 ) | 31.750 (1 1/4 ) | 45.1                               | 1.5                 |
| 41.275<br>(1 5/8)          | BR 263516                | 158                     | 41.275 (1 5/8 )              | 55.562 (2 3/16 ) | 25.400 (1 )     | 48.3                               | 1.5                 |
|                            | BR 263520                | 199                     | 41.275 (1 5/8 )              | 55.562 (2 3/16 ) | 31.750 (1 1/4 ) | 48.3                               | 1.5                 |
| 44.450<br>(1 3/4)          | BR 283716                | 170                     | 44.450 (1 3/4 )              | 58.738 (2 5/16 ) | 25.400 (1 )     | 51.5                               | 1.5                 |
|                            | BR 283720                | 215                     | 44.450 (1 3/4 )              | 58.738 (2 5/16 ) | 31.750 (1 1/4 ) | 51.5                               | 1.5                 |
|                            | BR 283820                | 250                     | 44.450 (1 3/4 )              | 60.325 (2 3/8 )  | 31.750 (1 1/4 ) | 53.1                               | 1.5                 |
| 47.625<br>(1 7/8)          | BR 303920                | 225                     | 47.625 (1 7/8 )              | 61.912 (2 7/16 ) | 31.750 (1 1/4 ) | 54.7                               | 1.5                 |

Notes<sup>(1)</sup> Maximum permissible corner radius of the housing  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.



BR



| Basic dynamic<br>load rating<br>$C$<br><br>N | Basic static<br>load rating<br>$C_0$<br><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br><br>min <sup>-1</sup> |
|----------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------|
| 18 900                                       | 19 700                                        | 25 000                                                                   |
| 21 700<br>27 600                             | 24 400<br>33 100                              | 20 000<br>20 000                                                         |
| 23 000<br>29 100                             | 27 100<br>36 800                              | 18 000<br>18 000                                                         |
| 25 300<br>32 100                             | 31 900<br>43 300                              | 16 000<br>16 000                                                         |
| 34 900<br>43 200                             | 49 900<br>65 600                              | 14 000<br>14 000                                                         |
| 36 000<br>44 600                             | 53 500<br>70 300                              | 13 000<br>13 000                                                         |
| 38 500<br>47 700                             | 60 000<br>78 900                              | 11 000<br>11 000                                                         |
| 43 700<br>54 200                             | 66 900<br>88 200                              | 11 000<br>11 000                                                         |
| 44 800<br>55 600                             | 70 900<br>93 400                              | 9 500<br>9 500                                                           |
| 47 500<br>58 900<br>58 900                   | 78 200<br>103 000<br>103 000                  | 9 000<br>9 000<br>9 000                                                  |
| 60 100                                       | 108 000                                       | 8 500                                                                    |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

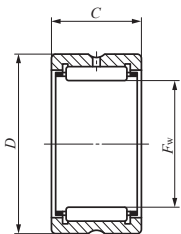
Without Inner Ring, Inch Series



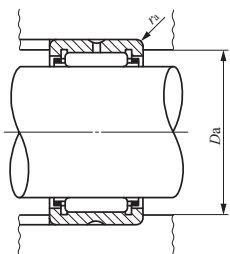
Shaft dia. 50.800 — 101.600mm

| Shaft dia.<br>mm<br>(inch) | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch) |                 |                | Standard mounting<br>dimensions mm |                     |
|----------------------------|--------------------------|---------------------|------------------------------|-----------------|----------------|------------------------------------|---------------------|
|                            |                          |                     | $F_w$                        | $D$             | $C$            | $D_a$<br>Max.                      | $r_{as\ max}^{(1)}$ |
| 50.800<br>(2)              | BR 324116<br>BR 324120   | 190                 | 50.800 (2 )                  | 65.088 (2 9/16) | 25.400 (1 )    | 57.8                               | 1.5                 |
|                            |                          | 240                 | 50.800 (2 )                  | 65.088 (2 9/16) | 31.750 (1 1/4) | 57.8                               | 1.5                 |
| 57.150<br>(2 1/4)          | BR 364824<br>BR 364828   | 435                 | 57.150 (2 1/4)               | 76.200 (3 )     | 38.100 (1 1/2) | 69                                 | 1.5                 |
|                            |                          | 510                 | 57.150 (2 1/4)               | 76.200 (3 )     | 44.450 (1 3/4) | 69                                 | 1.5                 |
| 63.500<br>(2 1/2)          | BR 405224<br>BR 405228   | 475                 | 63.500 (2 1/2)               | 82.550 (3 1/4)  | 38.100 (1 1/2) | 74.3                               | 2                   |
|                            |                          | 555                 | 63.500 (2 1/2)               | 82.550 (3 1/4)  | 44.450 (1 3/4) | 74.3                               | 2                   |
| 69.850<br>(2 3/4)          | BR 445624<br>BR 445628   | 510                 | 69.850 (2 3/4)               | 88.900 (3 1/2)  | 38.100 (1 1/2) | 80.7                               | 2                   |
|                            |                          | 600                 | 69.850 (2 3/4)               | 88.900 (3 1/2)  | 44.450 (1 3/4) | 80.7                               | 2                   |
| 76.200<br>(3)              | BR 486024<br>BR 486028   | 555                 | 76.200 (3 )                  | 95.250 (3 3/4)  | 38.100 (1 1/2) | 87                                 | 2                   |
|                            |                          | 650                 | 76.200 (3 )                  | 95.250 (3 3/4)  | 44.450 (1 3/4) | 87                                 | 2                   |
| 82.550<br>(3 1/4)          | BR 526828<br>BR 526832   | 990                 | 82.550 (3 1/4)               | 107.950 (4 1/4) | 44.450 (1 3/4) | 99.7                               | 2                   |
|                            |                          | 1 140               | 82.550 (3 1/4)               | 107.950 (4 1/4) | 50.800 (2 )    | 99.7                               | 2                   |
| 88.900<br>(3 1/2)          | BR 567232                | 1 220               | 88.900 (3 1/2)               | 114.300 (4 1/2) | 50.800 (2 )    | 106.1                              | 2                   |
| 95.250<br>(3 3/4)          | BR 607632                | 1 290               | 95.250 (3 3/4)               | 120.650 (4 3/4) | 50.800 (2 )    | 111.4                              | 2.5                 |
| 101.600<br>(4)             | BR 648032                | 1 370               | 101.600 (4 )                 | 127.000 (5 )    | 50.800 (2 )    | 117.8                              | 2.5                 |

Notes<sup>(1)</sup> Maximum permissible corner radius of the housing  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. In bearings with a roller set bore diameter  $F_w$  of 69.850 mm or less, the outer ring has an oil groove and an oil hole. In others, the outer ring has an oil groove and two oil holes.  
2. No grease is prepacked. Perform proper lubrication.



BR



| Basic dynamic<br>load rating<br>$C$<br>N | Basic static<br>load rating<br>$C_0$<br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| 51 000                                   | 89 400                                    | 8 000                                                                |
| 63 200                                   | 118 000                                   | 8 000                                                                |
| 90 300                                   | 158 000                                   | 7 000                                                                |
| 105 000                                  | 191 000                                   | 7 000                                                                |
| 94 600                                   | 174 000                                   | 6 500                                                                |
| 110 000                                  | 210 000                                   | 6 500                                                                |
| 98 700                                   | 189 000                                   | 5 500                                                                |
| 114 000                                  | 228 000                                   | 5 500                                                                |
| 105 000                                  | 211 000                                   | 5 500                                                                |
| 122 000                                  | 255 000                                   | 5 500                                                                |
| 141 000                                  | 259 000                                   | 5 000                                                                |
| 154 000                                  | 290 000                                   | 5 000                                                                |
| 162 000                                  | 316 000                                   | 4 500                                                                |
| 169 000                                  | 342 000                                   | 4 000                                                                |
| 176 000                                  | 368 000                                   | 4 000                                                                |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

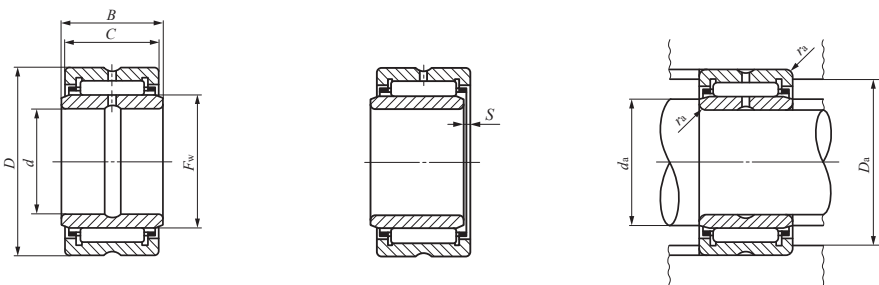
With Inner Ring, Inch Series



Shaft dia. 9.525 — 41.275mm

| Shaft dia.<br>mm<br>(inch)                        | Identification<br>number                                                         | Mass<br>(Ref.) | Boundary dimensions mm(inch)            |                                          |                                         |          |                                         |     | <sup>(1)</sup><br><i>S</i> |
|---------------------------------------------------|----------------------------------------------------------------------------------|----------------|-----------------------------------------|------------------------------------------|-----------------------------------------|----------|-----------------------------------------|-----|----------------------------|
|                                                   |                                                                                  | g              | <i>d</i>                                | <i>D</i>                                 | <i>C</i>                                | <i>B</i> | <i>F<sub>w</sub></i>                    |     |                            |
| <b>9.525</b><br>( <sup>3</sup> / <sub>8</sub> )   | <b>BRI 61812</b>                                                                 | 67.5           | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | 28.575 (1 <sup>1</sup> / <sub>8</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 19.300   | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 0.3 |                            |
| <b>12.700</b><br>( <sup>1</sup> / <sub>2</sub> )  | <b>BRI 82012</b><br><b>BRI 82016</b>                                             | 79.5           | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 19.300   | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 0.3 |                            |
|                                                   |                                                                                  | 106            | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> )  | 25.400 (1 )                             | 25.650   | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 0.5 |                            |
| <b>15.875</b><br>( <sup>5</sup> / <sub>8</sub> )  | <b>BRI 102212</b><br><b>BRI 102216</b>                                           | 91             | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 34.925 (1 <sup>3</sup> / <sub>8</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 19.300   | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | 0.3 |                            |
|                                                   |                                                                                  | 122            | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 34.925 (1 <sup>3</sup> / <sub>8</sub> )  | 25.400 (1 )                             | 25.650   | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | 0.5 |                            |
| <b>19.050</b><br>( <sup>3</sup> / <sub>4</sub> )  | <b>BRI 122412</b><br><b>BRI 122416</b>                                           | 102            | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 38.100 (1 <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 19.300   | 25.400 (1 )                             | 0.3 |                            |
|                                                   |                                                                                  | 136            | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | 38.100 (1 <sup>1</sup> / <sub>2</sub> )  | 25.400 (1 )                             | 25.650   | 25.400 (1 )                             | 0.5 |                            |
| <b>22.225</b><br>( <sup>7</sup> / <sub>8</sub> )  | <b>BRI 142616</b><br><b>BRI 142620</b>                                           | 152            | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | 41.275 (1 <sup>5</sup> / <sub>8</sub> )  | 25.400 (1 )                             | 25.650   | 28.575 (1 <sup>1</sup> / <sub>8</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 190            | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | 41.275 (1 <sup>5</sup> / <sub>8</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 28.575 (1 <sup>1</sup> / <sub>8</sub> ) | 0.5 |                            |
| <b>25.400</b><br>(1)                              | <b>BRI 162816</b><br><b>BRI 162820</b>                                           | 166            | 25.400 (1 )                             | 44.450 (1 <sup>3</sup> / <sub>4</sub> )  | 25.400 (1 )                             | 25.650   | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 210            | 25.400 (1 )                             | 44.450 (1 <sup>3</sup> / <sub>4</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 0.5 |                            |
| <b>28.575</b><br>(1 <sup>1</sup> / <sub>8</sub> ) | <b>BRI 183016</b><br><b>BRI 183020</b>                                           | 182            | 28.575 (1 <sup>1</sup> / <sub>8</sub> ) | 47.625 (1 <sup>7</sup> / <sub>8</sub> )  | 25.400 (1 )                             | 25.650   | 34.925 (1 <sup>3</sup> / <sub>8</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 225            | 28.575 (1 <sup>1</sup> / <sub>8</sub> ) | 47.625 (1 <sup>7</sup> / <sub>8</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 34.925 (1 <sup>3</sup> / <sub>8</sub> ) | 0.5 |                            |
| <b>31.750</b><br>(1 <sup>1</sup> / <sub>4</sub> ) | <b>BRI 203316</b><br><b>BRI 203320</b>                                           | 220            | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 52.388 (2 <sup>1</sup> / <sub>16</sub> ) | 25.400 (1 )                             | 25.650   | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 275            | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 52.388 (2 <sup>1</sup> / <sub>16</sub> ) | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 0.5 |                            |
| <b>34.925</b><br>(1 <sup>3</sup> / <sub>8</sub> ) | <b>BRI 223516</b><br><b>BRI 223520</b>                                           | 235            | 34.925 (1 <sup>3</sup> / <sub>8</sub> ) | 55.562 (2 <sup>3</sup> / <sub>16</sub> ) | 25.400 (1 )                             | 25.650   | 41.275 (1 <sup>5</sup> / <sub>8</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 295            | 34.925 (1 <sup>3</sup> / <sub>8</sub> ) | 55.562 (2 <sup>3</sup> / <sub>16</sub> ) | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 41.275 (1 <sup>5</sup> / <sub>8</sub> ) | 0.5 |                            |
| <b>38.100</b><br>(1 <sup>1</sup> / <sub>2</sub> ) | <b>BRI 243716</b><br><b>BRI 243720</b><br><b>BRI 243820</b><br><b>BRI 243920</b> | 250            | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 58.738 (2 <sup>5</sup> / <sub>16</sub> ) | 25.400 (1 )                             | 25.650   | 44.450 (1 <sup>3</sup> / <sub>4</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 315            | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 58.738 (2 <sup>5</sup> / <sub>16</sub> ) | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 44.450 (1 <sup>3</sup> / <sub>4</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 350            | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 60.325 (2 <sup>3</sup> / <sub>8</sub> )  | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 44.450 (1 <sup>3</sup> / <sub>4</sub> ) | 0.5 |                            |
|                                                   |                                                                                  | 380            | 38.100 (1 <sup>1</sup> / <sub>2</sub> ) | 61.912 (2 <sup>7</sup> / <sub>16</sub> ) | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 47.625 (1 <sup>7</sup> / <sub>8</sub> ) | 0.5 |                            |
| <b>41.275</b><br>(1 <sup>5</sup> / <sub>8</sub> ) | <b>BRI 264116</b><br><b>BRI 264120</b>                                           | 325            | 41.275 (1 <sup>5</sup> / <sub>8</sub> ) | 65.088 (2 <sup>9</sup> / <sub>16</sub> ) | 25.400 (1 )                             | 25.650   | 50.800 (2 )                             | 0.5 |                            |
|                                                   |                                                                                  | 410            | 41.275 (1 <sup>5</sup> / <sub>8</sub> ) | 65.088 (2 <sup>9</sup> / <sub>16</sub> ) | 31.750 (1 <sup>1</sup> / <sub>4</sub> ) | 32.000   | 50.800 (2 )                             | 0.5 |                            |

Notes<sup>(1)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(2)</sup> Maximum permissible corner radius of the shaft or housing  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The inner ring and the outer ring each have an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

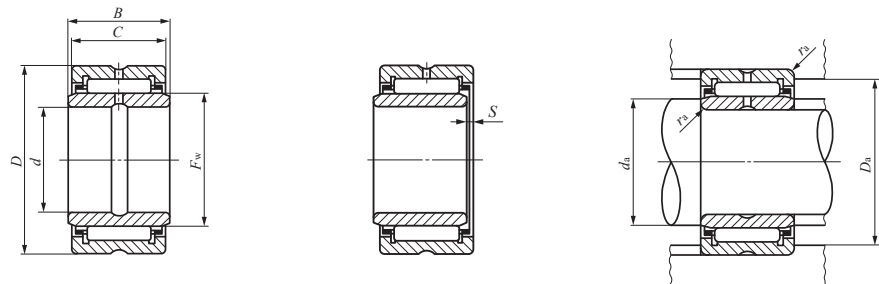


BRI

| Standard mounting dimensions mm |                              |                              |                                          | Basic dynamic load rating<br><i>C</i><br>N | Basic static load rating<br><i>C<sub>0</sub></i><br>N | Allowable rotational speed <sup>(3)</sup><br><br>min <sup>-1</sup> | Assembled inner ring |
|---------------------------------|------------------------------|------------------------------|------------------------------------------|--------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------|----------------------|
| <i>d<sub>a</sub></i><br>Min.    | <i>d<sub>a</sub></i><br>Max. | <i>D<sub>a</sub></i><br>Max. | <i>r<sub>as</sub></i> max <sup>(2)</sup> |                                            |                                                       |                                                                    |                      |
| 14                              | 14.5                         | 24.5                         | 0.6                                      | 18 900                                     | 19 700                                                | 25 000                                                             | LRB 61012            |
| 17.5                            | 18                           | 26.5                         | 1                                        | 21 700                                     | 24 400                                                | 20 000                                                             | LRB 81212            |
| 17.5                            | 18                           | 26.5                         | 1                                        | 27 600                                     | 33 100                                                | 20 000                                                             | LRB 81216            |
| 21                              | 21.2                         | 29.7                         | 1                                        | 23 000                                     | 27 100                                                | 18 000                                                             | LRB 101412           |
| 21                              | 21.2                         | 29.7                         | 1                                        | 29 100                                     | 36 800                                                | 18 000                                                             | LRB 101416           |
| 24                              | 24.4                         | 32.9                         | 1                                        | 25 300                                     | 31 900                                                | 16 000                                                             | LRB 121612           |
| 24                              | 24.4                         | 32.9                         | 1                                        | 32 100                                     | 43 300                                                | 16 000                                                             | LRB 121616           |
| 27                              | 27.5                         | 36                           | 1                                        | 34 900                                     | 49 900                                                | 14 000                                                             | LRB 141816           |
| 27                              | 27.5                         | 36                           | 1                                        | 43 200                                     | 65 600                                                | 14 000                                                             | LRB 141820           |
| 30.5                            | 30.7                         | 39.2                         | 1                                        | 36 000                                     | 53 500                                                | 13 000                                                             | LRB 162016           |
| 30.5                            | 30.7                         | 39.2                         | 1                                        | 44 600                                     | 70 300                                                | 13 000                                                             | LRB 162020           |
| 33.5                            | 33.9                         | 42.4                         | 1                                        | 38 500                                     | 60 000                                                | 11 000                                                             | LRB 182216           |
| 33.5                            | 33.9                         | 42.4                         | 1                                        | 47 700                                     | 78 900                                                | 11 000                                                             | LRB 182220           |
| 37                              | 37.1                         | 45.1                         | 1.5                                      | 43 700                                     | 66 900                                                | 11 000                                                             | LRB 202416           |
| 37                              | 37.1                         | 45.1                         | 1.5                                      | 54 200                                     | 88 200                                                | 11 000                                                             | LRB 202420           |
| 40.2                            | 40.2                         | 48.3                         | 1.5                                      | 44 800                                     | 70 900                                                | 9 500                                                              | LRB 222616           |
| 40.2                            | 40.2                         | 48.3                         | 1.5                                      | 55 600                                     | 93 400                                                | 9 500                                                              | LRB 222620           |
| 43.3                            | 43.4                         | 51.5                         | 1.5                                      | 47 500                                     | 78 200                                                | 9 000                                                              | LRB 242816           |
| 43.3                            | 43.4                         | 51.5                         | 1.5                                      | 58 900                                     | 103 000                                               | 9 000                                                              | LRB 242820           |
| 43.3                            | 43.4                         | 53.1                         | 1.5                                      | 58 900                                     | 103 000                                               | 9 000                                                              | LRB 242820           |
| 43.3                            | 43.4                         | 54.7                         | 1.5                                      | 60 100                                     | 108 000                                               | 8 500                                                              | LRB 243020           |
| 48                              | 49                           | 57.8                         | 1.5                                      | 51 000                                     | 89 400                                                | 8 000                                                              | LRB 263216           |
| 48                              | 49                           | 57.8                         | 1.5                                      | 63 200                                     | 118 000                                               | 8 000                                                              | LRB 263220           |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring, Inch Series



BRI

Shaft dia. 44.450 — 88.900mm

| Shaft dia.<br>mm<br>(inch) | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch) |                 |                |        |                |                  |
|----------------------------|--------------------------|---------------------|------------------------------|-----------------|----------------|--------|----------------|------------------|
|                            |                          |                     | d                            | D               | C              | B      | F <sub>w</sub> | S <sup>(1)</sup> |
| 44.450<br>(1 3/4)          | BRI 284824<br>BRI 284828 | 735                 | 44.450 (1 3/4)               | 76.200 (3 )     | 38.100 (1 1/2) | 38.350 | 57.150 (2 1/4) | 1                |
|                            |                          | 855                 | 44.450 (1 3/4)               | 76.200 (3 )     | 44.450 (1 3/4) | 44.700 | 57.150 (2 1/4) | 1                |
| 50.800<br>(2)              | BRI 325224<br>BRI 325228 | 810                 | 50.800 (2 )                  | 82.550 (3 1/4)  | 38.100 (1 1/2) | 38.350 | 63.500 (2 1/2) | 1                |
|                            |                          | 945                 | 50.800 (2 )                  | 82.550 (3 1/4)  | 44.450 (1 3/4) | 44.700 | 63.500 (2 1/2) | 1                |
| 57.150<br>(2 1/4)          | BRI 365624<br>BRI 365628 | 885                 | 57.150 (2 1/4)               | 88.900 (3 1/2)  | 38.100 (1 1/2) | 38.350 | 69.850 (2 3/4) | 1                |
|                            |                          | 1 040               | 57.150 (2 1/4)               | 88.900 (3 1/2)  | 44.450 (1 3/4) | 44.700 | 69.850 (2 3/4) | 1                |
| 63.500<br>(2 1/2)          | BRI 406024<br>BRI 406028 | 965                 | 63.500 (2 1/2)               | 95.250 (3 3/4)  | 38.100 (1 1/2) | 38.350 | 76.200 (3 )    | 1                |
|                            |                          | 1 130               | 63.500 (2 1/2)               | 95.250 (3 3/4)  | 44.450 (1 3/4) | 44.700 | 76.200 (3 )    | 1                |
| 69.850<br>(2 3/4)          | BRI 446828<br>BRI 446832 | 1 520               | 69.850 (2 3/4)               | 107.950 (4 1/4) | 44.450 (1 3/4) | 44.700 | 82.550 (3 1/4) | 1.5              |
|                            |                          | 1 740               | 69.850 (2 3/4)               | 107.950 (4 1/4) | 50.800 (2 )    | 51.050 | 82.550 (3 1/4) | 3                |
| 76.200<br>(3)              | BRI 487232               | 1 860               | 76.200 (3 )                  | 114.300 (4 1/2) | 50.800 (2 )    | 51.050 | 88.900 (3 1/2) | 3                |
| 82.550<br>(3 1/4)          | BRI 527632               | 1 980               | 82.550 (3 1/4)               | 120.650 (4 3/4) | 50.800 (2 )    | 51.050 | 95.250 (3 3/4) | 3                |
| 88.900<br>(3 1/2)          | BRI 568032               | 2 120               | 88.900 (3 1/2)               | 127.000 (5 )    | 50.800 (2 )    | 51.050 | 101.600 (4 )   | 3                |

Notes<sup>(1)</sup> Allowable axial shift amount of inner ring to outer ring  
<sup>(2)</sup> Maximum permissible corner radius of the shaft or housing  
<sup>(3)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. In bearings with a bearing bore diameter, *d*, of 57.150 mm or less, the outer ring has an oil groove and an oil hole. In bearings with a bearing bore diameter, *d*, of 76.200 mm or less, the inner ring has an oil groove and an oil hole. In others, the inner ring and the outer ring each have an oil groove and two oil holes.  
2. No grease is prepacked. Perform proper lubrication.

| Standard mounting dimensions mm |      |                       |                                           | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(3)</sup> | Assembled inner ring     |
|---------------------------------|------|-----------------------|-------------------------------------------|---------------------------|--------------------------|-------------------------------------------|--------------------------|
| <i>d</i> <sub>a</sub>           |      | <i>D</i> <sub>a</sub> | <i>r</i> <sub>as max</sub> <sup>(2)</sup> | <i>C</i>                  | <i>C</i> <sub>0</sub>    | min <sup>-1</sup>                         |                          |
| Min.                            | Max. | Max.                  |                                           | N                         | N                        |                                           |                          |
| 52.5                            | 55   | 69                    | 1.5                                       | 90 300                    | 158 000                  | 7 000                                     | LRB 283624<br>LRB 283628 |
| 52.5                            | 55   | 69                    | 1.5                                       | 105 000                   | 191 000                  | 7 000                                     |                          |
| 58                              | 61   | 74.3                  | 2                                         | 94 600                    | 174 000                  | 6 500                                     | LRB 324024<br>LRB 324028 |
| 58                              | 61   | 74.3                  | 2                                         | 110 000                   | 210 000                  | 6 500                                     |                          |
| 65                              | 67   | 80.7                  | 2                                         | 98 700                    | 189 000                  | 5 500                                     | LRB 364424<br>LRB 364428 |
| 65                              | 67   | 80.7                  | 2                                         | 114 000                   | 228 000                  | 5 500                                     |                          |
| 71                              | 73   | 87                    | 2                                         | 105 000                   | 211 000                  | 5 500                                     | LRB 404824<br>LRB 404828 |
| 71                              | 73   | 87                    | 2                                         | 122 000                   | 255 000                  | 5 500                                     |                          |
| 77                              | 79   | 99.7                  | 2                                         | 141 000                   | 259 000                  | 5 000                                     | LRB 445228<br>LRB 445232 |
| 77                              | 79   | 99.7                  | 2                                         | 154 000                   | 290 000                  | 5 000                                     |                          |
| 83.5                            | 86   | 106.1                 | 2                                         | 162 000                   | 316 000                  | 4 500                                     | LRB 485632               |
| 91                              | 93   | 111.4                 | 2.5                                       | 169 000                   | 342 000                  | 4 000                                     | LRB 526032               |
| 97                              | 99   | 117.8                 | 2.5                                       | 176 000                   | 368 000                  | 4 000                                     | LRB 566432               |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Seal, Without Inner Ring

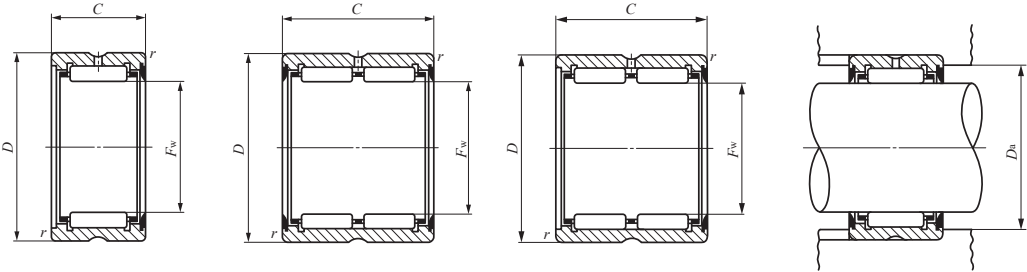


RNA49 ... UU  
RNA69 ... UU ( $F_w \leq 35$ )

Shaft dia. 14 — 45mm

| Shaft dia.<br>mm | Identification number |                 |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |     |     |                    |
|------------------|-----------------------|-----------------|----------------|---------------|---------------------|---------------------------|-----|-----|--------------------|
|                  | With two seals        | With one seal   | With two seals | With one seal |                     | $F_w$                     | $D$ | $C$ | $r_{s \min}^{(1)}$ |
| 14               | RNA 4900UU            | RNA 4900U       | —              | —             | 16.3                | 14                        | 22  | 13  | 0.3                |
| 16               | RNA 4901UU<br>—       | RNA 4901U<br>—  | —              | —             | 17.9                | 16                        | 24  | 13  | 0.3                |
|                  |                       |                 | RNA 6901UU     | RNA 6901U     | 30                  | 16                        | 24  | 22  | 0.3                |
| 18               | RNA 49/14UU           | RNA 49/14U      | —              | —             | 19.7                | 18                        | 26  | 13  | 0.3                |
| 20               | RNA 4902UU<br>—       | RNA 4902U<br>—  | —              | —             | 21.5                | 20                        | 28  | 13  | 0.3                |
|                  |                       |                 | RNA 6902UU     | RNA 6902U     | 37.5                | 20                        | 28  | 23  | 0.3                |
| 22               | RNA 4903UU<br>—       | RNA 4903U<br>—  | —              | —             | 23                  | 22                        | 30  | 13  | 0.3                |
|                  |                       |                 | RNA 6903UU     | RNA 6903U     | 40.5                | 22                        | 30  | 23  | 0.3                |
| 25               | RNA 4904UU<br>—       | RNA 4904U<br>—  | —              | —             | 54.5                | 25                        | 37  | 17  | 0.3                |
|                  |                       |                 | RNA 6904UU     | RNA 6904U     | 95.5                | 25                        | 37  | 30  | 0.3                |
| 28               | RNA 49/22UU<br>—      | RNA 49/22U<br>— | —              | —             | 55.5                | 28                        | 39  | 17  | 0.3                |
|                  |                       |                 | RNA 69/22UU    | RNA 69/22U    | 97.5                | 28                        | 39  | 30  | 0.3                |
| 30               | RNA 4905UU<br>—       | RNA 4905U<br>—  | —              | —             | 63                  | 30                        | 42  | 17  | 0.3                |
|                  |                       |                 | RNA 6905UU     | RNA 6905U     | 111                 | 30                        | 42  | 30  | 0.3                |
| 32               | RNA 49/28UU<br>—      | RNA 49/28U<br>— | —              | —             | 75.5                | 32                        | 45  | 17  | 0.3                |
|                  |                       |                 | RNA 69/28UU    | RNA 69/28U    | 133                 | 32                        | 45  | 30  | 0.3                |
| 35               | RNA 4906UU<br>—       | RNA 4906U<br>—  | —              | —             | 71                  | 35                        | 47  | 17  | 0.3                |
|                  |                       |                 | RNA 6906UU     | RNA 6906U     | 125                 | 35                        | 47  | 30  | 0.3                |
| 40               | RNA 49/32UU<br>—      | RNA 49/32U<br>— | —              | —             | 94.5                | 40                        | 52  | 20  | 0.6                |
|                  |                       |                 | RNA 69/32UU    | RNA 69/32U    | 170                 | 40                        | 52  | 36  | 0.6                |
| 42               | RNA 4907UU<br>—       | RNA 4907U<br>—  | —              | —             | 112                 | 42                        | 55  | 20  | 0.6                |
|                  |                       |                 | RNA 6907UU     | RNA 6907U     | 200                 | 42                        | 55  | 36  | 0.6                |
| 45               | RNA 49/38UU           | RNA 49/38U      | —              | —             | 119                 | 45                        | 58  | 20  | 0.6                |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.



RNA49 ... U  
RNA69 ... U ( $F_w \leq 35$ )  
RNA69 ... UU  
RNA69 ... U

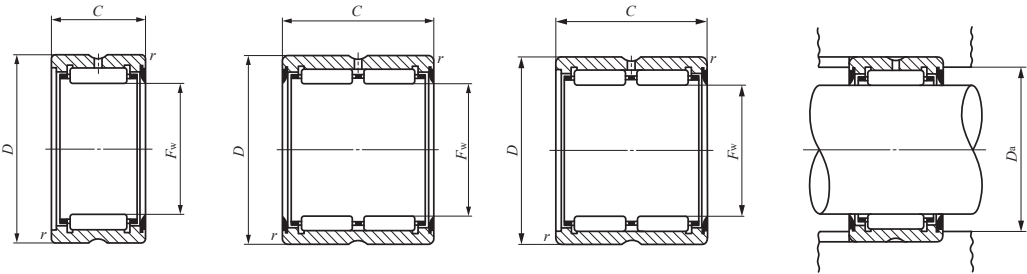
| Standard mounting dimension<br>$D_a$<br>Max. mm | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N | Allowable rotational speed <sup>(2)</sup><br>$n$<br>min <sup>-1</sup> |
|-------------------------------------------------|---------------------------------------|----------------------------------------|-----------------------------------------------------------------------|
| 20                                              | 8 080                                 | 8 490                                  | 14 000                                                                |
| 22                                              | 8 470                                 | 9 320                                  | 12 000                                                                |
| 22                                              | 15 500                                | 20 400                                 | 12 000                                                                |
| 24                                              | 9 260                                 | 10 800                                 | 11 000                                                                |
| 26                                              | 9 570                                 | 11 600                                 | 9 500                                                                 |
| 26                                              | 18 500                                | 27 100                                 | 9 500                                                                 |
| 28                                              | 10 300                                | 13 100                                 | 8 500                                                                 |
| 28                                              | 19 800                                | 30 600                                 | 8 500                                                                 |
| 35                                              | 18 000                                | 20 500                                 | 7 500                                                                 |
| 35                                              | 33 000                                | 44 600                                 | 7 500                                                                 |
| 37                                              | 18 300                                | 23 700                                 | 7 000                                                                 |
| 37                                              | 33 800                                | 52 000                                 | 7 000                                                                 |
| 40                                              | 20 300                                | 25 100                                 | 6 500                                                                 |
| 40                                              | 39 200                                | 58 700                                 | 6 500                                                                 |
| 43                                              | 21 000                                | 26 800                                 | 6 000                                                                 |
| 43                                              | 38 900                                | 59 100                                 | 6 000                                                                 |
| 45                                              | 21 500                                | 28 400                                 | 5 500                                                                 |
| 45                                              | 40 100                                | 63 000                                 | 5 500                                                                 |
| 48                                              | 29 400                                | 44 200                                 | 5 000                                                                 |
| 48                                              | 50 300                                | 88 300                                 | 5 000                                                                 |
| 51                                              | 30 100                                | 46 300                                 | 4 500                                                                 |
| 51                                              | 51 600                                | 92 600                                 | 4 500                                                                 |
| 54                                              | 31 600                                | 50 400                                 | 4 000                                                                 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Seal, Without Inner Ring



RNA49 ... UU



RNA49 ... U

RNA69 ... UU

RNA69 ... U

Shaft dia. 48 — 85mm

| Shaft dia.<br>mm | Identification number |               |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |     |     |             |
|------------------|-----------------------|---------------|----------------|---------------|---------------------|---------------------------|-----|-----|-------------|
|                  | With two seals        | With one seal | With two seals | With one seal |                     | $F_w$                     | $D$ | $C$ | $r_s^{(1)}$ |
| 48               | RNA 4908UU            | RNA 4908U     | —              | —             | 150                 | 48                        | 62  | 22  | 0.6         |
|                  | —                     | —             | RNA 6908UU     | RNA 6908U     | 270                 | 48                        | 62  | 40  | 0.6         |
| 50               | RNA 49/42UU           | RNA 49/42U    | —              | —             | 173                 | 50                        | 65  | 22  | 0.6         |
| 52               | RNA 4909UU            | RNA 4909U     | —              | —             | 197                 | 52                        | 68  | 22  | 0.6         |
|                  | —                     | —             | RNA 6909UU     | RNA 6909U     | 355                 | 52                        | 68  | 40  | 0.6         |
| 55               | RNA 49/48UU           | RNA 49/48U    | —              | —             | 187                 | 55                        | 70  | 22  | 0.6         |
| 58               | RNA 4910UU            | RNA 4910U     | —              | —             | 177                 | 58                        | 72  | 22  | 0.6         |
|                  | —                     | —             | RNA 6910UU     | RNA 6910U     | 320                 | 58                        | 72  | 40  | 0.6         |
| 60               | RNA 49/52UU           | RNA 49/52U    | —              | —             | 200                 | 60                        | 75  | 22  | 0.6         |
| 63               | RNA 4911UU            | RNA 4911U     | —              | —             | 265                 | 63                        | 80  | 25  | 1           |
|                  | —                     | —             | RNA 6911UU     | RNA 6911U     | 470                 | 63                        | 80  | 45  | 1           |
| 65               | RNA 49/58UU           | RNA 49/58U    | —              | —             | 275                 | 65                        | 82  | 25  | 1           |
| 68               | RNA 4912UU            | RNA 4912U     | —              | —             | 285                 | 68                        | 85  | 25  | 1           |
|                  | —                     | —             | RNA 6912UU     | RNA 6912U     | 505                 | 68                        | 85  | 45  | 1           |
| 70               | RNA 49/62UU           | RNA 49/62U    | —              | —             | 320                 | 70                        | 88  | 25  | 1           |
| 72               | RNA 4913UU            | RNA 4913U     | —              | —             | 325                 | 72                        | 90  | 25  | 1           |
|                  | —                     | —             | RNA 6913UU     | RNA 6913U     | 580                 | 72                        | 90  | 45  | 1           |
| 75               | RNA 49/68UU           | RNA 49/68U    | —              | —             | 465                 | 75                        | 95  | 30  | 1           |
| 80               | RNA 4914UU            | RNA 4914U     | —              | —             | 495                 | 80                        | 100 | 30  | 1           |
|                  | —                     | —             | RNA 6914UU     | RNA 6914U     | 910                 | 80                        | 100 | 54  | 1           |
| 85               | RNA 4915UU            | RNA 4915U     | —              | —             | 520                 | 85                        | 105 | 30  | 1           |
|                  | —                     | —             | RNA 6915UU     | RNA 6915U     | 960                 | 85                        | 105 | 54  | 1           |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.

| Standard mounting<br>dimension<br>$D_a$<br>Max.<br>mm | Basic dynamic<br>load rating<br>$C$<br>N | Basic static<br>load rating<br>$C_0$<br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|-------------------------------------------------------|------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| 58                                                    | 37 200                                   | 58 400                                    | 4 000                                                                |
| 58                                                    | 63 700                                   | 117 000                                   | 4 000                                                                |
| 61                                                    | 38 000                                   | 60 900                                    | 4 000                                                                |
| 64                                                    | 38 900                                   | 63 400                                    | 3 500                                                                |
| 64                                                    | 66 600                                   | 127 000                                   | 3 500                                                                |
| 66                                                    | 39 600                                   | 66 100                                    | 3 500                                                                |
| 68                                                    | 41 300                                   | 71 100                                    | 3 500                                                                |
| 68                                                    | 70 800                                   | 142 000                                   | 3 500                                                                |
| 71                                                    | 42 100                                   | 73 600                                    | 3 000                                                                |
| 75                                                    | 52 200                                   | 85 700                                    | 3 000                                                                |
| 75                                                    | 89 400                                   | 171 000                                   | 3 000                                                                |
| 77                                                    | 53 400                                   | 89 200                                    | 3 000                                                                |
| 80                                                    | 54 500                                   | 92 800                                    | 3 000                                                                |
| 80                                                    | 93 400                                   | 186 000                                   | 3 000                                                                |
| 83                                                    | 55 700                                   | 96 300                                    | 2 500                                                                |
| 85                                                    | 56 800                                   | 99 800                                    | 2 500                                                                |
| 85                                                    | 97 400                                   | 200 000                                   | 2 500                                                                |
| 90                                                    | 73 900                                   | 133 000                                   | 2 500                                                                |
| 95                                                    | 76 900                                   | 143 000                                   | 2 500                                                                |
| 95                                                    | 124 000                                  | 281 000                                   | 2 500                                                                |
| 100                                                   | 79 600                                   | 153 000                                   | 2 000                                                                |
| 100                                                   | 128 000                                  | 299 000                                   | 2 000                                                                |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Seal, Without Inner Ring

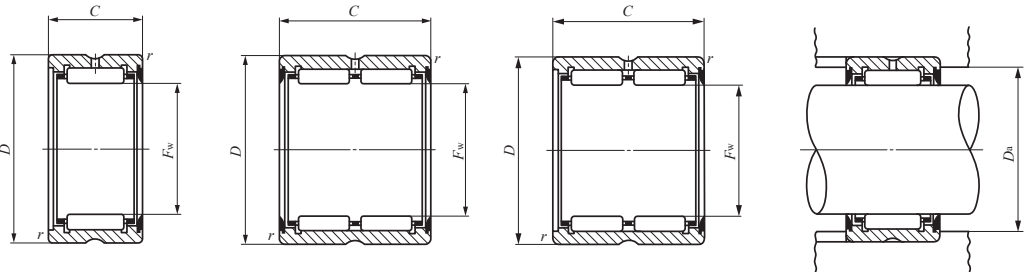


RNA49 ... UU

Shaft dia. 90 – 160mm

| Shaft dia.<br>mm | Identification number |               |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |     |     |                   |
|------------------|-----------------------|---------------|----------------|---------------|---------------------|---------------------------|-----|-----|-------------------|
|                  | With two seals        | With one seal | With two seals | With one seal |                     | $F_w$                     | $D$ | $C$ | $r_{s\min}^{(1)}$ |
| 90               | RNA 4916UU            | RNA 4916U     | —              | —             | 545                 | 90                        | 110 | 30  | 1                 |
|                  | —                     | —             | RNA 6916UU     | RNA 6916U     | 1 010               | 90                        | 110 | 54  | 1                 |
| 95               | RNA 49/82UU           | RNA 49/82U    | —              | —             | 570                 | 95                        | 115 | 30  | 1                 |
| 100              | RNA 4917UU            | RNA 4917U     | —              | —             | 695                 | 100                       | 120 | 35  | 1.1               |
|                  | —                     | —             | RNA 6917UU     | RNA 6917U     | 1 300               | 100                       | 120 | 63  | 1.1               |
| 105              | RNA 4918UU            | RNA 4918U     | —              | —             | 730                 | 105                       | 125 | 35  | 1.1               |
|                  | —                     | —             | RNA 6918UU     | RNA 6918U     | 1 360               | 105                       | 125 | 63  | 1.1               |
| 110              | RNA 4919UU            | RNA 4919U     | —              | —             | 760                 | 110                       | 130 | 35  | 1.1               |
|                  | —                     | —             | RNA 6919UU     | RNA 6919U     | 1 420               | 110                       | 130 | 63  | 1.1               |
| 115              | RNA 4920UU            | RNA 4920U     | —              | —             | 1 200               | 115                       | 140 | 40  | 1.1               |
| 125              | RNA 4922UU            | RNA 4922U     | —              | —             | 1 280               | 125                       | 150 | 40  | 1.1               |
| 135              | RNA 4924UU            | RNA 4924U     | —              | —             | 1 940               | 135                       | 165 | 45  | 1.1               |
| 150              | RNA 4926UU            | RNA 4926U     | —              | —             | 2 360               | 150                       | 180 | 50  | 1.5               |
| 160              | RNA 4928UU            | RNA 4928U     | —              | —             | 2 510               | 160                       | 190 | 50  | 1.5               |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.



RNA49 ... U

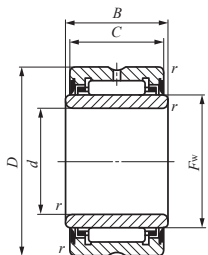
RNA69 ... UU

RNA69 ... U

| Standard mounting dimension<br>$D_a$<br>Max. mm | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N | Allowable rotational speed <sup>(2)</sup><br>$n$<br>min <sup>-1</sup> |
|-------------------------------------------------|---------------------------------------|----------------------------------------|-----------------------------------------------------------------------|
| 105                                             | 80 700                                | 158 000                                | 2 000                                                                 |
| 105                                             | 132 000                               | 317 000                                | 2 000                                                                 |
| 110                                             | 83 200                                | 168 000                                | 2 000                                                                 |
| 113.5                                           | 103 000                               | 225 000                                | 1 900                                                                 |
| 113.5                                           | 168 000                               | 448 000                                | 1 900                                                                 |
| 118.5                                           | 106 000                               | 238 000                                | 1 800                                                                 |
| 118.5                                           | 172 000                               | 471 000                                | 1 800                                                                 |
| 123.5                                           | 109 000                               | 250 000                                | 1 700                                                                 |
| 123.5                                           | 177 000                               | 493 000                                | 1 700                                                                 |
| 133.5                                           | 134 000                               | 297 000                                | 1 700                                                                 |
| 143.5                                           | 140 000                               | 322 000                                | 1 500                                                                 |
| 158.5                                           | 178 000                               | 410 000                                | 1 400                                                                 |
| 172                                             | 206 000                               | 511 000                                | 1 300                                                                 |
| 182                                             | 214 000                               | 549 000                                | 1 200                                                                 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Seal, With Inner Ring

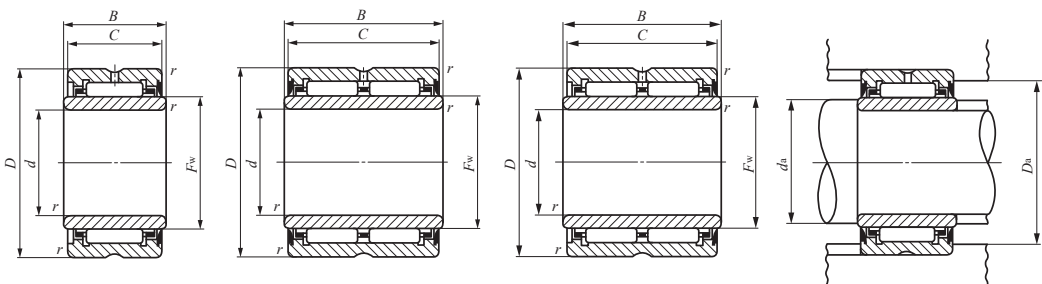


NA49 ... UU  
NA69 ... UU( $d \leq 30$ )

Shaft dia. 10 — 40mm

| Shaft dia.<br>mm | Identification number |                |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |          |
|------------------|-----------------------|----------------|----------------|---------------|---------------------|---------------------------|----------|----------|----------|
|                  | With two seals        | With one seal  | With two seals | With one seal |                     | $d$                       | $D$      | $C$      | $B$      |
| 10               | NA 4900UU             | NA 4900U       | —              | —             | 24.5                | 10                        | 22       | 13       | 14       |
| 12               | NA 4901UU<br>—        | NA 4901U<br>—  | NA 6901UU      | NA 6901U      | 27.5<br>45.5        | 12<br>12                  | 24<br>24 | 13<br>22 | 14<br>23 |
| 15               | NA 4902UU<br>—        | NA 4902U<br>—  | NA 6902UU      | NA 6902U      | 36<br>62.5          | 15<br>15                  | 28<br>28 | 13<br>23 | 14<br>24 |
| 17               | NA 4903UU<br>—        | NA 4903U<br>—  | NA 6903UU      | NA 6903U      | 39.5<br>68.5        | 17<br>17                  | 30<br>30 | 13<br>23 | 14<br>24 |
| 20               | NA 4904UU<br>—        | NA 4904U<br>—  | NA 6904UU      | NA 6904U      | 78.5<br>137         | 20<br>20                  | 37<br>37 | 17<br>30 | 18<br>31 |
| 22               | NA 49/22UU<br>—       | NA 49/22U<br>— | NA 69/22UU     | NA 69/22U     | 87.5<br>153         | 22<br>22                  | 39<br>39 | 17<br>30 | 18<br>31 |
| 25               | NA 4905UU<br>—        | NA 4905U<br>—  | NA 6905UU      | NA 6905U      | 92.5<br>162         | 25<br>25                  | 42<br>42 | 17<br>30 | 18<br>31 |
| 28               | NA 49/28UU<br>—       | NA 49/28U<br>— | NA 69/28UU     | NA 69/28U     | 101<br>177          | 28<br>28                  | 45<br>45 | 17<br>30 | 18<br>31 |
| 30               | NA 4906UU<br>—        | NA 4906U<br>—  | NA 6906UU      | NA 6906U      | 106<br>185          | 30<br>30                  | 47<br>47 | 17<br>30 | 18<br>31 |
| 32               | NA 49/32UU<br>—       | NA 49/32U<br>— | NA 69/32UU     | NA 69/32U     | 167<br>300          | 32<br>32                  | 52<br>52 | 20<br>36 | 21<br>37 |
| 35               | NA 4907UU<br>—        | NA 4907U<br>—  | NA 6907UU      | NA 6907U      | 179<br>320          | 35<br>35                  | 55<br>55 | 20<br>36 | 21<br>37 |
| 40               | NA 4908UU<br>—        | NA 4908U<br>—  | NA 6908UU      | NA 6908U      | 245<br>440          | 40<br>40                  | 62<br>62 | 22<br>40 | 23<br>41 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.

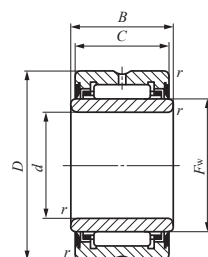


NA49 ... U  
NA69 ... U( $d \leq 30$ )  
NA69 ... UU  
NA69 ... U

| $r_{s \min}^{(1)}$ | $F_w$ | Standard mounting dimensions mm |               |               | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N | Allowable rotational speed <sup>(2)</sup><br>$\text{min}^{-1}$ | Assembled inner ring |
|--------------------|-------|---------------------------------|---------------|---------------|---------------------------------------|----------------------------------------|----------------------------------------------------------------|----------------------|
|                    |       | $d_a$<br>Min.                   | $d_a$<br>Max. | $D_a$<br>Max. |                                       |                                        |                                                                |                      |
| 0.3                | 14    | 12                              | 13            | 20            | 8 080                                 | 8 490                                  | 14 000                                                         | LRTZ 101414          |
| 0.3                | 16    | 14                              | 15            | 22            | 8 470                                 | 9 320                                  | 12 000                                                         | LRTZ 121614          |
| 0.3                | 16    | 14                              | 15            | 22            | 15 500                                | 20 400                                 | 12 000                                                         | LRTZ 121623          |
| 0.3                | 20    | 17                              | 19            | 26            | 9 570                                 | 11 600                                 | 9 500                                                          | LRTZ 152014          |
| 0.3                | 20    | 17                              | 19            | 26            | 18 500                                | 27 100                                 | 9 500                                                          | LRTZ 152024          |
| 0.3                | 22    | 19                              | 21            | 28            | 10 300                                | 13 100                                 | 8 500                                                          | LRTZ 172214          |
| 0.3                | 22    | 19                              | 21            | 28            | 19 800                                | 30 600                                 | 8 500                                                          | LRTZ 172224          |
| 0.3                | 25    | 22                              | 24            | 35            | 18 000                                | 20 500                                 | 7 500                                                          | LRTZ 202518          |
| 0.3                | 25    | 22                              | 24            | 35            | 33 000                                | 44 600                                 | 7 500                                                          | LRTZ 202531          |
| 0.3                | 28    | 24                              | 27            | 37            | 18 300                                | 23 700                                 | 7 000                                                          | LRTZ 222818          |
| 0.3                | 28    | 24                              | 27            | 37            | 33 800                                | 52 000                                 | 7 000                                                          | LRTZ 222831          |
| 0.3                | 30    | 27                              | 29            | 40            | 20 300                                | 25 100                                 | 6 500                                                          | LRTZ 253018          |
| 0.3                | 30    | 27                              | 29            | 40            | 39 200                                | 58 700                                 | 6 500                                                          | LRTZ 253031          |
| 0.3                | 32    | 30                              | 31            | 43            | 21 000                                | 26 800                                 | 6 000                                                          | LRTZ 283218          |
| 0.3                | 32    | 30                              | 31            | 43            | 38 900                                | 59 100                                 | 6 000                                                          | LRTZ 283231          |
| 0.3                | 35    | 32                              | 34            | 45            | 21 500                                | 28 400                                 | 5 500                                                          | LRTZ 303518          |
| 0.3                | 35    | 32                              | 34            | 45            | 40 100                                | 63 000                                 | 5 500                                                          | LRTZ 303531          |
| 0.6                | 40    | 36                              | 39            | 48            | 29 400                                | 44 200                                 | 5 000                                                          | LRTZ 324021          |
| 0.6                | 40    | 36                              | 39            | 48            | 50 300                                | 88 300                                 | 5 000                                                          | LRTZ 324037          |
| 0.6                | 42    | 39                              | 41            | 51            | 30 100                                | 46 300                                 | 4 500                                                          | LRTZ 354221          |
| 0.6                | 42    | 39                              | 41            | 51            | 51 600                                | 92 600                                 | 4 500                                                          | LRTZ 354237          |
| 0.6                | 48    | 44                              | 47            | 58            | 37 200                                | 58 400                                 | 4 000                                                          | LRTZ 404823          |
| 0.6                | 48    | 44                              | 47            | 58            | 63 700                                | 117 000                                | 4 000                                                          | LRTZ 404841          |

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Seal, With Inner Ring

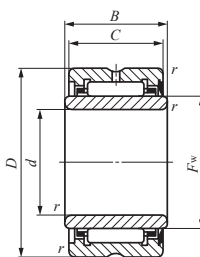


NA49 ... UU

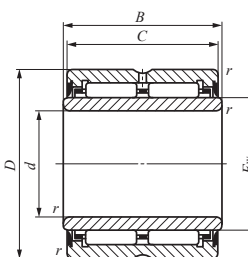
Shaft dia. 45 – 110mm

| Shaft dia.<br>mm | Identification number |               |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |     |    |    |
|------------------|-----------------------|---------------|----------------|---------------|---------------------|---------------------------|-----|----|----|
|                  | With two seals        | With one seal | With two seals | With one seal |                     | d                         | D   | C  | B  |
| 45               | NA 4909UU<br>—        | NA 4909U<br>— | —<br>NA 6909UU | —<br>NA 6909U | 290                 | 45                        | 68  | 22 | 23 |
|                  |                       |               |                |               | 520                 | 45                        | 68  | 40 | 41 |
| 50               | NA 4910UU<br>—        | NA 4910U<br>— | —<br>NA 6910UU | —<br>NA 6910U | 295                 | 50                        | 72  | 22 | 23 |
|                  |                       |               |                |               | 530                 | 50                        | 72  | 40 | 41 |
| 55               | NA 4911UU<br>—        | NA 4911U<br>— | —<br>NA 6911UU | —<br>NA 6911U | 415                 | 55                        | 80  | 25 | 26 |
|                  |                       |               |                |               | 730                 | 55                        | 80  | 45 | 46 |
| 60               | NA 4912UU<br>—        | NA 4912U<br>— | —<br>NA 6912UU | —<br>NA 6912U | 445                 | 60                        | 85  | 25 | 26 |
|                  |                       |               |                |               | 785                 | 60                        | 85  | 45 | 46 |
| 65               | NA 4913UU<br>—        | NA 4913U<br>— | —<br>NA 6913UU | —<br>NA 6913U | 475                 | 65                        | 90  | 25 | 26 |
|                  |                       |               |                |               | 845                 | 65                        | 90  | 45 | 46 |
| 70               | NA 4914UU<br>—        | NA 4914U<br>— | —<br>NA 6914UU | —<br>NA 6914U | 770                 | 70                        | 100 | 30 | 31 |
|                  |                       |               |                |               | 1 400               | 70                        | 100 | 54 | 55 |
| 75               | NA 4915UU<br>—        | NA 4915U<br>— | —<br>NA 6915UU | —<br>NA 6915U | 815                 | 75                        | 105 | 30 | 31 |
|                  |                       |               |                |               | 1 480               | 75                        | 105 | 54 | 55 |
| 80               | NA 4916UU<br>—        | NA 4916U<br>— | —<br>NA 6916UU | —<br>NA 6916U | 860                 | 80                        | 110 | 30 | 31 |
|                  |                       |               |                |               | 1 570               | 80                        | 110 | 54 | 55 |
| 85               | NA 4917UU<br>—        | NA 4917U<br>— | —<br>NA 6917UU | —<br>NA 6917U | 1 300               | 85                        | 120 | 35 | 36 |
|                  |                       |               |                |               | 2 360               | 85                        | 120 | 63 | 64 |
| 90               | NA 4918UU<br>—        | NA 4918U<br>— | —<br>NA 6918UU | —<br>NA 6918U | 1 360               | 90                        | 125 | 35 | 36 |
|                  |                       |               |                |               | 2 480               | 90                        | 125 | 63 | 64 |
| 95               | NA 4919UU<br>—        | NA 4919U<br>— | —<br>NA 6919UU | —<br>NA 6919U | 1 420               | 95                        | 130 | 35 | 36 |
|                  |                       |               |                |               | 2 600               | 95                        | 130 | 63 | 64 |
| 100              | NA 4920UU             | NA 4920U      | —              | —             | 1 980               | 100                       | 140 | 40 | 41 |
| 110              | NA 4922UU             | NA 4922U      | —              | —             | 2 150               | 110                       | 150 | 40 | 41 |

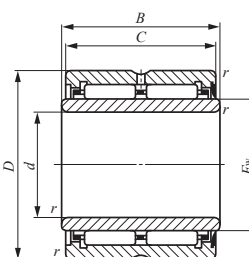
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.



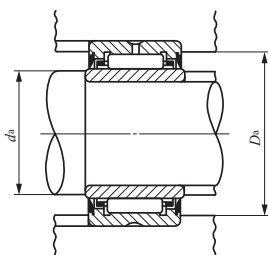
NA49 ... U



NA69 ... UU



NA69 ... U



| $r_s^{(1)}$<br>$\min F_w$ |     | Standard mounting dimensions mm |               |               | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N | Allowable rotational speed <sup>(2)</sup><br>$\min^{-1}$ | Assembled inner ring |          |
|---------------------------|-----|---------------------------------|---------------|---------------|---------------------------------------|----------------------------------------|----------------------------------------------------------|----------------------|----------|
|                           |     | $d_a$<br>Min.                   | $d_a$<br>Max. | $D_a$<br>Max. |                                       |                                        |                                                          |                      |          |
| 0.6                       | 52  | 49                              | 51            | 64            | 38 900                                | 63 400                                 | 3 500                                                    | LRTZ                 | 455223   |
| 0.6                       | 52  | 49                              | 51            | 64            | 66 600                                | 127 000                                | 3 500                                                    | LRTZ                 | 455241   |
| 0.6                       | 58  | 54                              | 57            | 68            | 41 300                                | 71 100                                 | 3 500                                                    | LRTZ                 | 505823   |
| 0.6                       | 58  | 54                              | 57            | 68            | 70 800                                | 142 000                                | 3 500                                                    | LRTZ                 | 505841   |
| 1                         | 63  | 60                              | 61            | 75            | 52 200                                | 85 700                                 | 3 000                                                    | LRTZ                 | 556326   |
| 1                         | 63  | 60                              | 61            | 75            | 89 400                                | 171 000                                | 3 000                                                    | LRTZ                 | 556346   |
| 1                         | 68  | 65                              | 66            | 80            | 54 500                                | 92 800                                 | 3 000                                                    | LRTZ                 | 606826   |
| 1                         | 68  | 65                              | 66            | 80            | 93 400                                | 186 000                                | 3 000                                                    | LRTZ                 | 606846   |
| 1                         | 72  | 70                              | 70.5          | 85            | 56 800                                | 99 800                                 | 2 500                                                    | LRTZ                 | 657226   |
| 1                         | 72  | 70                              | 70.5          | 85            | 97 400                                | 200 000                                | 2 500                                                    | LRTZ                 | 657246   |
| 1                         | 80  | 75                              | 78            | 95            | 76 900                                | 143 000                                | 2 500                                                    | LRTZ                 | 708031   |
| 1                         | 80  | 75                              | 78            | 95            | 124 000                               | 281 000                                | 2 500                                                    | LRTZ                 | 708055   |
| 1                         | 85  | 80                              | 83            | 100           | 79 600                                | 153 000                                | 2 000                                                    | LRTZ                 | 758531   |
| 1                         | 85  | 80                              | 83            | 100           | 128 000                               | 299 000                                | 2 000                                                    | LRTZ                 | 758555   |
| 1                         | 90  | 85                              | 88            | 105           | 80 700                                | 158 000                                | 2 000                                                    | LRTZ                 | 809031   |
| 1                         | 90  | 85                              | 88            | 105           | 132 000                               | 317 000                                | 2 000                                                    | LRTZ                 | 809055   |
| 1.1                       | 100 | 91.5                            | 98            | 113.5         | 103 000                               | 225 000                                | 1 900                                                    | LRTZ                 | 8510036  |
| 1.1                       | 100 | 91.5                            | 98            | 113.5         | 168 000                               | 448 000                                | 1 900                                                    | LRTZ                 | 8510064  |
| 1.1                       | 105 | 96.5                            | 103           | 118.5         | 106 000                               | 238 000                                | 1 800                                                    | LRTZ                 | 9010536  |
| 1.1                       | 105 | 96.5                            | 103           | 118.5         | 172 000                               | 471 000                                | 1 800                                                    | LRTZ                 | 9010564  |
| 1.1                       | 110 | 101.5                           | 108           | 123.5         | 109 000                               | 250 000                                | 1 700                                                    | LRTZ                 | 9511036  |
| 1.1                       | 110 | 101.5                           | 108           | 123.5         | 177 000                               | 493 000                                | 1 700                                                    | LRTZ                 | 9511064  |
| 1.1                       | 115 | 106.5                           | 113           | 133.5         | 134 000                               | 297 000                                | 1 700                                                    | LRTZ                 | 10011541 |
| 1.1                       | 125 | 116.5                           | 123           | 143.5         | 140 000                               | 322 000                                | 1 500                                                    | LRTZ                 | 11012541 |

MACHINED TYPE NEEDLE ROLLER BEARINGS

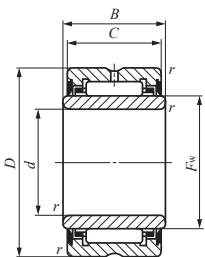
With Seal, With Inner Ring



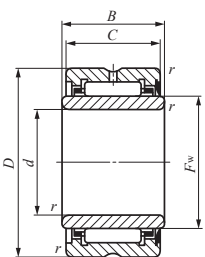
Shaft dia. 120 – 140mm

| Shaft dia.<br>mm | Identification number |               |                |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |          |
|------------------|-----------------------|---------------|----------------|---------------|---------------------|---------------------------|----------|----------|----------|
|                  | With two seals        | With one seal | With two seals | With one seal |                     | <i>d</i>                  | <i>D</i> | <i>C</i> | <i>B</i> |
| 120              | NA 4924UU             | NA 4924U      | —              | —             | 2 990               | 120                       | 165      | 45       | 46       |
| 130              | NA 4926UU             | NA 4926U      | —              | —             | 4 080               | 130                       | 180      | 50       | 51       |
| 140              | NA 4928UU             | NA 4928U      | —              | —             | 4 340               | 140                       | 190      | 50       | 51       |

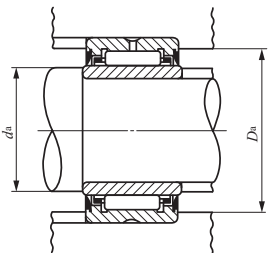
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease. Bearings with a seal on one side are not provided with prepacked grease. Perform proper lubrication for use.



NA49...UU



NA49...U



| $r_{s\min}^{(1)}$ | $F_w$ | Standard mounting dimensions mm |                               |                               | Basic dynamic load rating<br><i>C</i><br>N | Basic static load rating<br><i>C</i> <sub>0</sub><br>N | Allowable rotational speed <sup>(2)</sup><br>min <sup>-1</sup> | Assembled inner ring |
|-------------------|-------|---------------------------------|-------------------------------|-------------------------------|--------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------|----------------------|
|                   |       | <i>d</i> <sub>a</sub><br>Min.   | <i>d</i> <sub>a</sub><br>Max. | <i>D</i> <sub>a</sub><br>Max. |                                            |                                                        |                                                                |                      |
| 1.1               | 135   | 126.5                           | 133                           | 158.5                         | 178 000                                    | 410 000                                                | 1 400                                                          | LRTZ 12013546        |
| 1.5               | 150   | 138                             | 148                           | 172                           | 206 000                                    | 511 000                                                | 1 300                                                          | LRTZ 13015051        |
| 1.5               | 160   | 148                             | 158                           | 182                           | 214 000                                    | 549 000                                                | 1 200                                                          | LRTZ 14016051        |

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MACHINED TYPE NEEDLE ROLLER BEARINGS

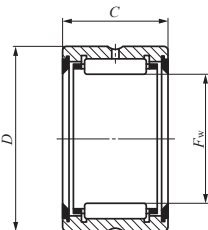
With Seal, Without Inner Ring, Inch Series



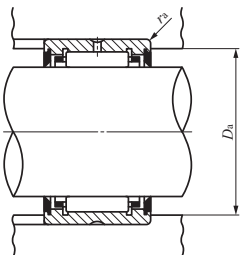
Shaft dia. 15.875 — 50.800mm

| Shaft dia.<br>mm<br>(inch) | Identification number<br><br>With two seals | Mass<br>(Ref.)<br><br>g | Boundary dimensions mm(inch) |                 |                | Standard mounting<br>dimensions mm |                     |
|----------------------------|---------------------------------------------|-------------------------|------------------------------|-----------------|----------------|------------------------------------|---------------------|
|                            |                                             |                         | $F_w$                        | $D$             | $C$            | $D_a$<br>Max.                      | $r_{as\ max}^{(1)}$ |
| 15.875<br>(5/8)            | BR 101816 UU                                | 54                      | 15.875 ( 5/8 )               | 28.575 (1 1/8)  | 25.400 (1 )    | 24.5                               | 0.6                 |
| 19.050<br>(3/4)            | BR 122016 UU                                | 68                      | 19.050 ( 3/4 )               | 31.750 (1 1/4)  | 25.400 (1 )    | 26.5                               | 1.0                 |
| 22.225<br>(7/8)            | BR 142216 UU                                | 76                      | 22.225 ( 7/8 )               | 34.925 (1 3/8)  | 25.400 (1 )    | 29.7                               | 1.0                 |
| 25.400<br>(1)              | BR 162416 UU                                | 83                      | 25.400 (1 )                  | 38.100 (1 1/2)  | 25.400 (1 )    | 32.9                               | 1.0                 |
| 28.575<br>(1 1/8)          | BR 182620 UU                                | 115                     | 28.575 (1 1/8)               | 41.275 (1 5/8)  | 31.750 (1 1/4) | 36.0                               | 1.0                 |
| 31.750<br>(1 1/4)          | BR 202820 UU                                | 124                     | 31.750 (1 1/4)               | 44.450 (1 3/4)  | 31.750 (1 1/4) | 39.2                               | 1.0                 |
| 34.925<br>(1 3/8)          | BR 223020 UU                                | 134                     | 34.925 (1 3/8)               | 47.625 (1 7/8)  | 31.750 (1 1/4) | 42.4                               | 1.0                 |
| 38.100<br>(1 1/2)          | BR 243320 UU                                | 168                     | 38.100 (1 1/2)               | 52.388 (2 1/16) | 31.750 (1 1/4) | 45.1                               | 1.5                 |
| 41.275<br>(1 5/8)          | BR 263520 UU                                | 179                     | 41.275 (1 5/8)               | 55.562 (2 3/16) | 31.750 (1 1/4) | 48.3                               | 1.5                 |
| 44.450<br>(1 3/4)          | BR 283720 UU                                | 193                     | 44.450 (1 3/4)               | 58.738 (2 5/16) | 31.750 (1 1/4) | 51.5                               | 1.5                 |
| 47.625<br>(1 7/8)          | BR 303920 UU                                | 202                     | 47.625 (1 7/8)               | 61.912 (2 7/16) | 31.750 (1 1/4) | 54.7                               | 1.5                 |
| 50.800<br>(2)              | BR 324120 UU                                | 216                     | 50.800 (2 )                  | 65.088 (2 9/16) | 31.750 (1 1/4) | 57.8                               | 1.5                 |

Notes<sup>(1)</sup> Maximum permissible corner radius of the housing  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease.  
3. If one side sealed type are needed, please contact IKO.



BR ... UU



| Basic dynamic<br>load rating<br>$C$<br>N | Basic static<br>load rating<br>$C_0$<br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| 18 300                                   | 20 000                                    | 12 000                                                               |
| 20 700                                   | 24 400                                    | 10 000                                                               |
| 21 600                                   | 26 900                                    | 9 000                                                                |
| 23 600                                   | 31 300                                    | 8 000                                                                |
| 34 900                                   | 49 900                                    | 7 000                                                                |
| 36 000                                   | 53 500                                    | 6 500                                                                |
| 38 500                                   | 60 000                                    | 5 500                                                                |
| 43 700                                   | 66 900                                    | 5 500                                                                |
| 44 800                                   | 70 900                                    | 4 500                                                                |
| 47 500                                   | 78 200                                    | 4 500                                                                |
| 48 500                                   | 82 100                                    | 4 000                                                                |
| 51 000                                   | 89 400                                    | 4 000                                                                |

MACHINED TYPE NEEDLE ROLLER BEARINGS

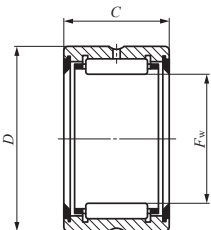
With Seal, Without Inner Ring, Inch Series



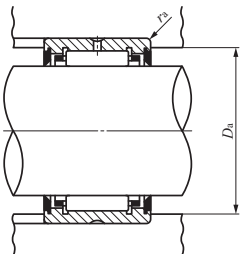
Shaft dia. 57.150 — 95.250mm

| Shaft dia.<br>mm<br>(inch) | Identification number<br><br>With two seals | Mass<br>(Ref.)<br><br>g | Boundary dimensions mm(inch) |                 |                | Standard mounting<br>dimensions mm |                     |
|----------------------------|---------------------------------------------|-------------------------|------------------------------|-----------------|----------------|------------------------------------|---------------------|
|                            |                                             |                         | $F_w$                        | $D$             | $C$            | $D_a$<br>Max.                      | $r_{as\ max}^{(1)}$ |
| 57.150<br>(2 1/4)          | BR 364828 UU                                | 459                     | 57.150 (2 1/4)               | 76.200 (3 )     | 44.450 (1 3/4) | 69.0                               | 1.5                 |
| 63.500<br>(2 1/2)          | BR 405228 UU                                | 499                     | 63.500 (2 1/2)               | 82.550 (3 1/4)  | 44.450 (1 3/4) | 74.3                               | 2.0                 |
| 69.850<br>(2 3/4)          | BR 445628 UU                                | 540                     | 69.850 (2 3/4)               | 88.900 (3 1/2)  | 44.450 (1 3/4) | 80.7                               | 2.0                 |
| 76.200<br>(3)              | BR 486028 UU                                | 585                     | 76.200 (3 )                  | 95.250 (3 3/4)  | 44.450 (1 3/4) | 87.0                               | 2.0                 |
| 82.550<br>(3 1/4)          | BR 526828 UU                                | 891                     | 82.550 (3 1/4)               | 107.950 (4 1/4) | 44.450 (1 3/4) | 99.7                               | 2.0                 |
| 88.900<br>(3 1/2)          | BR 567232 UU                                | 1 098                   | 88.900 (3 1/2)               | 114.300 (4 1/2) | 50.800 (2 )    | 106.1                              | 2.0                 |
| 95.250<br>(3 3/4)          | BR 607632 UU                                | 1 161                   | 95.250 (3 3/4)               | 120.650 (4 3/4) | 50.800 (2 )    | 111.4                              | 2.5                 |

Notes<sup>(1)</sup> Maximum permissible corner radius of the housing  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease.  
3. If one side sealed type are needed, please contact IKO.



BR ... UU



| Basic dynamic<br>load rating<br>$C$<br>N | Basic static<br>load rating<br>$C_0$<br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| 90 300                                   | 158 000                                   | 3 500                                                                |
| 94 600                                   | 174 000                                   | 3 000                                                                |
| 98 700                                   | 189 000                                   | 2 500                                                                |
| 105 000                                  | 211 000                                   | 2 500                                                                |
| 109 000                                  | 227 000                                   | 2 500                                                                |
| 142 000                                  | 265 000                                   | 2 000                                                                |
| 148 000                                  | 287 000                                   | 2 000                                                                |

D  
NA  
TAFI  
TRI  
BRI

MACHINED TYPE NEEDLE ROLLER BEARINGS

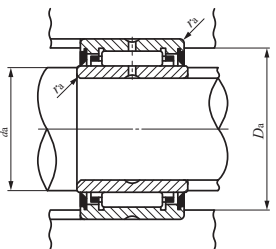
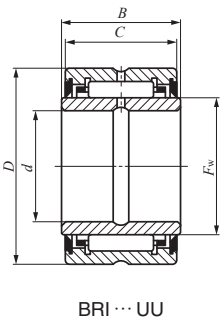
With Seal, With Inner Ring, Inch Series



Shaft dia. 9.525 — 44.450mm

| Shaft dia.<br>mm<br>(inch) | Identification number          | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch)       |                                      |                                    |          |                                    |
|----------------------------|--------------------------------|---------------------|------------------------------------|--------------------------------------|------------------------------------|----------|------------------------------------|
|                            | With two seals                 |                     | <i>d</i>                           | <i>D</i>                             | <i>C</i>                           | <i>B</i> | <i>F<sub>w</sub></i>               |
| 9.525<br>(3/8)             | BRI 61816 UU                   | 79                  | 9.525 ( 3/8 )                      | 28.575 (1 1/8 )                      | 25.400 (1 )                        | 25.650   | 15.875 ( 5/8 )                     |
| 12.700<br>(1/2)            | BRI 82016 UU                   | 99                  | 12.700 ( 1/2 )                     | 31.750 (1 1/4 )                      | 25.400 (1 )                        | 25.650   | 19.050 ( 3/4 )                     |
| 15.875<br>(5/8)            | BRI 102216 UU                  | 113.5               | 15.875 ( 5/8 )                     | 34.925 (1 3/8 )                      | 25.400 (1 )                        | 25.650   | 22.225 ( 7/8 )                     |
| 19.050<br>(3/4)            | BRI 122416 UU                  | 127                 | 19.050 ( 3/4 )                     | 38.100 (1 1/2 )                      | 25.400 (1 )                        | 25.650   | 25.400 (1 )                        |
| 22.225<br>(7/8)            | BRI 142620 UU                  | 177                 | 22.225 ( 7/8 )                     | 41.275 (1 5/8 )                      | 31.750 (1 1/4 )                    | 32.000   | 28.575 (1 1/8 )                    |
| 25.400<br>(1)              | BRI 162820 UU                  | 196                 | 25.400 (1 )                        | 44.450 (1 3/4 )                      | 31.750 (1 1/4 )                    | 32.000   | 31.750 (1 1/4 )                    |
| 28.575<br>(1 1/8)          | BRI 183020 UU                  | 211                 | 28.575 (1 1/8 )                    | 47.625 (1 7/8 )                      | 31.750 (1 1/4 )                    | 32.000   | 34.925 (1 3/8 )                    |
| 31.750<br>(1 1/4)          | BRI 203320 UU                  | 254                 | 31.750 (1 1/4 )                    | 52.388 (2 1/16 )                     | 31.750 (1 1/4 )                    | 32.000   | 38.100 (1 1/2 )                    |
| 34.925<br>(1 3/8)          | BRI 223520 UU                  | 275                 | 34.925 (1 3/8 )                    | 55.562 (2 3/16 )                     | 31.750 (1 1/4 )                    | 32.000   | 41.275 (1 5/8 )                    |
| 38.100<br>(1 1/2)          | BRI 243720 UU<br>BRI 243920 UU | 293<br>362          | 38.100 (1 1/2 )<br>38.100 (1 1/2 ) | 58.738 (2 5/16 )<br>61.912 (2 7/16 ) | 31.750 (1 1/4 )<br>31.750 (1 1/4 ) | 32.000   | 44.450 (1 3/4 )<br>47.625 (1 7/8 ) |
| 41.275<br>(1 5/8)          | BRI 264120 UU                  | 386                 | 41.275 (1 5/8 )                    | 65.088 (2 9/16 )                     | 31.750 (1 1/4 )                    | 32.000   | 50.800 (2 )                        |
| 44.450<br>(1 3/4)          | BRI 284828 UU                  | 804                 | 44.450 (1 3/4 )                    | 76.200 (3 )                          | 44.450 (1 3/4 )                    | 44.700   | 57.150 (2 1/4 )                    |

Notes<sup>(1)</sup> Maximum permissible corner radius of the shaft or housing  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The inner ring and the outer ring each have an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease.  
3. If one side sealed type are needed, please contact IKO.



| Standard mounting dimensions mm |      |                      |                                          | Basic dynamic load rating | Basic static load rating  | Allowable rotational speed <sup>(2)</sup> | Assembled inner ring |
|---------------------------------|------|----------------------|------------------------------------------|---------------------------|---------------------------|-------------------------------------------|----------------------|
| Min.                            | Max. | <i>d<sub>a</sub></i> | <i>r<sub>as max</sub></i> <sup>(1)</sup> | <i>C</i><br>N             | <i>C<sub>0</sub></i><br>N | min <sup>-1</sup>                         |                      |
| 14                              | 14.5 | 24.5                 | 0.6                                      | 18 300                    | 20 000                    | 12 000                                    | LRBZ 61016 B         |
| 17.5                            | 18   | 26.5                 | 0.6                                      | 20 700                    | 24 400                    | 10 000                                    | LRBZ 81216 B         |
| 21                              | 21.2 | 29.7                 | 0.6                                      | 21 600                    | 26 900                    | 9 000                                     | LRBZ 101416 B        |
| 24                              | 24.4 | 32.9                 | 0.6                                      | 23 600                    | 31 300                    | 8 000                                     | LRBZ 121616 B        |
| 27                              | 27.5 | 36.0                 | 0.6                                      | 34 900                    | 49 900                    | 7 000                                     | LRBZ 141820 B        |
| 30.5                            | 30.7 | 39.2                 | 0.6                                      | 36 000                    | 53 500                    | 6 500                                     | LRBZ 162020 B        |
| 33.5                            | 33.9 | 42.4                 | 0.6                                      | 38 500                    | 60 000                    | 5 500                                     | LRBZ 182220 B        |
| 37                              | 37.1 | 45.1                 | 0.6                                      | 43 700                    | 66 900                    | 5 500                                     | LRBZ 202420 B        |
| 40.2                            | 40.2 | 48.3                 | 0.6                                      | 44 800                    | 70 900                    | 4 500                                     | LRBZ 222620 B        |
| 43.3                            | 43.4 | 51.5                 | 0.6                                      | 47 500                    | 78 200                    | 4 500                                     | LRBZ 242820 B        |
| 43.3                            | 45   | 54.7                 | 1                                        | 48 500                    | 82 100                    | 4 000                                     | LRBZ 243020 B        |
| 48                              | 49   | 57.8                 | 1                                        | 51 000                    | 89 400                    | 4 000                                     | LRBZ 263220 B        |
| 52.5                            | 55   | 69.0                 | 1.5                                      | 90 300                    | 158 000                   | 3 500                                     | LRBZ 283628 B        |

MACHINED TYPE NEEDLE ROLLER BEARINGS

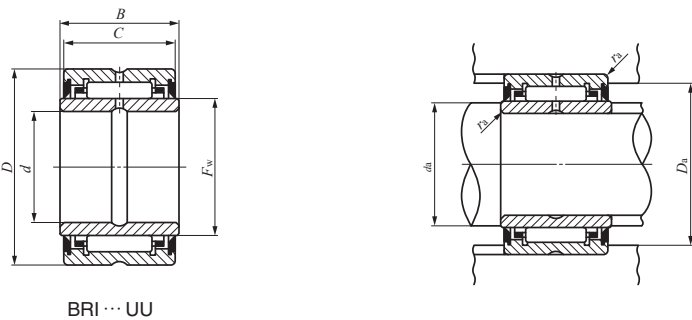
With Seal, With Inner Ring, Inch Series



Shaft dia. 50.800 — 82.550mm

| Shaft dia.<br>mm<br>(inch) | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch) |                 |                |          |                      |
|----------------------------|-----------------------|---------------------|------------------------------|-----------------|----------------|----------|----------------------|
|                            | With two seals        |                     | <i>d</i>                     | <i>D</i>        | <i>C</i>       | <i>B</i> | <i>F<sub>w</sub></i> |
| 50.800<br>(2)              | BRI 325228 UU         | 889                 | 50.800 (2 )                  | 82.550 (3 1/4)  | 44.450 (1 3/4) | 44.700   | 63.500 (2 1/2)       |
| 57.150<br>(2 1/4)          | BRI 365628 UU         | 980                 | 57.150 (2 1/4)               | 88.900 (3 1/2)  | 44.450 (1 3/4) | 44.700   | 69.850 (2 3/4)       |
| 63.500<br>(2 1/2)          | BRI 406028 UU         | 1 065               | 63.500 (2 1/2)               | 95.250 (3 3/4)  | 44.450 (1 3/4) | 44.700   | 76.200 (3 )          |
| 69.850<br>(2 3/4)          | BRI 446828 UU         | 1 421               | 69.850 (2 3/4)               | 107.950 (4 1/4) | 44.450 (1 3/4) | 44.700   | 82.550 (3 1/4)       |
| 76.200<br>(3)              | BRI 487232 UU         | 1 738               | 76.200 (3 )                  | 114.300 (4 1/2) | 50.800 (2 )    | 51.050   | 88.900 (3 1/2)       |
| 82.550<br>(3 1/4)          | BRI 527632 UU         | 1 851               | 82.550 (3 1/4)               | 120.650 (4 3/4) | 50.800 (2 )    | 51.050   | 95.250 (3 3/4)       |

Notes<sup>(1)</sup> Maximum permissible corner radius of the shaft or housing  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication.  
Remarks1. The inner ring and the outer ring each have an oil groove and an oil hole.  
2. Bearings are provided with prepacked grease.  
3. If one side sealed type are needed, please contact IKO.

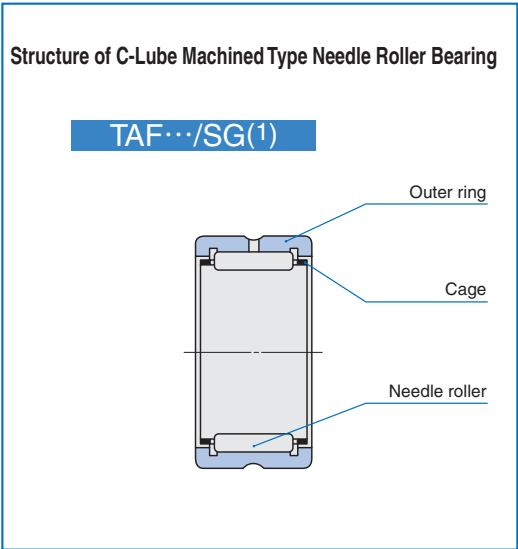


| Standard mounting dimensions<br>mm |                              |                              |                                          | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C<sub>0</sub></i><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> | Assembled inner ring |
|------------------------------------|------------------------------|------------------------------|------------------------------------------|-----------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------|----------------------|
| <i>d<sub>a</sub></i><br>Min.       | <i>d<sub>a</sub></i><br>Max. | <i>D<sub>a</sub></i><br>Max. | <i>r<sub>as</sub></i> max <sup>(1)</sup> |                                               |                                                          |                                                                      |                      |
| 58                                 | 61                           | 74.3                         | 1.5                                      | 94 600                                        | 174 000                                                  | 3 000                                                                | LRBZ 324028 B        |
| 65                                 | 67                           | 80.7                         | 1.5                                      | 98 700                                        | 189 000                                                  | 2 500                                                                | LRBZ 364428 B        |
| 71                                 | 73                           | 87.0                         | 1.5                                      | 105 000                                       | 211 000                                                  | 2 500                                                                | LRBZ 404828 B        |
| 77                                 | 79                           | 99.7                         | 1.5                                      | 109 000                                       | 227 000                                                  | 2 500                                                                | LRBZ 445228 B        |
| 83.5                               | 86                           | 106.1                        | 1.5                                      | 142 000                                       | 265 000                                                  | 2 000                                                                | LRBZ 485632 B        |
| 91                                 | 93                           | 111.4                        | 1.5                                      | 148 000                                       | 287 000                                                  | 2 000                                                                | LRBZ 526032 B        |

# C-LUBE MACHINED TYPE NEEDLE ROLLER BEARINGS

## Structure and features

C-Lube Machined Type Needle Roller Bearing is a bearing that is lubricated with a newly developed thermosetting solid-type lubricant. A large amount of lubricating oil and fine particles of ultra high molecular weight polyolefin resin are solidified by heat treatment to fill the inner space of the bearing. As the bearing rotates, the lubricating oil oozes out onto the raceway in proper quantities, maintaining the lubrication performance for a long period of time. C-Lube Machined Type Needle Roller Bearings are bearings with a low sectional height and large load ratings. The outer ring has high rigidity and can easily be used even for light alloy housings.



Note(1) Thermosetting solid-type lubricant fills inner space of the bearing.

## Type

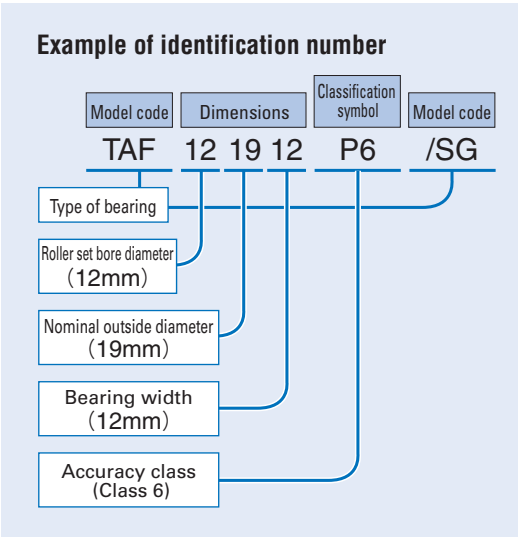
C-Lube Machined Type Needle Roller Bearing is available in type shown in Table 1.

Table 1 Type of bearing

| Type          |                | Needle bearing with cage |
|---------------|----------------|--------------------------|
| Series        |                | Without inner ring       |
| Metric series | For light duty | TAF.../SG                |

## Identification number

The identification number of C-Lube Machined Type Needle Roller Bearing consists of model code, dimensions and classification symbol. Example is shown below.



## Accuracy

C-Lube Machined Type Needle Roller Bearings are manufactured based on JIS (See page A31.). The tolerances for the smallest single roller set bore diameter of bearings without inner ring are based on Table 14 on page A33.

## Fit

The recommended fits for C-Lube Machined Type Needle Roller Bearings are shown in Tables 21 to 23 on pages A41 and A42.

## Allowable Rotational Speed

The allowable rotational speed of C-Lube Machined Type Needle Roller Bearing is affected by mounting and operating conditions. The reference  $d_{mn}$  value (1) is 20,000.

Note(1)  $d_{mn}$  value = {(Bore diameter of bearing [mm] + Outside diameter of bearing [mm])/2} x rotational speed [min<sup>-1</sup>]

## Lubrication

As the internal space of C-Lube Machined Type Needle Roller Bearing is filled with thermosetting solid-type lubricant C-Lube, regreasing is not possible due to the structure.

## Oil hole

Table 2 shows the number of oil holes on the outer ring.

Table 2 Number of oil holes of outer ring

| Nominal roller set bore diameter $F_w$ mm | Number of hole holes of outer ring |
|-------------------------------------------|------------------------------------|
| $F_w \leq 26$                             | 0                                  |
| $26 < F_w$                                | 1                                  |

Remark If there is oil hole on the outer ring, care must be exercised not to let oil holes within the load range.

## Mounting

- 1 Mounting dimensions for C-Lube Machined Type Needle Roller Bearings are shown in the table of dimensions.
- 2 When mounting, pay special attention to avoid locating the oil hole within the loading zone. This may lead to a short bearing life.

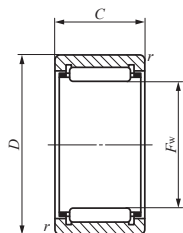
## Precaution for Use

- 1 Do not wash C-Lube Machined Type Needle Roller Bearing with organic solvent and/or white kerosene, which have the ability of removing fat nor leave them in contact with the above agents.
- 2 To ensure normal rotation of the C-Lube Machined Type Needle Roller Bearing, apply a load of 1% or over of the dynamic load rating at use.
- 3 The operating temperature range is -15~+80°C. For continuous operation, the recommended operating temperature is +60°C or less.
- 4 When using two or more C-Lube Machined Type Needle Roller Bearings adjacent to each other on the same shaft, it is necessary to obtain an even load distribution. On request, a set of bearings is available, in which bearings are matched to obtain an even load distribution.

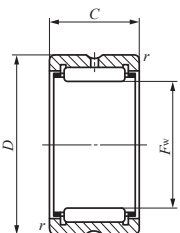
Further, C-Lube Machined Type Needle Roller Bearing for food machinery is also available. If needed, please contact IKO.

C-LUBE MACHINED TYPE NEEDLE ROLLER BEARINGS

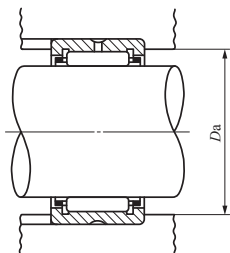
Without Inner Ring



TAF .../SG  
F<sub>w</sub> ≤ 26



TAF .../SG  
F<sub>w</sub> > 26



Shaft dia. 10—45mm

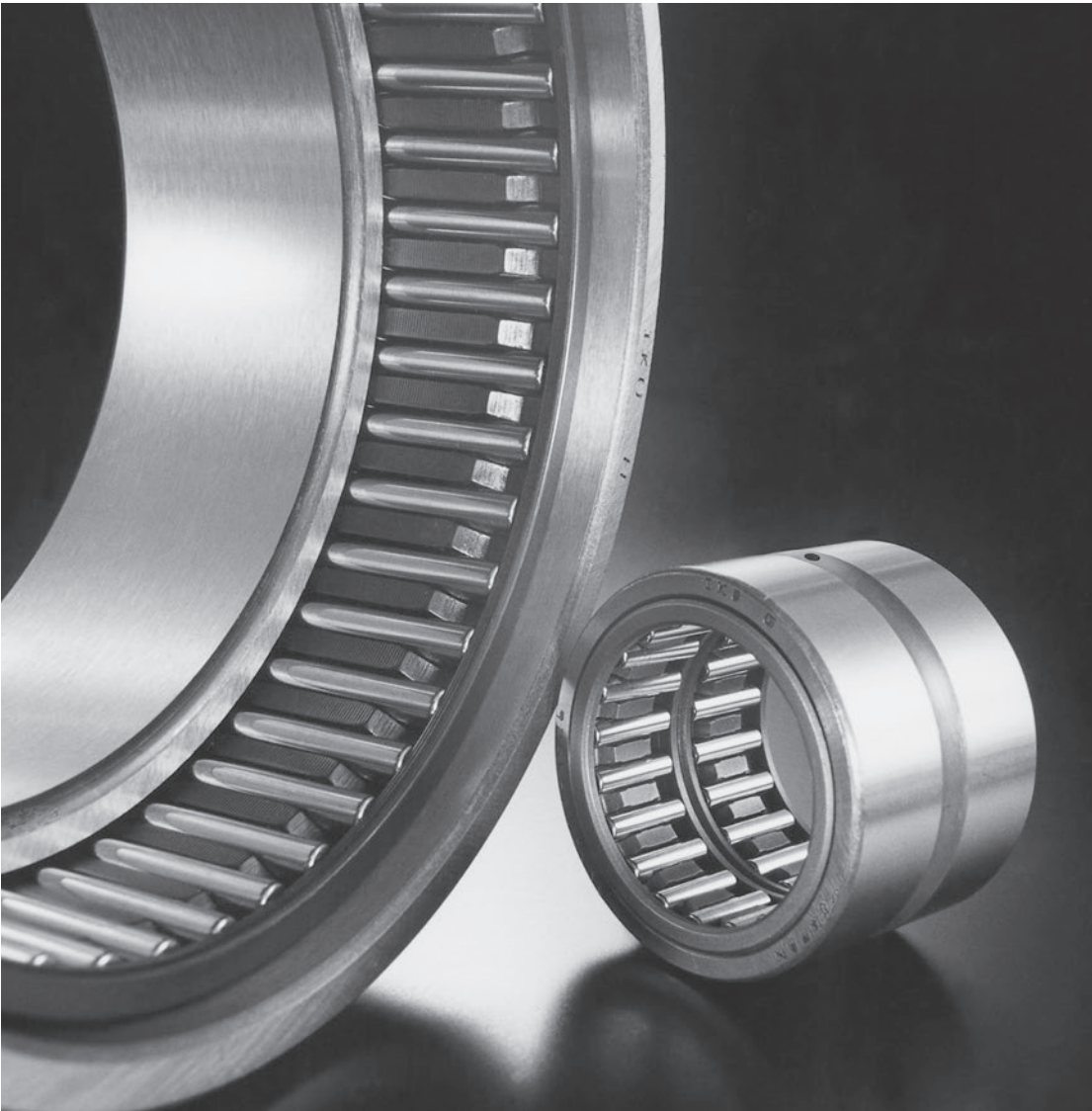
| Shaft dia. | Identification number | Mass (Ref.)<br>g | Boundary dimensions mm |    |    |                                   | Standard mounting dimension<br>D <sub>a</sub><br>Max. mm | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|------------|-----------------------|------------------|------------------------|----|----|-----------------------------------|----------------------------------------------------------|-------------------------------------|-------------------------------------------------|
|            |                       |                  | F <sub>w</sub>         | D  | C  | r <sub>s</sub> min <sup>(1)</sup> |                                                          |                                     |                                                 |
| 10         | TAF 101712/SG         | 11               | 10                     | 17 | 12 | 0.2                               | 15.4                                                     | 5 880                               | 5 970                                           |
|            | TAF 101716/SG         | 14.7             | 10                     | 17 | 16 | 0.2                               | 15.4                                                     | 8 230                               | 9 190                                           |
| 12         | TAF 121912/SG         | 12.5             | 12                     | 19 | 12 | 0.3                               | 17                                                       | 6 610                               | 7 260                                           |
|            | TAF 121916/SG         | 16.8             | 12                     | 19 | 16 | 0.3                               | 17                                                       | 9 250                               | 11 200                                          |
| 14         | TAF 142216/SG         | 22               | 14                     | 22 | 16 | 0.3                               | 20                                                       | 11 700                              | 13 700                                          |
|            | TAF 142220/SG         | 27.5             | 14                     | 22 | 20 | 0.3                               | 20                                                       | 14 800                              | 18 600                                          |
| 15         | TAF 152316/SG         | 23.5             | 15                     | 23 | 16 | 0.3                               | 21                                                       | 12 300                              | 14 900                                          |
|            | TAF 152320/SG         | 29               | 15                     | 23 | 20 | 0.3                               | 21                                                       | 15 600                              | 20 200                                          |
| 16         | TAF 162416/SG         | 24               | 16                     | 24 | 16 | 0.3                               | 22                                                       | 12 300                              | 15 100                                          |
|            | TAF 162420/SG         | 30               | 16                     | 24 | 20 | 0.3                               | 22                                                       | 15 500                              | 20 400                                          |
| 18         | TAF 182616/SG         | 26.5             | 18                     | 26 | 16 | 0.3                               | 24                                                       | 13 400                              | 17 500                                          |
|            | TAF 182620/SG         | 33               | 18                     | 26 | 20 | 0.3                               | 24                                                       | 17 000                              | 23 600                                          |
| 19         | TAF 192716/SG         | 28               | 19                     | 27 | 16 | 0.3                               | 25                                                       | 14 000                              | 18 700                                          |
|            | TAF 192720/SG         | 35.5             | 19                     | 27 | 20 | 0.3                               | 25                                                       | 17 700                              | 25 300                                          |
| 20         | TAF 202816/SG         | 28.5             | 20                     | 28 | 16 | 0.3                               | 26                                                       | 13 900                              | 18 800                                          |
|            | TAF 202820/SG         | 37               | 20                     | 28 | 20 | 0.3                               | 26                                                       | 17 600                              | 25 400                                          |
| 21         | TAF 212916/SG         | 30               | 21                     | 29 | 16 | 0.3                               | 27                                                       | 14 400                              | 20 000                                          |
|            | TAF 212920/SG         | 37.5             | 21                     | 29 | 20 | 0.3                               | 27                                                       | 18 200                              | 27 100                                          |
| 22         | TAF 223016/SG         | 31               | 22                     | 30 | 16 | 0.3                               | 28                                                       | 14 900                              | 21 200                                          |
|            | TAF 223020/SG         | 39               | 22                     | 30 | 20 | 0.3                               | 28                                                       | 18 900                              | 28 700                                          |
| 24         | TAF 243216/SG         | 33               | 24                     | 32 | 16 | 0.3                               | 30                                                       | 15 300                              | 22 500                                          |
|            | TAF 243220/SG         | 42               | 24                     | 32 | 20 | 0.3                               | 30                                                       | 19 400                              | 30 500                                          |
| 25         | TAF 253316/SG         | 35               | 25                     | 33 | 16 | 0.3                               | 31                                                       | 15 800                              | 23 700                                          |
|            | TAF 253320/SG         | 43.5             | 25                     | 33 | 20 | 0.3                               | 31                                                       | 20 000                              | 32 100                                          |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension r.  
Remarks1. Models with a nominal roller set bore diameter F<sub>w</sub> of 26mm or less are provided without oil holes, other models are provided with one oil hole and oil groove.  
2. This bearing can not be re-lubricated as thermosetting solid-type lubricant C-Lube fills inner space of the bearing.

| Shaft dia. | Identification number | Mass (Ref.)<br>g | Boundary dimensions mm |    |    |                                   | Standard mounting dimension<br>D <sub>a</sub><br>Max. mm | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|------------|-----------------------|------------------|------------------------|----|----|-----------------------------------|----------------------------------------------------------|-------------------------------------|-------------------------------------------------|
|            |                       |                  | F <sub>w</sub>         | D  | C  | r <sub>s</sub> min <sup>(1)</sup> |                                                          |                                     |                                                 |
| 29         | TAF 293820/SG         | 59               | 29                     | 38 | 20 | 0.3                               | 36                                                       | 21 600                              | 37 200                                          |
|            | TAF 293830/SG         | 88               | 29                     | 38 | 30 | 0.3                               | 36                                                       | 30 900                              | 59 100                                          |
| 30         | TAF 304020/SG         | 67               | 30                     | 40 | 20 | 0.3                               | 38                                                       | 25 100                              | 40 100                                          |
|            | TAF 304030/SG         | 101              | 30                     | 40 | 30 | 0.3                               | 38                                                       | 36 000                              | 63 900                                          |
| 35         | TAF 354520/SG         | 76.5             | 35                     | 45 | 20 | 0.3                               | 43                                                       | 26 900                              | 46 200                                          |
|            | TAF 354530/SG         | 116.5            | 35                     | 45 | 30 | 0.3                               | 43                                                       | 38 600                              | 73 600                                          |
| 40         | TAF 405020/SG         | 86               | 40                     | 50 | 20 | 0.3                               | 48                                                       | 29 400                              | 54 100                                          |
|            | TAF 405030/SG         | 130              | 40                     | 50 | 30 | 0.3                               | 48                                                       | 42 300                              | 86 200                                          |
| 45         | TAF 455520/SG         | 95.5             | 45                     | 55 | 20 | 0.3                               | 53                                                       | 31 000                              | 60 200                                          |
|            | TAF 455530/SG         | 144              | 45                     | 55 | 30 | 0.3                               | 53                                                       | 44 600                              | 95 800                                          |

# NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

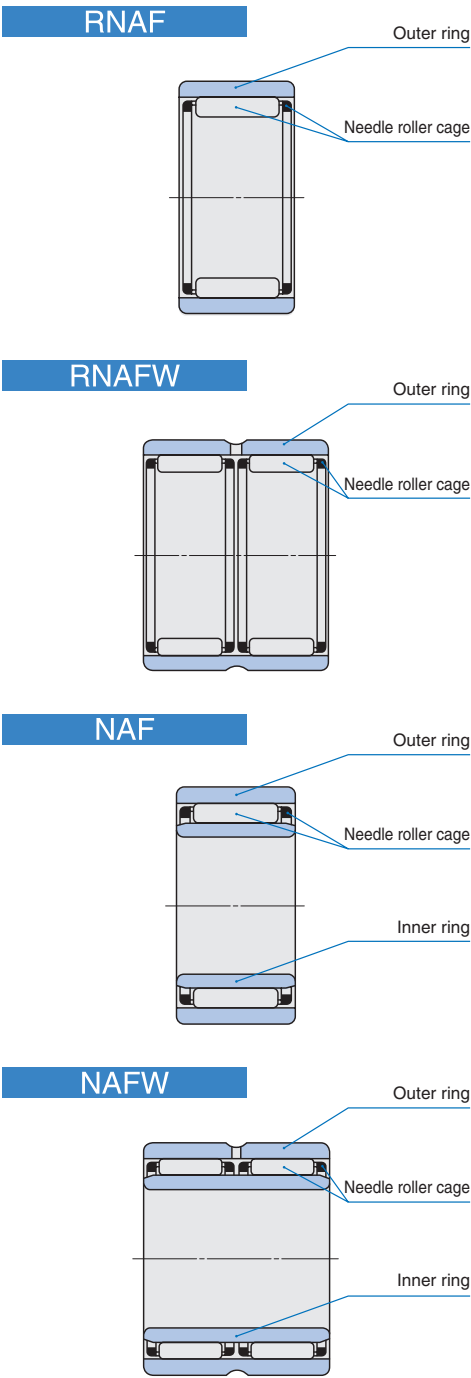
- Needle Roller Bearings with Separable Cage - Without Inner Ring
- Needle Roller Bearings with Separable Cage - With Inner Ring



## Structure and Features

In IKO Needle Roller Bearings with Separable Cage, the inner ring, outer ring and IKO Needle Roller Cage are combined, and they can be separated easily. This type has a simple structure with high accuracy. In addition, the radial clearance can be freely chosen by selecting and combining these component parts. As Needle Roller Cages are used, these bearings have excellent rotational performance. These bearings are most suitable for mass-production high accuracy products such as machine tools, textile machinery, and printing machines.

Structures of Needle Roller Bearings with Separable Cage



Types

Needle Roller Bearings with Separable Cage are available in the types shown in Table 1.

Table 1 Type of bearing

| Type       | Single-row         |                 | Double-row         |                 |
|------------|--------------------|-----------------|--------------------|-----------------|
|            | Without inner ring | With inner ring | Without inner ring | With inner ring |
| Model code | RNAF               | NAF             | RNAFW              | NAFW            |

Needle Roller Bearings with Separable Cage - Without Inner Ring

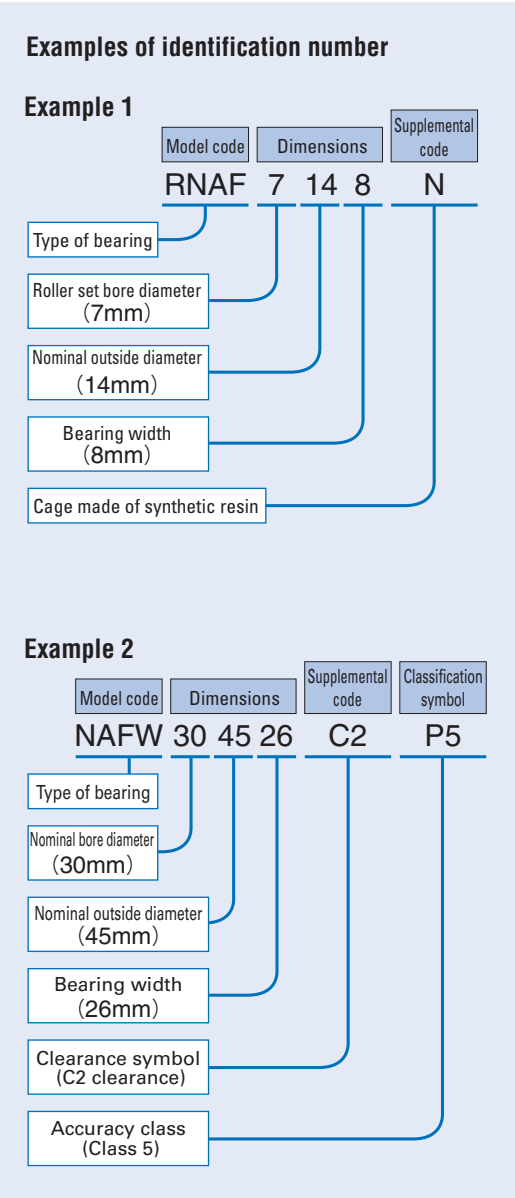
The single-row as well as the double-row types are available with the same sectional height, and either of them can be selected according to load conditions. As shown in the section, "Design of shaft and housing" on page A44, any desired radial internal clearance can be selected by combining a shaft which is heat-treated and finished by grinding.

Needle Roller Bearings with Separable Cage - With Inner Ring

These bearings are made to the CN clearance shown in Table 19 on page A37. When especially high accuracy is required, it is possible to supply semi-finished inner rings which have a finishing allowance on their outside diameter so that they can be ground after being press-fitted to shafts.

Identification Number

The identification number of Needle Roller Bearings with Separable Cage consists of a model code, dimensions, any supplemental codes and a classification symbol. The arrangement examples are as follows.



Accuracy

Needle Roller Bearings with Separable Cage are manufactured to the accuracy based on JIS (See page A31.). Tolerances for the smallest single roller set bore diameter of bearings without inner ring are based on Table 14 on page A33.

Clearance

Radial internal clearances of Needle Roller Bearings with Separable Cage are made to the CN clearance shown in Table 18 on page A37.

Fit

Recommended fits for Needle Roller Bearings with Separable Cage are shown in Tables 21 to 23 on pages A41 and A42.

Lubrication

Needle Roller Bearings with Separable Cage are not provided with prepacked grease. Perform proper lubrication for use. Using them without lubrication will increase the wear of the rolling contact surfaces and shorten their lives.

Oil Hole

The double-row type outer rings have both an oil hole and an oil groove, but the single-row type outer rings do not. When outer rings with an oil hole are required, attach "-OH" before the clearance symbol in the identification number, and when outer rings with both an oil hole and an oil groove are required, attach "-OG" to the same position.

Example: NAF 203517 - OH C2 P6

When outer rings with multiple oil holes or inner rings with oil hole(s) are required, please contact IKO.

Operating temperature range

For synthetic resin cages, "N" is added at the end of the identification number. The operating temperature range for Needle Roller Bearings with Separable Cage is -20 ~ +120°C. However, the maximum allowable temperature for synthetic resin cages is +110°C, and when they are continuously operated, it is +100°C.

Mounting

Mounting examples of Needle Roller Bearings with Separable Cage are shown in Fig.1. When mounting Needle Roller Bearings with Separable Cage, it is necessary to locate the needle cage axially. The needle cage is guided by shoulders of the shaft and housing or by side plates, and their guide surfaces must be heat-treated and finished by grinding at right angles to the shaft central axis. Dimensions related to mounting are shown in the table of dimensions.

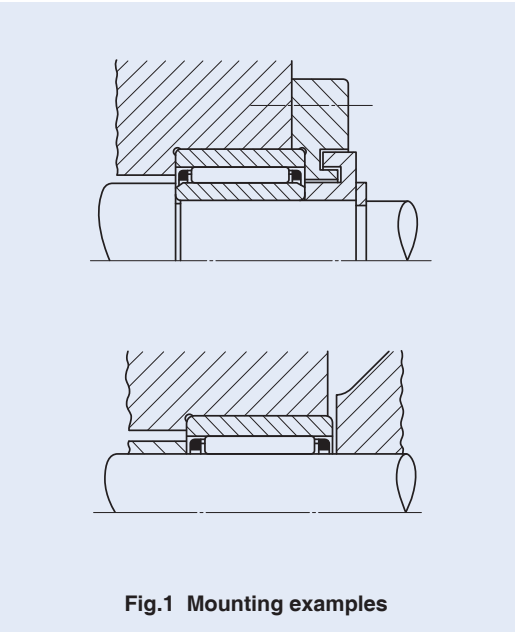


Fig.1 Mounting examples

NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

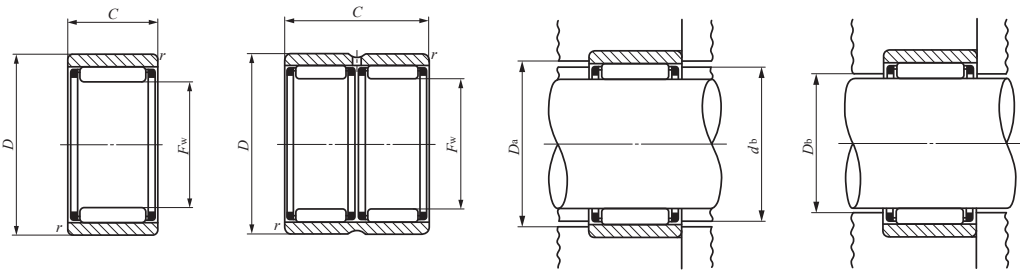
Without Inner Ring



Shaft dia. 5 – 18mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |    |                                   | Standard mounting dimensions mm |                        |                | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|------------------|-----------------------|---------------------|------------------------|----|----|-----------------------------------|---------------------------------|------------------------|----------------|-------------------------------------|-------------------------------------------------|
|                  |                       |                     | F <sub>w</sub>         | D  | C  | r <sub>s min</sub> <sup>(1)</sup> | d <sub>b</sub>                  | D <sub>a</sub><br>Max. | D <sub>b</sub> |                                     |                                                 |
| 5                | RNAF 5108N            | 2.8                 | 5                      | 10 | 8  | 0.2                               | 6.7                             | 8.4                    | 5.4            | 2 420                               | 1 950                                           |
| 6                | RNAF 6138N            | 5.5                 | 6                      | 13 | 8  | 0.3                               | 8.4                             | 11                     | 6.4            | 2 700                               | 2 320                                           |
| 7                | RNAF 7148N            | 6.1                 | 7                      | 14 | 8  | 0.3                               | 9.4                             | 12                     | 7.4            | 2 960                               | 2 690                                           |
| 8                | RNAF 81510            | 8.2                 | 8                      | 15 | 10 | 0.3                               | 10.4                            | 13                     | 8.4            | 3 630                               | 3 600                                           |
|                  | RNAFW 81620           | 20.5                | 8                      | 16 | 20 | 0.3                               | 10.8                            | 14                     | 8.4            | 6 220                               | 7 200                                           |
| 10               | RNAF 101710           | 9.6                 | 10                     | 17 | 10 | 0.3                               | 12.4                            | 15                     | 10.4           | 4 160                               | 4 550                                           |
|                  | RNAF 102012           | 18.7                | 10                     | 20 | 12 | 0.3                               | 13.5                            | 18                     | 10.4           | 5 940                               | 6 000                                           |
| 12               | RNAF 122212           | 19.5                | 12                     | 22 | 12 | 0.3                               | 15.5                            | 20                     | 12.4           | 9 030                               | 8 460                                           |
| 14               | RNAF 142213           | 18.7                | 14                     | 22 | 13 | 0.3                               | 17.6                            | 20                     | 14.6           | 7 860                               | 9 410                                           |
|                  | RNAFW 142220          | 28.5                | 14                     | 22 | 20 | 0.3                               | 17.6                            | 20                     | 14.6           | 10 800                              | 14 200                                          |
|                  | RNAF 142612           | 29                  | 14                     | 26 | 12 | 0.3                               | 19.4                            | 24                     | 14.6           | 9 790                               | 9 680                                           |
| 15               | RNAF 152313           | 19.7                | 15                     | 23 | 13 | 0.3                               | 18.6                            | 21                     | 15.6           | 8 250                               | 10 200                                          |
|                  | RNAFW 152320          | 30.5                | 15                     | 23 | 20 | 0.3                               | 18.6                            | 21                     | 15.6           | 11 400                              | 15 400                                          |
| 16               | RNAF 162413           | 21                  | 16                     | 24 | 13 | 0.3                               | 19.6                            | 22                     | 16.6           | 8 620                               | 11 000                                          |
|                  | RNAFW 162420          | 32                  | 16                     | 24 | 20 | 0.3                               | 19.6                            | 22                     | 16.6           | 11 900                              | 16 700                                          |
|                  | RNAF 162812           | 31.5                | 16                     | 28 | 12 | 0.3                               | 21.4                            | 26                     | 16.6           | 10 500                              | 10 900                                          |
| 17               | RNAF 172513           | 22                  | 17                     | 25 | 13 | 0.3                               | 20.6                            | 23                     | 17.6           | 8 980                               | 11 800                                          |
|                  | RNAFW 172520          | 33.5                | 17                     | 25 | 20 | 0.3                               | 20.6                            | 23                     | 17.6           | 12 400                              | 17 900                                          |
| 18               | RNAF 182613           | 23                  | 18                     | 26 | 13 | 0.3                               | 21.6                            | 24                     | 18.6           | 9 330                               | 12 700                                          |
|                  | RNAFW 182620          | 35                  | 18                     | 26 | 20 | 0.3                               | 21.6                            | 24                     | 18.6           | 12 900                              | 19 100                                          |
|                  | RNAF 183012           | 34.5                | 18                     | 30 | 12 | 0.3                               | 23.4                            | 28                     | 18.6           | 11 800                              | 13 100                                          |
|                  | RNAFW 183024          | 69.5                | 18                     | 30 | 24 | 0.3                               | 23.4                            | 28                     | 18.6           | 20 200                              | 26 200                                          |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remarks1. The character "N" at the end of the identification number indicates that a synthetic resin cage is incorporated.  
2. RNAF has no oil hole. RNAFW is provided with an oil groove and an oil hole on the outer ring.  
3. No grease is prepacked. Perform proper lubrication.



RNAF RNAFW

| Allowable rotational speed <sup>(2)</sup><br>min <sup>-1</sup> |
|----------------------------------------------------------------|
| 85 000                                                         |
| 75 000                                                         |
| 65 000                                                         |
| 60 000                                                         |
| 60 000                                                         |
| 50 000                                                         |
| 50 000                                                         |
| 40 000                                                         |
| 35 000                                                         |
| 35 000                                                         |
| 35 000                                                         |
| 35 000                                                         |
| 35 000                                                         |
| 35 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |
| 30 000                                                         |

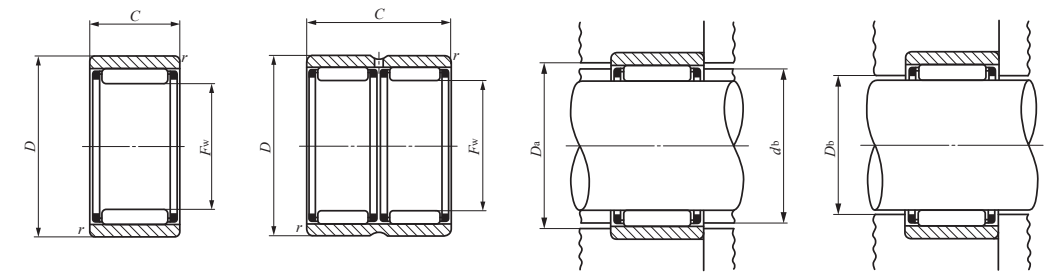
### Without Inner Ring



Shaft dia. 20 – 40mm

| Shaft dia.<br><br>mm | Identification number | Mass<br>(Ref.)<br><br>g | Boundary dimensions    mm |     |     |                             | Standard mounting<br>dimensions    mm |               |       | Basic dynamic<br>load rating<br><br>N | Basic static<br>load rating<br><br>N |
|----------------------|-----------------------|-------------------------|---------------------------|-----|-----|-----------------------------|---------------------------------------|---------------|-------|---------------------------------------|--------------------------------------|
|                      |                       |                         | $F_w$                     | $D$ | $C$ | $r_s$ <sup>(1)</sup><br>min | $d_b$                                 | $D_a$<br>Max. | $D_b$ |                                       |                                      |
| 20                   | RNAF 202813           | 25                      | 20                        | 28  | 13  | 0.3                         | 23.6                                  | 26            | 20.6  | 9 590                                 | 13 500                               |
|                      | RNAFW 202826          | 49.5                    | 20                        | 28  | 26  | 0.3                         | 23.6                                  | 26            | 20.6  | 16 400                                | 27 100                               |
|                      | RNAF 203212           | 37.5                    | 20                        | 32  | 12  | 0.3                         | 25.4                                  | 30            | 20.6  | 12 400                                | 14 300                               |
|                      | RNAFW 203224          | 75                      | 20                        | 32  | 24  | 0.3                         | 25.4                                  | 30            | 20.6  | 21 200                                | 28 600                               |
| 22                   | RNAF 223013           | 27                      | 22                        | 30  | 13  | 0.3                         | 25.6                                  | 28            | 22.6  | 10 200                                | 15 200                               |
|                      | RNAFW 223026          | 53.5                    | 22                        | 30  | 26  | 0.3                         | 25.6                                  | 28            | 22.6  | 17 500                                | 30 300                               |
|                      | RNAF 223516           | 58.5                    | 22                        | 35  | 16  | 0.3                         | 27.8                                  | 33            | 22.6  | 17 600                                | 20 900                               |
|                      | RNAFW 223532          | 117                     | 22                        | 35  | 32  | 0.3                         | 27.8                                  | 33            | 22.6  | 30 200                                | 41 800                               |
| 25                   | RNAF 253517           | 51                      | 25                        | 35  | 17  | 0.3                         | 29.5                                  | 33            | 25.6  | 17 300                                | 26 600                               |
|                      | RNAFW 253526          | 78                      | 25                        | 35  | 26  | 0.3                         | 29.5                                  | 33            | 25.6  | 22 400                                | 37 200                               |
|                      | RNAF 253716           | 57                      | 25                        | 37  | 16  | 0.3                         | 30.4                                  | 35            | 25.6  | 19 400                                | 24 500                               |
|                      | RNAFW 253732          | 114                     | 25                        | 37  | 32  | 0.3                         | 30.4                                  | 35            | 25.6  | 33 200                                | 49 000                               |
| 28                   | RNAF 284016           | 62.5                    | 28                        | 40  | 16  | 0.3                         | 33.4                                  | 38            | 28.6  | 20 100                                | 26 500                               |
|                      | RNAFW 284032          | 125                     | 28                        | 40  | 32  | 0.3                         | 33.4                                  | 38            | 28.6  | 34 400                                | 53 000                               |
| 30                   | RNAF 304017           | 59                      | 30                        | 40  | 17  | 0.3                         | 34.5                                  | 38            | 30.6  | 18 700                                | 31 100                               |
|                      | RNAFW 304026          | 90.5                    | 30                        | 40  | 26  | 0.3                         | 34.5                                  | 38            | 30.6  | 24 200                                | 43 400                               |
|                      | RNAF 304216           | 66                      | 30                        | 42  | 16  | 0.3                         | 35.4                                  | 40            | 30.6  | 20 800                                | 28 400                               |
|                      | RNAFW 304232          | 132                     | 30                        | 42  | 32  | 0.3                         | 35.4                                  | 40            | 30.6  | 35 700                                | 56 800                               |
| 35                   | RNAF 354517           | 67.5                    | 35                        | 45  | 17  | 0.3                         | 39.5                                  | 43            | 35.6  | 20 500                                | 36 900                               |
|                      | RNAFW 354526          | 103                     | 35                        | 45  | 26  | 0.3                         | 39.5                                  | 43            | 35.6  | 26 600                                | 51 500                               |
|                      | RNAF 354716           | 75.5                    | 35                        | 47  | 16  | 0.3                         | 40.4                                  | 45            | 35.6  | 23 100                                | 33 900                               |
|                      | RNAFW 354732          | 151                     | 35                        | 47  | 32  | 0.3                         | 40.4                                  | 45            | 35.6  | 39 500                                | 67 800                               |
| 40                   | RNAF 405017           | 76                      | 40                        | 50  | 17  | 0.3                         | 43.5                                  | 48            | 40.8  | 22 200                                | 42 700                               |
|                      | RNAFW 405034          | 152                     | 40                        | 50  | 34  | 0.3                         | 43.5                                  | 48            | 40.8  | 38 000                                | 85 400                               |
|                      | RNAF 405520           | 140                     | 40                        | 55  | 20  | 0.3                         | 45.2                                  | 53            | 40.8  | 31 400                                | 48 000                               |
|                      | RNAFW 405540          | 280                     | 40                        | 55  | 40  | 0.3                         | 45.2                                  | 53            | 40.8  | 53 900                                | 96 000                               |

|                      |                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Notes <sup>(1)</sup> | Minimum allowable value of chamfer dimension $r$                                                                            |
| <sup>(2)</sup>       | Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable. |
| Remarks1.            | RNAF has no oil hole. RNAFW is provided with an oil groove and an oil hole on the outer ring.                               |
| 2.                   | No grease is prepacked. Perform proper lubrication.                                                                         |



RNAF

RNAFW

| Allowable rotational speed <sup>(2)</sup> |
|-------------------------------------------|
| min <sup>-1</sup>                         |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 25 000                                    |
| 20 000                                    |
| 20 000                                    |
| 20 000                                    |
| 20 000                                    |
| 18 000                                    |
| 18 000                                    |
| 17 000                                    |
| 17 000                                    |
| 17 000                                    |
| 17 000                                    |
| 14 000                                    |
| 14 000                                    |
| 14 000                                    |
| 14 000                                    |
| 12 000                                    |
| 12 000                                    |
| 12 000                                    |
| 12 000                                    |

NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

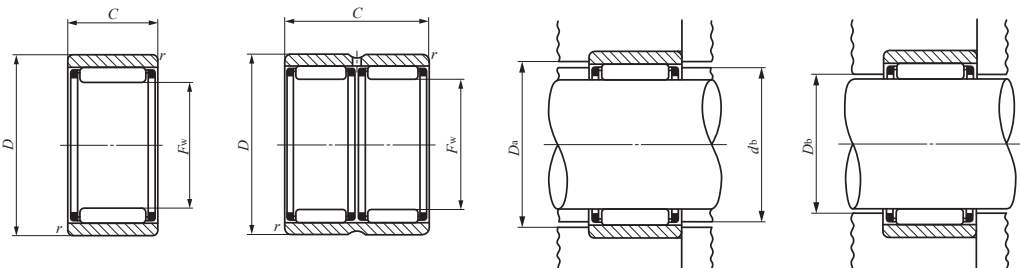
Without Inner Ring



Shaft dia. 45 – 100mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |          |          |                                          | Standard mounting dimensions mm |                               |                       | Basic dynamic load rating<br><i>C</i><br>N | Basic static load rating<br><i>C</i> <sub>0</sub><br>N |
|------------------|-----------------------|---------------------|------------------------|----------|----------|------------------------------------------|---------------------------------|-------------------------------|-----------------------|--------------------------------------------|--------------------------------------------------------|
|                  |                       |                     | <i>F</i> <sub>w</sub>  | <i>D</i> | <i>C</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>d</i> <sub>b</sub>           | <i>D</i> <sub>a</sub><br>Max. | <i>D</i> <sub>b</sub> |                                            |                                                        |
| 45               | RNAF 455517           | 83.5                | 45                     | 55       | 17       | 0.3                                      | 48.5                            | 53                            | 45.8                  | 23 300                                     | 47 100                                                 |
|                  | RNAFW 455534          | 167                 | 45                     | 55       | 34       | 0.3                                      | 48.5                            | 53                            | 45.8                  | 39 900                                     | 94 200                                                 |
|                  | RNAF 456220           | 184                 | 45                     | 62       | 20       | 0.3                                      | 50.9                            | 60                            | 45.8                  | 33 200                                     | 53 300                                                 |
|                  | RNAFW 456240          | 370                 | 45                     | 62       | 40       | 0.3                                      | 50.9                            | 60                            | 45.8                  | 56 900                                     | 107 000                                                |
| 50               | RNAF 506220           | 138                 | 50                     | 62       | 20       | 0.3                                      | 54.2                            | 60                            | 50.8                  | 27 100                                     | 59 300                                                 |
|                  | RNAFW 506240          | 275                 | 50                     | 62       | 40       | 0.3                                      | 54.2                            | 60                            | 50.8                  | 46 400                                     | 119 000                                                |
|                  | RNAF 506520           | 170                 | 50                     | 65       | 20       | 0.3                                      | 55.2                            | 63                            | 50.8                  | 35 900                                     | 61 100                                                 |
|                  | RNAFW 506540          | 340                 | 50                     | 65       | 40       | 0.6                                      | 55.2                            | 61                            | 50.8                  | 61 500                                     | 122 000                                                |
| 55               | RNAF 556820           | 167                 | 55                     | 68       | 20       | 0.3                                      | 59.5                            | 66                            | 55.8                  | 28 600                                     | 66 000                                                 |
|                  | RNAFW 556840          | 335                 | 55                     | 68       | 40       | 0.3                                      | 59.5                            | 66                            | 55.8                  | 49 000                                     | 132 000                                                |
|                  | RNAF 557220           | 220                 | 55                     | 72       | 20       | 1                                        | 60.9                            | 67                            | 55.8                  | 37 400                                     | 66 400                                                 |
|                  | RNAFW 557240          | 440                 | 55                     | 72       | 40       | 1                                        | 60.9                            | 67                            | 55.8                  | 64 100                                     | 133 000                                                |
| 60               | RNAF 607820           | 255                 | 60                     | 78       | 20       | 1                                        | 66.3                            | 73                            | 60.8                  | 38 900                                     | 71 700                                                 |
|                  | RNAFW 607840          | 510                 | 60                     | 78       | 40       | 1                                        | 66.3                            | 73                            | 60.8                  | 66 700                                     | 143 000                                                |
| 65               | RNAF 658530           | 470                 | 65                     | 85       | 30       | 1.5                                      | 72                              | 77                            | 66                    | 59 300                                     | 127 000                                                |
|                  | RNAFW 658560          | 945                 | 65                     | 85       | 60       | 1.5                                      | 72                              | 77                            | 66                    | 102 000                                    | 255 000                                                |
| 70               | RNAF 709030           | 500                 | 70                     | 90       | 30       | 1.5                                      | 77                              | 82                            | 71                    | 61 200                                     | 136 000                                                |
|                  | RNAFW 709060          | 1 000               | 70                     | 90       | 60       | 1.5                                      | 77                              | 82                            | 71                    | 105 000                                    | 272 000                                                |
| 75               | RNAF 759530           | 530                 | 75                     | 95       | 30       | 1.5                                      | 82                              | 87                            | 76                    | 63 100                                     | 144 000                                                |
|                  | RNAFW 759560          | 1 060               | 75                     | 95       | 60       | 1.5                                      | 82                              | 87                            | 76                    | 108 000                                    | 289 000                                                |
| 80               | RNAF 8010030          | 560                 | 80                     | 100      | 30       | 1.5                                      | 87                              | 92                            | 81                    | 65 000                                     | 153 000                                                |
|                  | RNAFW 8010060         | 1 120               | 80                     | 100      | 60       | 1.5                                      | 87                              | 92                            | 81                    | 111 000                                    | 306 000                                                |
| 85               | RNAF 8510530          | 590                 | 85                     | 105      | 30       | 1.5                                      | 92                              | 97                            | 86                    | 66 600                                     | 161 000                                                |
| 90               | RNAF 9011030          | 625                 | 90                     | 110      | 30       | 1.5                                      | 97                              | 102                           | 91                    | 69 600                                     | 174 000                                                |
| 95               | RNAF 9511530          | 655                 | 95                     | 115      | 30       | 1.5                                      | 102                             | 107                           | 96                    | 70 900                                     | 182 000                                                |
| 100              | RNAF 10012030         | 685                 | 100                    | 120      | 30       | 1.5                                      | 107                             | 112                           | 101                   | 72 500                                     | 191 000                                                |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remarks1. RNAF has no oil hole. RNAFW is provided with an oil groove and an oil hole on the outer ring.  
2. No grease is prepacked. Perform proper lubrication.

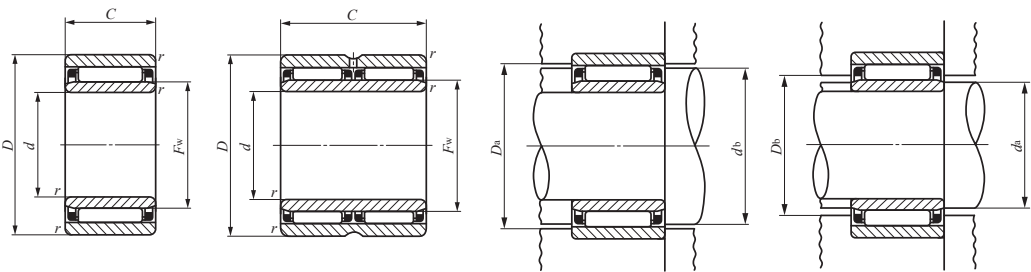


RNAF RNAFW

| Allowable rotational speed <sup>(2)</sup><br>min <sup>-1</sup> |
|----------------------------------------------------------------|
| 11 000                                                         |
| 11 000                                                         |
| 11 000                                                         |
| 11 000                                                         |
| 10 000                                                         |
| 10 000                                                         |
| 10 000                                                         |
| 10 000                                                         |
| 9 000                                                          |
| 9 000                                                          |
| 9 000                                                          |
| 9 000                                                          |
| 8 500                                                          |
| 8 500                                                          |
| 7 500                                                          |
| 7 500                                                          |
| 7 000                                                          |
| 7 000                                                          |
| 6 500                                                          |
| 6 500                                                          |
| 6 000                                                          |
| 6 000                                                          |
| 6 000                                                          |
| 5 500                                                          |
| 5 500                                                          |
| 4 500                                                          |

NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

With Inner Ring



NAF NAFW

Shaft dia. 6 – 25mm

| Shaft dia.<br><br>mm | Identification number | Mass<br>(Ref.)<br><br>g | Boundary dimensions    mm |          |          |                                          |                       | Standard mounting dimensions    mm |                               |                               |      |                       |
|----------------------|-----------------------|-------------------------|---------------------------|----------|----------|------------------------------------------|-----------------------|------------------------------------|-------------------------------|-------------------------------|------|-----------------------|
|                      |                       |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>F</i> <sub>w</sub> | <i>d</i> <sub>b</sub>              | <i>D</i> <sub>a</sub><br>Max. | <i>d</i> <sub>a</sub><br>Min. | Max. | <i>D</i> <sub>b</sub> |
| 6                    | NAF 61710             | 13.5                    | 6                         | 17       | 10       | 0.3                                      | 10                    | 12.4                               | 15                            | 8                             | 9.7  | 10.4                  |
| 7                    | NAF 72012             | 22.5                    | 7                         | 20       | 12       | 0.3                                      | 10                    | 13.5                               | 18                            | 9                             | 9.7  | 10.4                  |
| 9                    | NAF 92212             | 24                      | 9                         | 22       | 12       | 0.3                                      | 12                    | 15.5                               | 20                            | 11                            | 11.5 | 12.4                  |
| 10                   | NAF 102213            | 26                      | 10                        | 22       | 13       | 0.3                                      | 14                    | 17.6                               | 20                            | 12                            | 13   | 14.6                  |
|                      | NAFW 102220           | 40                      | 10                        | 22       | 20       | 0.3                                      | 14                    | 17.6                               | 20                            | 12                            | 13   | 14.6                  |
|                      | NAF 102612            | 36                      | 10                        | 26       | 12       | 0.3                                      | 14                    | 19.4                               | 24                            | 12                            | 13   | 14.6                  |
| 12                   | NAF 122413            | 29.5                    | 12                        | 24       | 13       | 0.3                                      | 16                    | 19.6                               | 22                            | 14                            | 15   | 16.6                  |
|                      | NAFW 122420           | 45.5                    | 12                        | 24       | 20       | 0.3                                      | 16                    | 19.6                               | 22                            | 14                            | 15   | 16.6                  |
|                      | NAF 122812            | 40                      | 12                        | 28       | 12       | 0.3                                      | 16                    | 21.4                               | 26                            | 14                            | 15   | 16.6                  |
| 15                   | NAF 152813            | 38.5                    | 15                        | 28       | 13       | 0.3                                      | 20                    | 23.6                               | 26                            | 17                            | 19   | 20.6                  |
|                      | NAFW 152826           | 77.5                    | 15                        | 28       | 26       | 0.3                                      | 20                    | 23.6                               | 26                            | 17                            | 19   | 20.6                  |
|                      | NAF 153212            | 50.5                    | 15                        | 32       | 12       | 0.3                                      | 20                    | 25.4                               | 30                            | 17                            | 19   | 20.6                  |
| 17                   | NAF 173013            | 42.5                    | 17                        | 30       | 13       | 0.3                                      | 22                    | 25.6                               | 28                            | 19                            | 21   | 22.6                  |
|                      | NAFW 173026           | 84.5                    | 17                        | 30       | 26       | 0.3                                      | 22                    | 25.6                               | 28                            | 19                            | 21   | 22.6                  |
|                      | NAF 173516            | 77.5                    | 17                        | 35       | 16       | 0.3                                      | 22                    | 27.8                               | 33                            | 19                            | 21   | 22.6                  |
|                      | NAFW 173532           | 155                     | 17                        | 35       | 32       | 0.3                                      | 22                    | 27.8                               | 33                            | 19                            | 21   | 22.6                  |
| 20                   | NAF 203517            | 74                      | 20                        | 35       | 17       | 0.3                                      | 25                    | 29.5                               | 33                            | 22                            | 24   | 25.6                  |
|                      | NAFW 203526           | 114                     | 20                        | 35       | 26       | 0.3                                      | 25                    | 29.5                               | 33                            | 22                            | 24   | 25.6                  |
|                      | NAF 203716            | 79                      | 20                        | 37       | 16       | 0.3                                      | 25                    | 30.4                               | 35                            | 22                            | 24   | 25.6                  |
|                      | NAFW 203732           | 158                     | 20                        | 37       | 32       | 0.3                                      | 25                    | 30.4                               | 35                            | 22                            | 24   | 25.6                  |
| 25                   | NAF 254017            | 87.5                    | 25                        | 40       | 17       | 0.3                                      | 30                    | 34.5                               | 38                            | 27                            | 29   | 30.6                  |
|                      | NAFW 254026           | 135                     | 25                        | 40       | 26       | 0.3                                      | 30                    | 34.5                               | 38                            | 27                            | 29   | 30.6                  |
|                      | NAF 254216            | 94                      | 25                        | 42       | 16       | 0.3                                      | 30                    | 35.4                               | 40                            | 27                            | 29   | 30.6                  |
|                      | NAFW 254232           | 186                     | 25                        | 42       | 32       | 0.3                                      | 30                    | 35.4                               | 40                            | 27                            | 29   | 30.6                  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remarks1. NAF has no oil hole. NAFW is provided with an oil groove and an oil hole on the outer ring.  
2. No grease is prepacked. Perform proper lubrication.

| Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> | Assembled<br>inner ring |
|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|-------------------------|
| 4 160                                         | 4 550                                                     | 50 000                                                               | LRT 61010               |
| 5 940                                         | 6 000                                                     | 50 000                                                               | LRT 71012-1             |
| 9 030                                         | 8 460                                                     | 40 000                                                               | LRT 91212               |
| 7 860                                         | 9 410                                                     | 35 000                                                               | LRT 101413              |
| 10 800                                        | 14 200                                                    | 35 000                                                               | LRT 101420              |
| 9 790                                         | 9 680                                                     | 35 000                                                               | LRT 101412              |
| 8 620                                         | 11 000                                                    | 30 000                                                               | LRT 121613              |
| 11 900                                        | 16 700                                                    | 30 000                                                               | LRT 121620              |
| 10 500                                        | 10 900                                                    | 30 000                                                               | LRT 121612              |
| 9 590                                         | 13 500                                                    | 25 000                                                               | LRT 152013              |
| 16 400                                        | 27 100                                                    | 25 000                                                               | LRT 152026              |
| 12 400                                        | 14 300                                                    | 25 000                                                               | LRT 152012              |
| 10 200                                        | 15 200                                                    | 25 000                                                               | LRT 172213              |
| 17 500                                        | 30 300                                                    | 25 000                                                               | LRT 172226              |
| 17 600                                        | 20 900                                                    | 25 000                                                               | LRT 172216              |
| 30 200                                        | 41 800                                                    | 25 000                                                               | LRT 172232              |
| 17 300                                        | 26 600                                                    | 20 000                                                               | LRT 202517              |
| 22 400                                        | 37 200                                                    | 20 000                                                               | LRT 202526              |
| 19 400                                        | 24 500                                                    | 20 000                                                               | LRT 202516              |
| 33 200                                        | 49 000                                                    | 20 000                                                               | LRT 202532              |
| 18 700                                        | 31 100                                                    | 17 000                                                               | LRT 253017              |
| 24 200                                        | 43 400                                                    | 17 000                                                               | LRT 253026              |
| 20 800                                        | 28 400                                                    | 17 000                                                               | LRT 253016              |
| 35 700                                        | 56 800                                                    | 17 000                                                               | LRT 253032              |

NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

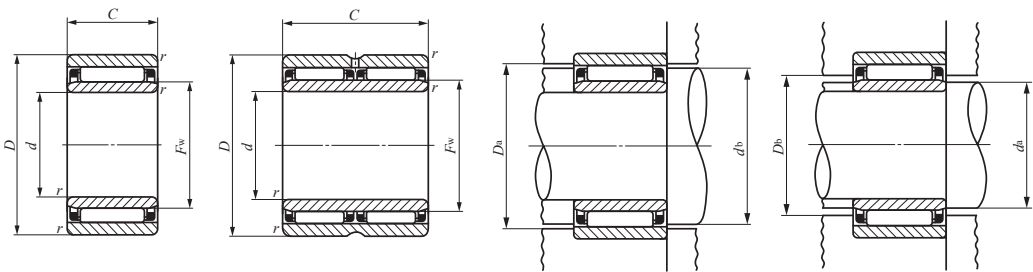
With Inner Ring



Shaft dia. 30 – 65mm

| Shaft dia.<br><br>mm | Identification number | Mass<br>(Ref.)<br><br>g | Boundary dimensions   mm |          |          |                                          |                       | Standard mounting dimensions   mm |                               |                                      |                       |      |
|----------------------|-----------------------|-------------------------|--------------------------|----------|----------|------------------------------------------|-----------------------|-----------------------------------|-------------------------------|--------------------------------------|-----------------------|------|
|                      |                       |                         | <i>d</i>                 | <i>D</i> | <i>C</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>F</i> <sub>w</sub> | <i>d</i> <sub>b</sub>             | <i>D</i> <sub>a</sub><br>Max. | <i>d</i> <sub>a</sub><br>Min.   Max. | <i>D</i> <sub>b</sub> |      |
| 30                   | NAF 304517            | 101                     | 30                       | 45       | 17       | 0.3                                      | 35                    | 39.5                              | 43                            | 32                                   | 34                    | 35.6 |
|                      | NAFW 304526           | 155                     | 30                       | 45       | 26       | 0.3                                      | 35                    | 39.5                              | 43                            | 32                                   | 34                    | 35.6 |
|                      | NAF 304716            | 107                     | 30                       | 47       | 16       | 0.3                                      | 35                    | 40.4                              | 45                            | 32                                   | 34                    | 35.6 |
|                      | NAFW 304732           | 215                     | 30                       | 47       | 32       | 0.3                                      | 35                    | 40.4                              | 45                            | 32                                   | 34                    | 35.6 |
| 35                   | NAF 355017            | 115                     | 35                       | 50       | 17       | 0.3                                      | 40                    | 43.5                              | 48                            | 37                                   | 39                    | 40.8 |
|                      | NAFW 355034           | 230                     | 35                       | 50       | 34       | 0.3                                      | 40                    | 43.5                              | 48                            | 37                                   | 39                    | 40.8 |
|                      | NAF 355520            | 186                     | 35                       | 55       | 20       | 0.3                                      | 40                    | 45.2                              | 53                            | 37                                   | 39                    | 40.8 |
|                      | NAFW 355540           | 375                     | 35                       | 55       | 40       | 0.3                                      | 40                    | 45.2                              | 53                            | 37                                   | 39                    | 40.8 |
| 40                   | NAF 405517            | 128                     | 40                       | 55       | 17       | 0.3                                      | 45                    | 48.5                              | 53                            | 42                                   | 44                    | 45.8 |
|                      | NAFW 405534           | 255                     | 40                       | 55       | 34       | 0.3                                      | 45                    | 48.5                              | 53                            | 42                                   | 44                    | 45.8 |
|                      | NAF 406220            | 235                     | 40                       | 62       | 20       | 0.3                                      | 45                    | 50.9                              | 60                            | 42                                   | 44                    | 45.8 |
|                      | NAFW 406240           | 475                     | 40                       | 62       | 40       | 0.3                                      | 45                    | 50.9                              | 60                            | 42                                   | 44                    | 45.8 |
| 45                   | NAF 456220            | 196                     | 45                       | 62       | 20       | 0.3                                      | 50                    | 54.2                              | 60                            | 47                                   | 49                    | 50.8 |
|                      | NAFW 456240           | 390                     | 45                       | 62       | 40       | 0.3                                      | 50                    | 54.2                              | 60                            | 47                                   | 49                    | 50.8 |
|                      | NAF 457220            | 340                     | 45                       | 72       | 20       | 1                                        | 55                    | 60.9                              | 67                            | 50                                   | 54                    | 55.8 |
|                      | NAFW 457240           | 685                     | 45                       | 72       | 40       | 1                                        | 55                    | 60.9                              | 67                            | 50                                   | 54                    | 55.8 |
| 50                   | NAF 506820            | 230                     | 50                       | 68       | 20       | 0.3                                      | 55                    | 59.5                              | 66                            | 52                                   | 54                    | 55.8 |
|                      | NAFW 506840           | 465                     | 50                       | 68       | 40       | 0.3                                      | 55                    | 59.5                              | 66                            | 52                                   | 54                    | 55.8 |
|                      | NAF 507820            | 390                     | 50                       | 78       | 20       | 1                                        | 60                    | 66.3                              | 73                            | 55                                   | 59                    | 60.8 |
|                      | NAFW 507840           | 775                     | 50                       | 78       | 40       | 1                                        | 60                    | 66.3                              | 73                            | 55                                   | 59                    | 60.8 |
| 55                   | NAF 558530            | 690                     | 55                       | 85       | 30       | 1.5                                      | 65                    | 72                                | 77                            | 63                                   | 63.5                  | 66   |
|                      | NAFW 558560           | 1 380                   | 55                       | 85       | 60       | 1.5                                      | 65                    | 72                                | 77                            | 63                                   | 63.5                  | 66   |
| 60                   | NAF 609030            | 740                     | 60                       | 90       | 30       | 1.5                                      | 70                    | 77                                | 82                            | 68                                   | 68.5                  | 71   |
|                      | NAFW 609060           | 1 480                   | 60                       | 90       | 60       | 1.5                                      | 70                    | 77                                | 82                            | 68                                   | 68.5                  | 71   |
| 65                   | NAF 659530            | 790                     | 65                       | 95       | 30       | 1.5                                      | 75                    | 82                                | 87                            | 73                                   | 73.5                  | 76   |
|                      | NAFW 659560           | 1 580                   | 65                       | 95       | 60       | 1.5                                      | 75                    | 82                                | 87                            | 73                                   | 73.5                  | 76   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remarks1. NAF has no oil hole. NAFW is provided with an oil groove and an oil hole on the outer ring.  
2. No grease is prepacked. Perform proper lubrication.



NAF NAFW

| Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> | Assembled<br>inner ring |
|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|-------------------------|
| 20 500                                        | 36 900                                                    | 14 000                                                               | LRT 303517              |
| 26 600                                        | 51 500                                                    | 14 000                                                               | LRT 303526              |
| 23 100                                        | 33 900                                                    | 14 000                                                               | LRT 303516              |
| 39 500                                        | 67 800                                                    | 14 000                                                               | LRT 303532              |
| 22 200                                        | 42 700                                                    | 12 000                                                               | LRT 354017              |
| 38 000                                        | 85 400                                                    | 12 000                                                               | LRT 354034              |
| 31 400                                        | 48 000                                                    | 12 000                                                               | LRT 354020              |
| 53 900                                        | 96 000                                                    | 12 000                                                               | LRT 354040              |
| 23 300                                        | 47 100                                                    | 11 000                                                               | LRT 404517              |
| 39 900                                        | 94 200                                                    | 11 000                                                               | LRT 404534              |
| 33 200                                        | 53 300                                                    | 11 000                                                               | LRT 404520              |
| 56 900                                        | 107 000                                                   | 11 000                                                               | LRT 404540              |
| 27 100                                        | 59 300                                                    | 10 000                                                               | LRT 455020              |
| 46 400                                        | 119 000                                                   | 10 000                                                               | LRT 455040              |
| 37 400                                        | 66 400                                                    | 9 000                                                                | LRT 455520              |
| 64 100                                        | 133 000                                                   | 9 000                                                                | LRT 455540              |
| 28 600                                        | 66 000                                                    | 9 000                                                                | LRT 505520              |
| 49 000                                        | 132 000                                                   | 9 000                                                                | LRT 505540              |
| 38 900                                        | 71 700                                                    | 8 500                                                                | LRT 506020              |
| 66 700                                        | 143 000                                                   | 8 500                                                                | LRT 506040              |
| 59 300                                        | 127 000                                                   | 7 500                                                                | LRT 556530              |
| 102 000                                       | 255 000                                                   | 7 500                                                                | LRT 556560              |
| 61 200                                        | 136 000                                                   | 7 000                                                                | LRT 607030              |
| 105 000                                       | 272 000                                                   | 7 000                                                                | LRT 607060              |
| 63 100                                        | 144 000                                                   | 6 500                                                                | LRT 657530              |
| 108 000                                       | 289 000                                                   | 6 500                                                                | LRT 657560              |

NEEDLE ROLLER BEARINGS WITH SEPARABLE CAGE

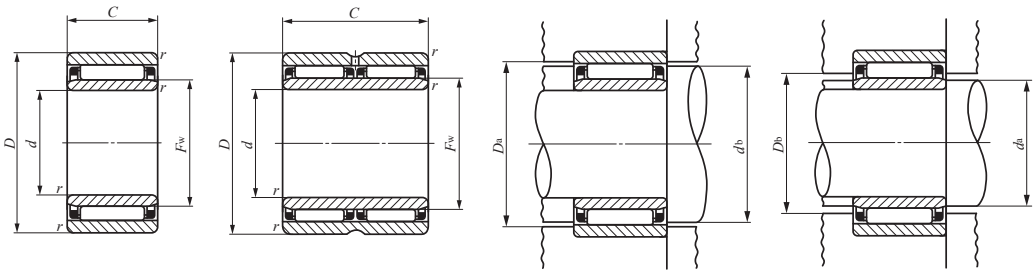
With Inner Ring



Shaft dia. 70 — 90mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |          |          |                                          |                       | Standard mounting dimensions mm |                               |                               |                               |                       |
|------------------|-----------------------|---------------------|------------------------|----------|----------|------------------------------------------|-----------------------|---------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------|
|                  |                       |                     | <i>d</i>               | <i>D</i> | <i>C</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>F</i> <sub>w</sub> | <i>d</i> <sub>b</sub>           | <i>D</i> <sub>a</sub><br>Max. | <i>d</i> <sub>a</sub><br>Min. | <i>d</i> <sub>a</sub><br>Max. | <i>D</i> <sub>b</sub> |
| 70               | NAF 7010030           | 835                 | 70                     | 100      | 30       | 1.5                                      | 80                    | 87                              | 92                            | 78                            | 78.5                          | 81                    |
|                  | NAFW 7010060          | 1 680               | 70                     | 100      | 60       | 1.5                                      | 80                    | 87                              | 92                            | 78                            | 78.5                          | 81                    |
| 75               | NAF 7510530           | 885                 | 75                     | 105      | 30       | 1.5                                      | 85                    | 92                              | 97                            | 83                            | 83.5                          | 86                    |
| 80               | NAF 8011030           | 935                 | 80                     | 110      | 30       | 1.5                                      | 90                    | 97                              | 102                           | 88                            | 88.5                          | 91                    |
| 85               | NAF 8511530           | 985                 | 85                     | 115      | 30       | 1.5                                      | 95                    | 102                             | 107                           | 93                            | 93.5                          | 96                    |
| 90               | NAF 9012030           | 1 040               | 90                     | 120      | 30       | 1.5                                      | 100                   | 107                             | 112                           | 98                            | 98.5                          | 101                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.  
Remarks1. NAF has no oil hole. NAFW is provided with an oil groove and an oil hole on the outer ring.  
2. No grease is prepacked. Perform proper lubrication.

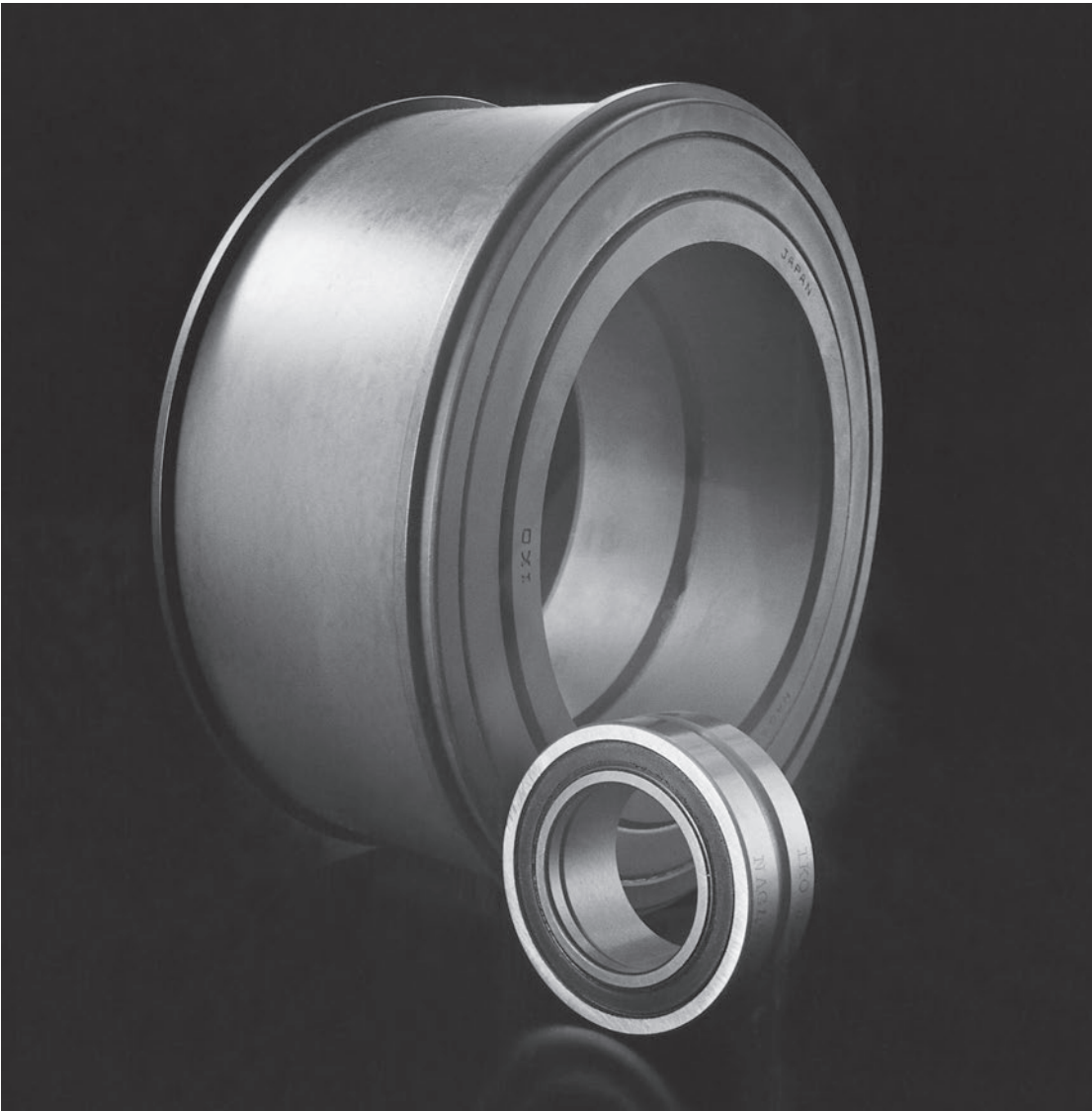


NAF NAFW

| Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> | Assembled<br>inner ring |
|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|-------------------------|
| 65 000                                        | 153 000                                                   | 6 000                                                                | LRT 708030-1            |
| 111 000                                       | 306 000                                                   | 6 000                                                                | LRT 708060              |
| 66 600                                        | 161 000                                                   | 6 000                                                                | LRT 758530-1            |
| 69 600                                        | 174 000                                                   | 5 500                                                                | LRT 809030-1            |
| 70 900                                        | 182 000                                                   | 5 500                                                                | LRT 859530              |
| 72 500                                        | 191 000                                                   | 4 500                                                                | LRT 9010030             |

# ROLLER BEARINGS

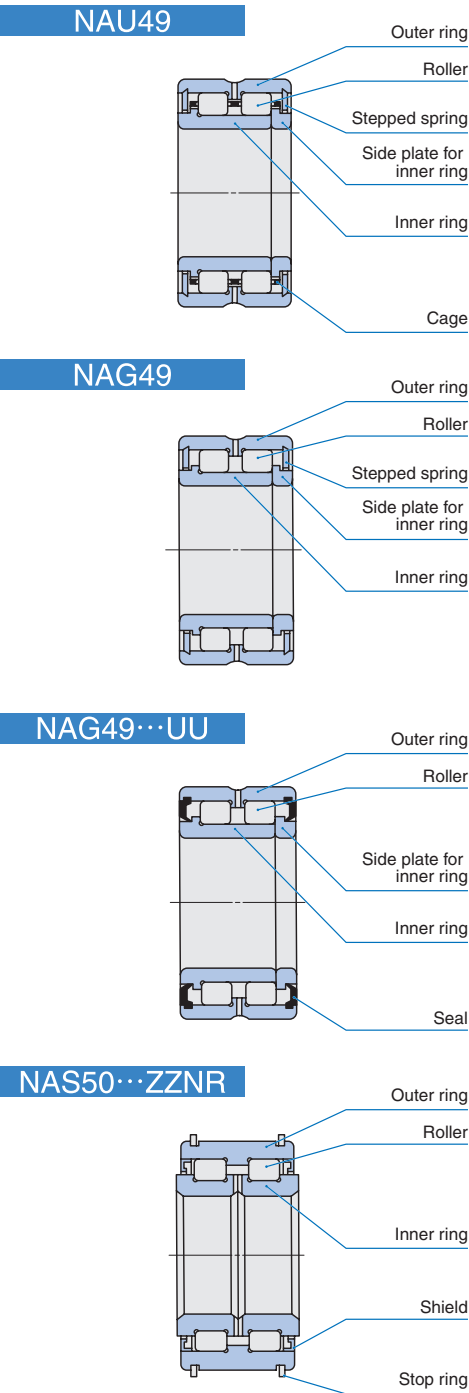
- Caged Roller Bearings
- Full Complement Roller Bearings
- Roller Bearings for Sheaves



## Structure and Features

IKO Roller Bearings in which rollers are incorporated in two rows are non-separable heavy-duty bearings. They can withstand not only radial loads but axial loads as well, which are supported at the contacts between the shoulders of inner and outer rings and the end faces of rollers. Therefore, they are most suitable for use at the fixing side of a shaft. Like needle roller bearings, they are also compact. Roller bearings include the caged type, full complement type and the type for sheaves, and any bearings suitable for the operating conditions can be selected. In particular, these bearings are used for heavy-duty machines such as construction machinery, and industrial machinery.

### Structures of Roller Bearings



E  
NAG  
NAU  
TRU  
NAS

Types

The types of Roller Bearings shown in Table 1 are available.

Table 1 Type of bearing

| Type        | Caged type             | Full complement type | For sheaves  |
|-------------|------------------------|----------------------|--------------|
| Series      |                        |                      |              |
| Standard    | NAU49<br>TRU           | NAG49                | —            |
| With seal   | NAU49...UU<br>TRU...UU | NAG49...UU           | NAS50...UUNR |
| With shield | —                      | —                    | NAS50...ZZNR |

Caged Roller Bearings

These bearings are suitable for high-speed rotations and fluctuating loads. Also, as the axial distance between the double-row rollers is comparatively large, large moment loads can be supported. Caged roller bearings with seal incorporate seals on both sides. Synthetic resin rubber seals are excellent in the prevention of dust penetration and grease leakage, providing an excellent sealing effect.

Full Complement Roller Bearings

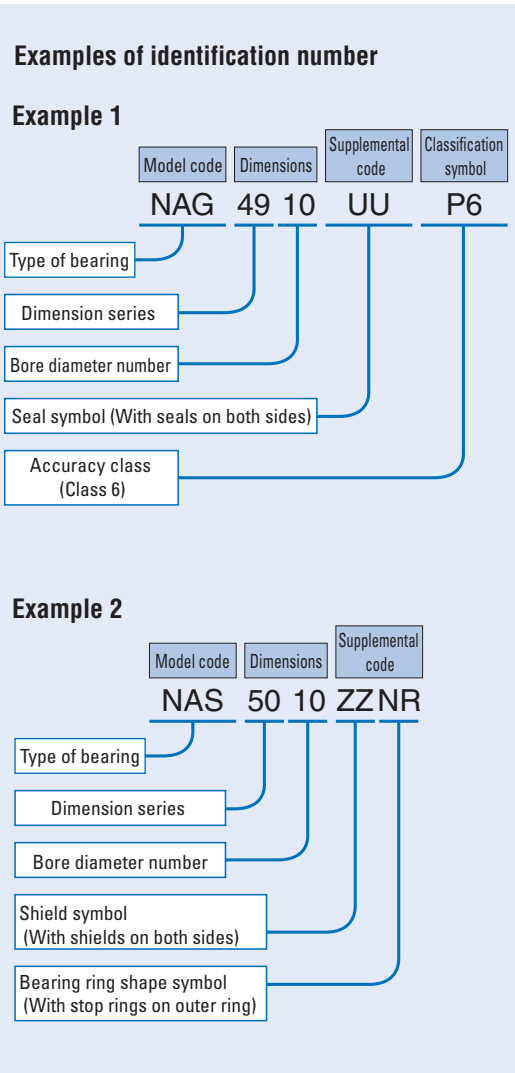
These bearings are suitable for low-speed rotations or oscillating motions and heavy loads. Similar to the caged type, the structure is advantageous for supporting moment loads. The bearings with seal incorporate seals on both sides.

Roller Bearings for Sheaves

These bearings are the double-row full complement type with a low sectional height designed for use in sheaves. There are two types; the sealed type and the shield type. They can withstand heavy radial loads and shock loads at comparatively low-speed rotations, and can also withstand axial loads. They can easily be fixed axially to sheaves using the stop rings of the outer ring. As the width of the inner ring is designed to be larger than that of the outer ring, they require no spacer between sheaves. The structure is stable because the double-row rollers can withstand the moment loads caused by rope transition. The surfaces of these bearings are treated to have high corrosion resistance.

Identification Number

The identification number of Roller Bearings consists of a model code, dimensions, any supplemental codes and a classification symbol. The arrangement examples are shown below.



Accuracy

Roller Bearings are manufactured in accordance with JIS (See page A31.). A side plate for inner ring is assembled on one side of caged or full complement roller bearings. The tolerance of bore diameter of the side plate is shown below. Tolerances of Roller Bearings for Sheaves represent the values before surface treatment. The tolerance of internal distance between cir-clips is shown below. Tolerance of bore diameter of the side plate *d*: E7 Tolerance of internal distance between cir-clips *C*<sub>1</sub>: 0~+0.4mm

Clearance

Roller Bearings are manufactured to the CN clearance shown in Table 18 on page A37. However, Roller Bearings for Sheaves are manufactured so that proper operating clearances are obtained after being mounted with a specified fit.

Fit

The recommended fits for Roller Bearings are shown in Tables 21 to 22 on pages A41 and A42. The recommended fits for Roller Bearings for Sheaves are shown in Table 2.

Table 2 Recommended fits for Roller Bearings for Sheaves

| Tolerance class of shaft | Tolerance class of housing bore |
|--------------------------|---------------------------------|
| g6                       | N7                              |

Table 3 Bearings with prepacked grease ○ : With prepacked grease × : Without prepacked grease

| Type                 | Standard  | With seals | With shields |
|----------------------|-----------|------------|--------------|
| Caged type           | NAU , TRU | ×          | ○            |
| Full complement type | NAG       | ×          | ○            |
| For sheaves          | NAS       | —          | ○            |

Table 4 Number of oil holes of the inner ring and outer ring

| Type                 |     | Number of oil holes of the outer ring |          |            | Number of oil holes of the inner ring |              |
|----------------------|-----|---------------------------------------|----------|------------|---------------------------------------|--------------|
|                      |     | Nominal bore diameter $d$ mm          | Standard | With seals |                                       | With shields |
| Caged type           | NAU | $d \leq 17$                           | 0        | 0          | —                                     | 0            |
|                      |     | $17 < d$                              | 2        | 2          |                                       |              |
|                      | TRU | 2                                     | 2        | —          | 0                                     |              |
| Full complement type | NAG | $d \leq 17$                           | 0        | 0          | —                                     | 0            |
|                      |     | $17 < d$                              | 2        | 2          |                                       |              |
| For sheaves          | NAS | —                                     |          | 0          | 0                                     | 2            |

Remark The bearings with oil holes are also provided with an oil groove.

Lubrication

Bearings with prepacked grease are shown in Table 3. For Caged Roller Bearings and Full Complement Roller Bearings, ALVANIA GREASE S2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease. For Roller Bearings for Sheaves, ALVANIA GREASE EP2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease. In the case of bearings without prepacked grease, perform proper lubrication for use. Operating without lubrication will increase the wear of the rolling contact surfaces and shorten their lives.

Oil Hole

The number of oil holes of the inner and outer rings is shown in Table 4.

Operating Temperature Range

The operating temperature range for Roller Bearings is -20℃~+120℃. However, the maximum allowable temperature for Roller Bearings for Sheaves is +110℃.

■ Axial Load Capacity

Axial load capacity is not determined from the basic dynamic load rating based on rolling fatigue, but is determined by the amount of heat generated by sliding contact between the ends of rollers and guide shoulders of the inner and outer rings. It is therefore limited by the load conditions, sliding speeds, lubrication methods, etc.

The axial load capacity of Roller Bearings is obtained from the following equation.

If the axial load increases in comparison with the radial load, it will start to interfere with the smooth rolling motion. The axial load should therefore be within 20% of the radial load.

$$C_A = f_v a f_A \dots\dots\dots (1)$$
  
where,  $C_A$  : Axial load capacity N  
 $f_v$  : Speed correction factor  
 $f_v$  is obtained from Fig.2 by calculating the  $d_m n$  value.  
 $d_m n = d_m \times n$   
 $d_m$  : Mean value of bearing bore and outside diameters mm  
 $\left( d_m \doteq \frac{d + D}{2} \right)$   
 $n$  : Rotational speed min<sup>-1</sup>  
When  $d_m n \leq 1000$ ,  $f_v = 1$ .  
 $a$  : Value determined by type of bearing (See Table 5. )  
 $f_A$  : Axial load capacity factor (See Fig.1.)

Table 5 Value by type of bearing

| Type of bearing | a    |
|-----------------|------|
| NAS 50          | 1    |
| NAG 49          | 0.78 |
| NAU 49, TRU     | 0.7  |

Calculation example

When a roller bearing for sheaves NAS 5016 ZZ NR is run at  $n = 250 \text{ min}^{-1}$  under grease lubrication and subjected to an intermittent axial load, the axial load capacity is calculated as follows.

As the bearing bore diameter is 80 mm,  $f_A = 18000$  is obtained from the axial load capacity line of Fig. 1 (ii).

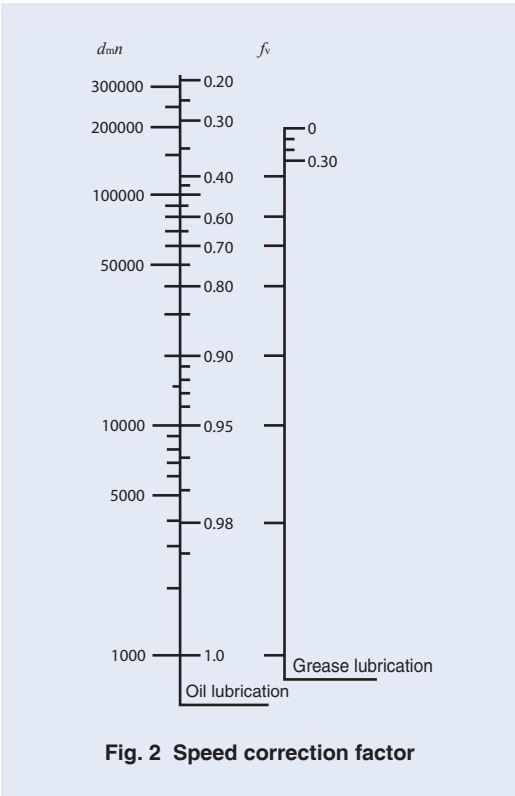
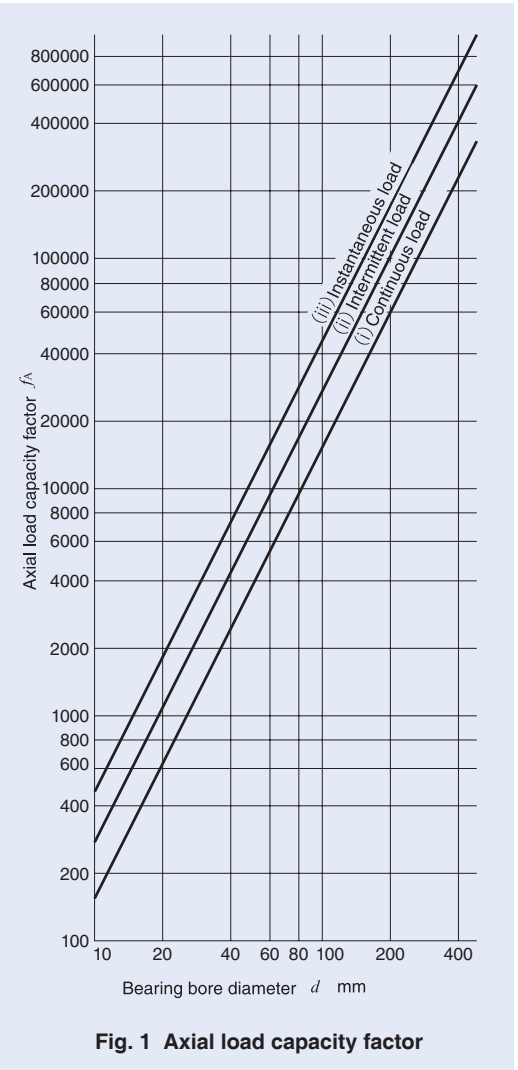
$$a = 1$$
  
$$d_m \doteq \frac{80 + 125}{2} = 102.5$$

$$d_m n = 102.5 \times 250 \doteq 25600$$

From Fig. 2,  $f_v \doteq 0.87$

Therefore, the axial load capacity  $C_A$  is obtained.

$$C_A = f_v a f_A = 0.87 \times 1 \times 18000 \doteq 15700 \text{ N}$$

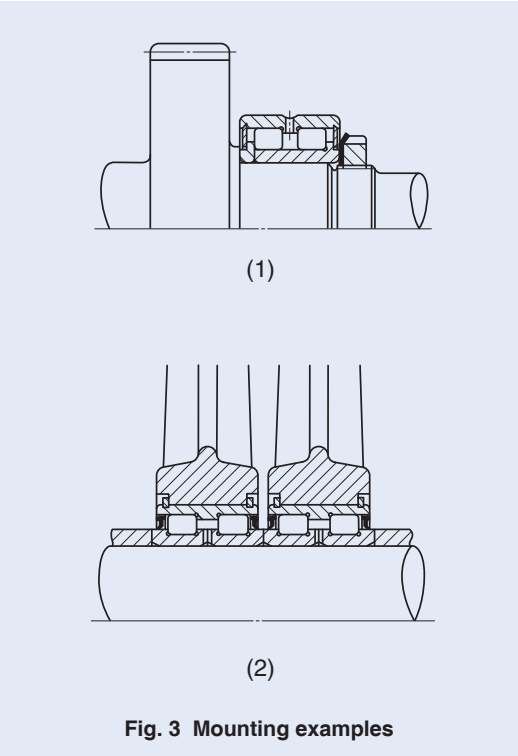


■ Mounting

Unlike needle roller bearings, Caged and Full Complement Roller Bearings are non-separable.

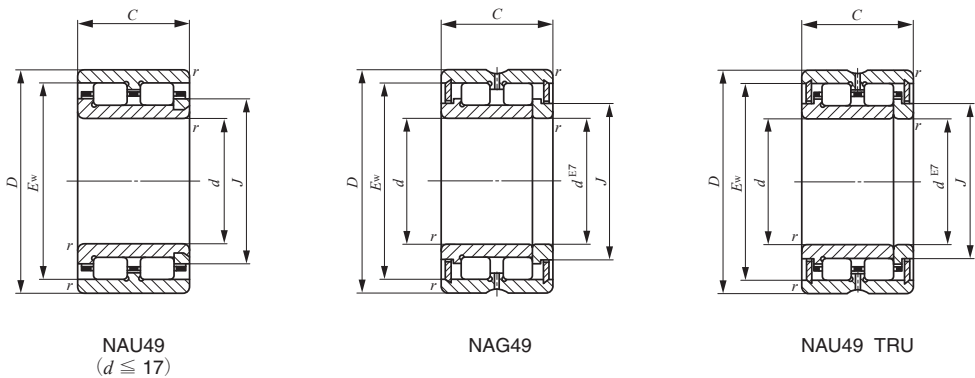
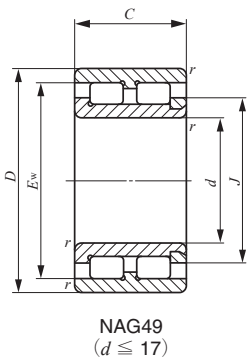
As shown in Fig. 3 (1), the inner ring should be press-fitted until it makes close contact with the shaft shoulder, and fixed axially with a nut. Dimensions of the shoulders of the shaft and housing should be based on  $J$  and  $E_W$  shown in the table of dimensions, respectively.

In the case of Roller Bearings for Sheaves, as shown in Fig. 3 (2), the outer ring should be fixed by stop rings after being press-fitted into the sheaves, and the inner ring should be fixed securely in the axial direction.



ROLLER BEARINGS

Caged Roller Bearings  
Full Complement Roller Bearings



Shaft dia. 10 – 35mm

| Shaft<br>dia.<br>mm | Identification number   |            |            | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |                       |
|---------------------|-------------------------|------------|------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|-----------------------|
|                     | Full complement<br>type | Caged type |            |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s</sub> min | <i>J</i> | <i>E</i> <sub>w</sub> |
| 10                  | NAG 4900                | —          | —          | 25.5                    | 10                        | 22       | 13       | 0.3                                         | 15.5     | 18.5                  |
|                     | —                       | NAU 4900   | —          | 24.5                    | 10                        | 22       | 13       | 0.3                                         | 15.5     | 18.5                  |
| 12                  | NAG 4901                | —          | —          | 28.5                    | 12                        | 24       | 13       | 0.3                                         | 17       | 20                    |
|                     | —                       | NAU 4901   | —          | 27.5                    | 12                        | 24       | 13       | 0.3                                         | 17       | 20                    |
| 15                  | NAG 4902                | —          | —          | 38                      | 15                        | 28       | 13       | 0.3                                         | 21       | 24                    |
|                     | —                       | NAU 4902   | —          | 36.5                    | 15                        | 28       | 13       | 0.3                                         | 21       | 24                    |
|                     | —                       | —          | TRU 153320 | 80.5                    | 15                        | 33       | 20       | 0.3                                         | 19.5     | 27                    |
| 17                  | NAG 4903                | —          | —          | 41                      | 17                        | 30       | 13       | 0.3                                         | 22.5     | 25.5                  |
|                     | —                       | NAU 4903   | —          | 39.5                    | 17                        | 30       | 13       | 0.3                                         | 22.5     | 25.5                  |
|                     | —                       | —          | TRU 173425 | 100                     | 17                        | 34       | 25       | 0.3                                         | 21.5     | 29.5                  |
| 20                  | NAG 4904                | —          | —          | 76.5                    | 20                        | 37       | 17       | 0.3                                         | 24       | 31.5                  |
|                     | —                       | NAU 4904   | —          | 76                      | 20                        | 37       | 17       | 0.3                                         | 24       | 31.5                  |
|                     | —                       | —          | TRU 203820 | 96.5                    | 20                        | 38       | 20       | 0.3                                         | 25       | 32.5                  |
|                     | —                       | —          | TRU 203825 | 122                     | 20                        | 38       | 25       | 0.3                                         | 25       | 32.5                  |
| 25                  | NAG 4905                | —          | —          | 89.5                    | 25                        | 42       | 17       | 0.3                                         | 29.5     | 37                    |
|                     | —                       | NAU 4905   | —          | 89                      | 25                        | 42       | 17       | 0.3                                         | 29.5     | 37                    |
|                     | —                       | —          | TRU 254425 | 154                     | 25                        | 44       | 25       | 0.3                                         | 30.5     | 38                    |
| 28                  | —                       | —          | TRU 284530 | 173                     | 28                        | 45       | 30       | 0.3                                         | 31.5     | 39.5                  |
| 30                  | NAG 4906                | —          | —          | 103                     | 30                        | 47       | 17       | 0.3                                         | 34       | 41.5                  |
|                     | —                       | NAU 4906   | —          | 102                     | 30                        | 47       | 17       | 0.3                                         | 34       | 41.5                  |
|                     | —                       | —          | TRU 304830 | 197                     | 30                        | 48       | 30       | 0.3                                         | 35       | 42.5                  |
| 32                  | —                       | —          | TRU 325230 | 260                     | 32                        | 52       | 30       | 0.6                                         | 38       | 46                    |
| 35                  | NAG 4907                | —          | —          | 172                     | 35                        | 55       | 20       | 0.6                                         | 40       | 49                    |
|                     | —                       | NAU 4907   | —          | 168                     | 35                        | 55       | 20       | 0.6                                         | 40       | 49                    |
|                     | —                       | —          | TRU 355630 | 270                     | 35                        | 56       | 30       | 0.6                                         | 40       | 49                    |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The NAG and NAU series with a bore diameter *d* of 17 mm or less have no oil hole. In others, the outer ring has an oil groove and two oil holes.  
2. No grease is prepacked. Perform proper lubrication.

| Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| 9 650<br>6 580                                | 10 800<br>6 470                                           | 17 000<br>30 000                                                     |
| 10 300<br>6 950                               | 12 000<br>7 120                                           | 15 000<br>25 000                                                     |
| 11 800<br>7 950<br>10 400                     | 15 200<br>9 020<br>10 400                                 | 12 000<br>20 000<br>20 000                                           |
| 12 300<br>8 240<br>18 000                     | 16 500<br>9 670<br>21 600                                 | 11 000<br>19 000<br>18 000                                           |
| 15 600<br>10 700<br>12 100<br>18 700          | 18 900<br>11 300<br>13 400<br>23 600                      | 9 500<br>16 000<br>16 000<br>16 000                                  |
| 17 500<br>11 900<br>21 000                    | 23 200<br>13 900<br>28 900                                | 7 500<br>13 000<br>13 000                                            |
| 28 700                                        | 43 800                                                    | 12 000                                                               |
| 19 400<br>13 000<br>29 400                    | 27 600<br>16 200<br>46 600                                | 6 500<br>12 000<br>11 000                                            |
| 29 800                                        | 44 200                                                    | 10 000                                                               |
| 28 700<br>19 500<br>32 200                    | 43 800<br>26 300<br>49 800                                | 5 500<br>10 000<br>10 000                                            |

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ROLLER BEARINGS

Caged Roller Bearings  
Full Complement Roller Bearings

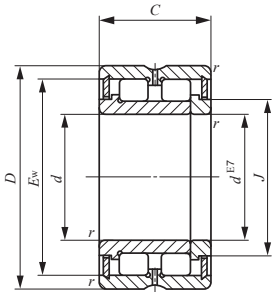


Shaft dia. 40 — 80mm

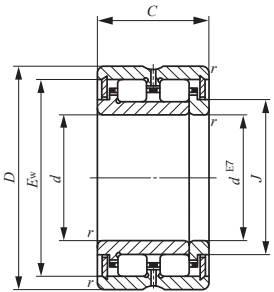
| Shaft<br>dia.<br>mm | Identification number   |            |             | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |                      |
|---------------------|-------------------------|------------|-------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|----------------------|
|                     | Full complement<br>type | Caged type |             |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>J</i> | <i>E<sub>w</sub></i> |
|                     |                         |            |             |                         |                           |          |          |                                             |          |                      |
| 40                  | NAG 4908                | —          | —           | 225                     | 40                        | 62       | 22       | 0.6                                         | 46       | 56                   |
|                     | —                       | —          | TRU 405930  | 265                     | 40                        | 59       | 30       | 0.6                                         | 45       | 52.5                 |
|                     | —                       | NAU 4908   | —           | 220                     | 40                        | 62       | 22       | 0.6                                         | 46       | 56                   |
| 42                  | —                       | —          | TRU 426230  | 290                     | 42                        | 62       | 30       | 0.6                                         | 48       | 56.5                 |
| 45                  | NAG 4909                | —          | —           | 265                     | 45                        | 68       | 22       | 0.6                                         | 51       | 61                   |
|                     | —                       | —          | TRU 456430  | 295                     | 45                        | 64       | 30       | 0.6                                         | 50.5     | 58.5                 |
|                     | —                       | NAU 4909   | —           | 260                     | 45                        | 68       | 22       | 0.6                                         | 51       | 61                   |
| 50                  | NAG 4910                | —          | —           | 270                     | 50                        | 72       | 22       | 0.6                                         | 55.5     | 65.5                 |
|                     | —                       | NAU 4910   | —           | 265                     | 50                        | 72       | 22       | 0.6                                         | 55.5     | 65.5                 |
|                     | —                       | —          | TRU 507745  | 710                     | 50                        | 77       | 45       | 1                                           | 58       | 69                   |
| 55                  | NAG 4911                | —          | —           | 395                     | 55                        | 80       | 25       | 1                                           | 61.5     | 72.5                 |
|                     | —                       | NAU 4911   | —           | 385                     | 55                        | 80       | 25       | 1                                           | 61.5     | 72.5                 |
|                     | —                       | —          | TRU 558138  | 615                     | 55                        | 81       | 38       | 1                                           | 61.5     | 72.5                 |
| 60                  | NAG 4912                | —          | —           | 425                     | 60                        | 85       | 25       | 1                                           | 67       | 77.5                 |
|                     | —                       | NAU 4912   | —           | 415                     | 60                        | 85       | 25       | 1                                           | 67       | 77.5                 |
|                     | —                       | —          | TRU 608945  | 880                     | 60                        | 89       | 45       | 1                                           | 69.5     | 81.5                 |
| 65                  | NAG 4913                | —          | —           | 455                     | 65                        | 90       | 25       | 1                                           | 72       | 83                   |
|                     | —                       | NAU 4913   | —           | 440                     | 65                        | 90       | 25       | 1                                           | 72       | 83                   |
| 70                  | NAG 4914                | —          | —           | 725                     | 70                        | 100      | 30       | 1                                           | 79       | 91.5                 |
|                     | —                       | NAU 4914   | —           | 705                     | 70                        | 100      | 30       | 1                                           | 79       | 91.5                 |
| 75                  | NAG 4915                | —          | —           | 775                     | 75                        | 105      | 30       | 1                                           | 83.5     | 95.5                 |
|                     | —                       | NAU 4915   | —           | 750                     | 75                        | 105      | 30       | 1                                           | 83.5     | 95.5                 |
|                     | —                       | —          | TRU 7510845 | 1 240                   | 75                        | 108      | 45       | 1                                           | 85.5     | 98.5                 |
| 80                  | NAG 4916                | —          | —           | 815                     | 80                        | 110      | 30       | 1                                           | 89.5     | 102                  |
|                     | —                       | NAU 4916   | —           | 790                     | 80                        | 110      | 30       | 1                                           | 89.5     | 102                  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.

Remarks1. The outer ring has an oil groove and two oil holes.  
2. No grease is prepacked. Perform proper lubrication.



NAG49



NAU49 TRU

| Basic dynamic<br>load rating<br><i>C</i><br><br>N | Basic static<br>load rating<br><i>C<sub>0</sub></i><br><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br><br>min <sup>-1</sup> |
|---------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------|
| 34 600                                            | 49 500                                                       | 5 000                                                                    |
| 34 700                                            | 62 500                                                       | 8 500                                                                    |
| 23 400                                            | 29 400                                                       | 8 500                                                                    |
| 34 600                                            | 57 800                                                       | 8 000                                                                    |
| 36 400                                            | 54 700                                                       | 4 500                                                                    |
| 32 600                                            | 59 700                                                       | 8 000                                                                    |
| 24 800                                            | 32 800                                                       | 8 000                                                                    |
| 38 200                                            | 59 900                                                       | 4 000                                                                    |
| 26 200                                            | 36 200                                                       | 7 000                                                                    |
| 75 700                                            | 134 000                                                      | 7 000                                                                    |
| 48 100                                            | 77 700                                                       | 3 500                                                                    |
| 33 000                                            | 47 000                                                       | 6 500                                                                    |
| 61 400                                            | 104 000                                                      | 6 500                                                                    |
| 50 300                                            | 84 300                                                       | 3 500                                                                    |
| 34 700                                            | 51 400                                                       | 6 000                                                                    |
| 88 100                                            | 152 000                                                      | 6 000                                                                    |
| 53 200                                            | 93 000                                                       | 3 000                                                                    |
| 36 900                                            | 57 100                                                       | 5 500                                                                    |
| 77 700                                            | 139 000                                                      | 3 000                                                                    |
| 53 700                                            | 84 600                                                       | 5 000                                                                    |
| 80 000                                            | 146 000                                                      | 2 500                                                                    |
| 54 800                                            | 88 200                                                       | 5 000                                                                    |
| 103 000                                           | 190 000                                                      | 4 500                                                                    |
| 83 000                                            | 157 000                                                      | 2 500                                                                    |
| 57 200                                            | 95 500                                                       | 4 500                                                                    |

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ROLLER BEARINGS

Caged Roller Bearings  
Full Complement Roller Bearings

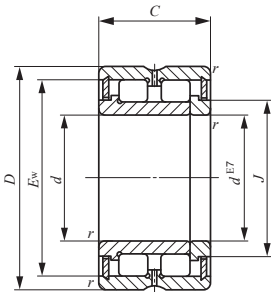


Shaft dia. 85 – 140mm

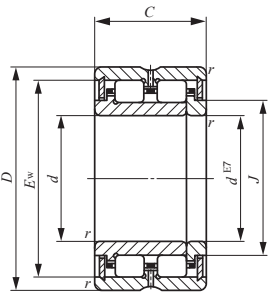
| Shaft<br>dia.<br>mm | Identification number   |            |              | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |                       |
|---------------------|-------------------------|------------|--------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|-----------------------|
|                     | Full complement<br>type | Caged type |              |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>J</i> | <i>E</i> <sub>w</sub> |
| 85                  | NAG 4917                | —          | —            | 1 190                   | 85                        | 120      | 35       | 1.5                                         | 96       | 110                   |
|                     | —                       | —          | TRU 8511850  | 1 530                   | 85                        | 118      | 50       | 1                                           | 94.5     | 107.5                 |
|                     | —                       | NAU 4917   | —            | 1 150                   | 85                        | 120      | 35       | 1.5                                         | 96       | 110                   |
|                     | —                       | —          | TRU 8512045  | 1 500                   | 85                        | 120      | 45       | 1.5                                         | 96.5     | 110                   |
| 90                  | NAG 4918                | —          | —            | 1 250                   | 90                        | 125      | 35       | 1.5                                         | 101      | 115.5                 |
|                     | —                       | NAU 4918   | —            | 1 210                   | 90                        | 125      | 35       | 1.5                                         | 101      | 115.5                 |
|                     | —                       | —          | TRU 9012550  | 1 740                   | 90                        | 125      | 50       | 1.5                                         | 101      | 114                   |
| 95                  | NAG 4919                | —          | —            | 1 300                   | 95                        | 130      | 35       | 1.5                                         | 106      | 120.5                 |
|                     | —                       | NAU 4919   | —            | 1 270                   | 95                        | 130      | 35       | 1.5                                         | 106      | 120.5                 |
| 100                 | NAG 4920                | —          | —            | 1 850                   | 100                       | 140      | 40       | 1.5                                         | 114.5    | 129.5                 |
|                     | —                       | —          | TRU 10013550 | 1 900                   | 100                       | 135      | 50       | 1.5                                         | 112      | 125.5                 |
|                     | —                       | NAU 4920   | —            | 1 770                   | 100                       | 140      | 40       | 1.5                                         | 114.5    | 129.5                 |
| 105                 | —                       | —          | TRU 10515350 | 2 890                   | 105                       | 153      | 50       | 1.5                                         | 120      | 138                   |
| 110                 | NAG 4922                | —          | —            | 2 010                   | 110                       | 150      | 40       | 1.5                                         | 123      | 138.5                 |
|                     | —                       | NAU 4922   | —            | 1 930                   | 110                       | 150      | 40       | 1.5                                         | 123      | 138.5                 |
| 120                 | NAG 4924                | —          | —            | 2 780                   | 120                       | 165      | 45       | 1.5                                         | 136      | 153.5                 |
|                     | —                       | NAU 4924   | —            | 2 680                   | 120                       | 165      | 45       | 1.5                                         | 136      | 153.5                 |
| 125                 | —                       | —          | TRU 12517860 | 4 490                   | 125                       | 178      | 60       | 1.5                                         | 143.5    | 162                   |
| 130                 | NAG 4926                | —          | —            | 3 750                   | 130                       | 180      | 50       | 2                                           | 147      | 165.5                 |
|                     | —                       | NAU 4926   | —            | 3 610                   | 130                       | 180      | 50       | 2                                           | 147      | 165.5                 |
| 135                 | —                       | —          | TRU 13518860 | 4 790                   | 135                       | 188      | 60       | 1.5                                         | 154      | 172.5                 |
| 140                 | NAG 4928                | —          | —            | 3 990                   | 140                       | 190      | 50       | 2                                           | 157.5    | 176                   |
|                     | —                       | NAU 4928   | —            | 3 840                   | 140                       | 190      | 50       | 2                                           | 157.5    | 176                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.

Remarks1. The outer ring has an oil groove and two oil holes.  
2. No grease is prepacked. Perform proper lubrication.



NAG49



NAU49 TRU

| Basic dynamic<br>load rating<br><i>C</i><br><br>N | Basic static<br>load rating<br><i>C<sub>0</sub></i><br><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br><br>min <sup>-1</sup> |
|---------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------|
| 111 000                                           | 200 000                                                      | 2 500                                                                    |
| 114 000                                           | 222 000                                                      | 4 000                                                                    |
| 75 400                                            | 120 000                                                      | 4 000                                                                    |
| 110 000                                           | 215 000                                                      | 4 000                                                                    |
| 114 000                                           | 211 000                                                      | 2 500                                                                    |
| 79 500                                            | 130 000                                                      | 4 000                                                                    |
| 119 000                                           | 240 000                                                      | 4 000                                                                    |
| 117 000                                           | 222 000                                                      | 2 000                                                                    |
| 81 000                                            | 136 000                                                      | 4 000                                                                    |
| 152 000                                           | 292 000                                                      | 2 000                                                                    |
| 124 000                                           | 264 000                                                      | 3 500                                                                    |
| 106 000                                           | 181 000                                                      | 3 500                                                                    |
| 159 000                                           | 286 000                                                      | 3 500                                                                    |
| 161 000                                           | 322 000                                                      | 1 900                                                                    |
| 113 000                                           | 200 000                                                      | 3 500                                                                    |
| 208 000                                           | 431 000                                                      | 1 700                                                                    |
| 146 000                                           | 268 000                                                      | 3 000                                                                    |
| 211 000                                           | 408 000                                                      | 3 000                                                                    |
| 240 000                                           | 495 000                                                      | 1 600                                                                    |
| 166 000                                           | 304 000                                                      | 2 500                                                                    |
| 220 000                                           | 442 000                                                      | 2 500                                                                    |
| 249 000                                           | 531 000                                                      | 1 500                                                                    |
| 174 000                                           | 327 000                                                      | 2 500                                                                    |

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ROLLER BEARINGS

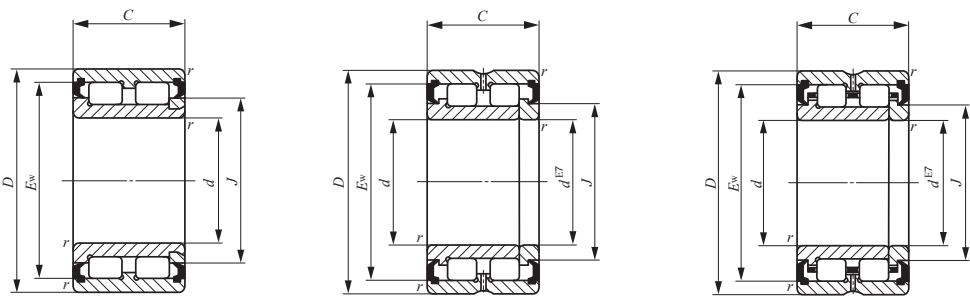
Caged Roller Bearings **With Seal**  
Full Complement Roller Bearings **With Seal**



Shaft dia. 10 – 40mm

| Shaft<br>dia.<br>mm | Identification number     |                           |              | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |
|---------------------|---------------------------|---------------------------|--------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|
|                     | Full complement<br>type   | Caged type                |              |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>J</i> |
| 10                  | NAG 4900UU                | —                         | —            | 25.5                    | 10                        | 22       | 13       | 0.3                                         | 15.5     |
| 12                  | NAG 4901UU                | —                         | —            | 28.5                    | 12                        | 24       | 13       | 0.3                                         | 17       |
| 15                  | NAG 4902UU<br>—           | —                         | —            | 38                      | 15                        | 28       | 13       | 0.3                                         | 21       |
|                     |                           | —                         | TRU 153320UU | 80.5                    | 15                        | 33       | 20       | 0.3                                         | 19.5     |
| 17                  | NAG 4903UU<br>—           | —                         | —            | 41                      | 17                        | 30       | 13       | 0.3                                         | 22.5     |
|                     |                           | —                         | TRU 173425UU | 100                     | 17                        | 34       | 25       | 0.3                                         | 21.5     |
| 20                  | NAG 4904UU<br>—<br>—<br>— | —<br>NAU 4904UU<br>—<br>— | —            | 76.5                    | 20                        | 37       | 17       | 0.3                                         | 24       |
|                     |                           |                           | —            | 76                      | 20                        | 37       | 17       | 0.3                                         | 24       |
|                     |                           |                           | TRU 203820UU | 96.5                    | 20                        | 38       | 20       | 0.3                                         | 25       |
|                     |                           |                           | TRU 203825UU | 122                     | 20                        | 38       | 25       | 0.3                                         | 25       |
| 25                  | NAG 4905UU<br>—<br>—      | —<br>NAU 4905UU<br>—      | —            | 89.5                    | 25                        | 42       | 17       | 0.3                                         | 29.5     |
|                     |                           |                           | —            | 89                      | 25                        | 42       | 17       | 0.3                                         | 29.5     |
|                     |                           |                           | TRU 254425UU | 154                     | 25                        | 44       | 25       | 0.3                                         | 30.5     |
| 28                  | —                         | —                         | TRU 284530UU | 173                     | 28                        | 45       | 30       | 0.3                                         | 31.5     |
| 30                  | NAG 4906UU<br>—<br>—      | —<br>NAU 4906UU<br>—      | —            | 103                     | 30                        | 47       | 17       | 0.3                                         | 34       |
|                     |                           |                           | —            | 102                     | 30                        | 47       | 17       | 0.3                                         | 34       |
|                     |                           |                           | TRU 304830UU | 197                     | 30                        | 48       | 30       | 0.3                                         | 35       |
| 32                  | —                         | —                         | TRU 325230UU | 260                     | 32                        | 52       | 30       | 0.6                                         | 38       |
| 35                  | NAG 4907UU<br>—<br>—      | —<br>NAU 4907UU<br>—      | —            | 172                     | 35                        | 55       | 20       | 0.6                                         | 40       |
|                     |                           |                           | —            | 168                     | 35                        | 55       | 20       | 0.6                                         | 40       |
|                     |                           |                           | TRU 355630UU | 270                     | 35                        | 56       | 30       | 0.6                                         | 40       |
| 40                  | NAG 4908UU<br>—<br>—      | —<br>—<br>NAU 4908UU      | —            | 225                     | 40                        | 62       | 22       | 0.6                                         | 46       |
|                     |                           |                           | TRU 405930UU | 265                     | 40                        | 59       | 30       | 0.6                                         | 45       |
|                     |                           |                           | —            | 220                     | 40                        | 62       | 22       | 0.6                                         | 46       |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The NAG and NAU series with a bore diameter, *d*, of 17 mm or less have no oil hole. In others, the outer ring has an oil groove and two oil holes.  
2. The bearings with seals are provided with prepacked grease.



NAG49 ... UU  
(*d* ≤ 17)

NAG49 ... UU

NAU49 ... UU  
TRU ... UU

| <i>E</i> <sub>w</sub> | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|-----------------------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| 19.5                  | 9 650                                         | 10 800                                                    | 10 000                                                               |
| 21                    | 10 300                                        | 12 000                                                    | 9 000                                                                |
| 25                    | 11 800                                        | 15 200                                                    | 7 000                                                                |
| 27                    | 10 400                                        | 10 400                                                    | 9 500                                                                |
| 26.5                  | 12 300                                        | 16 500                                                    | 6 500                                                                |
| 29.5                  | 18 000                                        | 21 600                                                    | 8 500                                                                |
| 31.5                  | 15 600                                        | 18 900                                                    | 5 500                                                                |
| 31.5                  | 10 700                                        | 11 300                                                    | 8 000                                                                |
| 32.5                  | 12 100                                        | 13 400                                                    | 7 500                                                                |
| 32.5                  | 18 700                                        | 23 600                                                    | 7 500                                                                |
| 37                    | 17 500                                        | 23 200                                                    | 4 500                                                                |
| 37                    | 11 900                                        | 13 900                                                    | 6 500                                                                |
| 38                    | 21 000                                        | 28 900                                                    | 6 000                                                                |
| 39.5                  | 28 700                                        | 43 800                                                    | 6 000                                                                |
| 41.5                  | 19 400                                        | 27 600                                                    | 4 000                                                                |
| 41.5                  | 13 000                                        | 16 200                                                    | 5 500                                                                |
| 42.5                  | 29 400                                        | 46 600                                                    | 5 500                                                                |
| 46                    | 29 800                                        | 44 200                                                    | 5 000                                                                |
| 49                    | 28 700                                        | 43 800                                                    | 3 500                                                                |
| 49                    | 19 500                                        | 26 300                                                    | 4 500                                                                |
| 49                    | 32 200                                        | 49 800                                                    | 4 500                                                                |
| 56                    | 34 600                                        | 49 500                                                    | 3 000                                                                |
| 52.5                  | 34 700                                        | 62 500                                                    | 4 000                                                                |
| 56                    | 23 400                                        | 29 400                                                    | 4 000                                                                |

E

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ROLLER BEARINGS

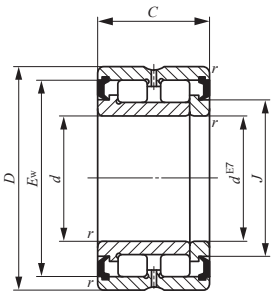
Caged Roller Bearings **With Seal**  
Full Complement Roller Bearings **With Seal**



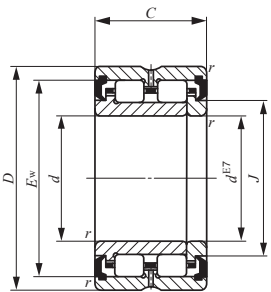
Shaft dia. 42 – 80mm

| Shaft<br>dia.<br>mm | Identification number   |            |               | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |
|---------------------|-------------------------|------------|---------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|
|                     | Full complement<br>type | Caged type |               |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>J</i> |
| 42                  | —                       | —          | TRU 426230UU  | 290                     | 42                        | 62       | 30       | 0.6                                         | 48       |
| 45                  | NAG 4909UU              | —          | —             | 265                     | 45                        | 68       | 22       | 0.6                                         | 51       |
|                     | —                       | —          | TRU 456430UU  | 295                     | 45                        | 64       | 30       | 0.6                                         | 50.5     |
|                     | —                       | NAU 4909UU | —             | 260                     | 45                        | 68       | 22       | 0.6                                         | 51       |
| 50                  | NAG 4910UU              | —          | —             | 270                     | 50                        | 72       | 22       | 0.6                                         | 55.5     |
|                     | —                       | NAU 4910UU | —             | 265                     | 50                        | 72       | 22       | 0.6                                         | 55.5     |
|                     | —                       | —          | TRU 507745UU  | 710                     | 50                        | 77       | 45       | 1                                           | 58       |
| 55                  | NAG 4911UU              | —          | —             | 395                     | 55                        | 80       | 25       | 1                                           | 61.5     |
|                     | —                       | NAU 4911UU | —             | 385                     | 55                        | 80       | 25       | 1                                           | 61.5     |
|                     | —                       | —          | TRU 558138UU  | 615                     | 55                        | 81       | 38       | 1                                           | 61.5     |
| 60                  | NAG 4912UU              | —          | —             | 425                     | 60                        | 85       | 25       | 1                                           | 67       |
|                     | —                       | NAU 4912UU | —             | 415                     | 60                        | 85       | 25       | 1                                           | 67       |
|                     | —                       | —          | TRU 608945UU  | 880                     | 60                        | 89       | 45       | 1                                           | 69.5     |
| 65                  | NAG 4913UU              | —          | —             | 455                     | 65                        | 90       | 25       | 1                                           | 72       |
|                     | —                       | NAU 4913UU | —             | 440                     | 65                        | 90       | 25       | 1                                           | 72       |
| 70                  | NAG 4914UU              | —          | —             | 725                     | 70                        | 100      | 30       | 1                                           | 79       |
|                     | —                       | NAU 4914UU | —             | 705                     | 70                        | 100      | 30       | 1                                           | 79       |
| 75                  | NAG 4915UU              | —          | —             | 775                     | 75                        | 105      | 30       | 1                                           | 83.5     |
|                     | —                       | NAU 4915UU | —             | 750                     | 75                        | 105      | 30       | 1                                           | 83.5     |
|                     | —                       | —          | TRU 7510845UU | 1 240                   | 75                        | 108      | 45       | 1                                           | 85.5     |
| 80                  | NAG 4916UU              | —          | —             | 815                     | 80                        | 110      | 30       | 1                                           | 89.5     |
|                     | —                       | NAU 4916UU | —             | 790                     | 80                        | 110      | 30       | 1                                           | 89.5     |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The outer ring has an oil groove and two oil holes.  
2. The bearings with seals are provided with prepacked grease.



NAG49 ... UU



NAU49 ... UU  
TRU ... UU

| <i>E</i> <sub>w</sub> | Basic dynamic<br>load rating<br><i>C</i> | Basic static<br>load rating<br><i>C</i> <sub>0</sub> | Allowable<br>rotational<br>speed <sup>(2)</sup> |
|-----------------------|------------------------------------------|------------------------------------------------------|-------------------------------------------------|
|                       | N                                        | N                                                    | min <sup>-1</sup>                               |
| 56.5                  | 34 600                                   | 57 800                                               | 4 000                                           |
| 61                    | 36 400                                   | 54 700                                               | 2 500                                           |
| 58.5                  | 32 600                                   | 59 700                                               | 3 500                                           |
| 61                    | 24 800                                   | 32 800                                               | 3 500                                           |
| 65.5                  | 38 200                                   | 59 900                                               | 2 500                                           |
| 65.5                  | 26 200                                   | 36 200                                               | 3 500                                           |
| 69                    | 75 700                                   | 134 000                                              | 3 500                                           |
| 72.5                  | 48 100                                   | 77 700                                               | 2 000                                           |
| 72.5                  | 33 000                                   | 47 000                                               | 3 000                                           |
| 72.5                  | 61 400                                   | 104 000                                              | 3 000                                           |
| 77.5                  | 50 300                                   | 84 300                                               | 2 000                                           |
| 77.5                  | 34 700                                   | 51 400                                               | 3 000                                           |
| 81.5                  | 88 100                                   | 152 000                                              | 3 000                                           |
| 83                    | 53 200                                   | 93 000                                               | 1 900                                           |
| 83                    | 36 900                                   | 57 100                                               | 2 500                                           |
| 91.5                  | 77 700                                   | 139 000                                              | 1 800                                           |
| 91.5                  | 53 700                                   | 84 600                                               | 2 500                                           |
| 95.5                  | 80 000                                   | 146 000                                              | 1 700                                           |
| 95.5                  | 54 800                                   | 88 200                                               | 2 500                                           |
| 98.5                  | 103 000                                  | 190 000                                              | 2 000                                           |
| 102                   | 83 000                                   | 157 000                                              | 1 600                                           |
| 102                   | 57 200                                   | 95 500                                               | 2 000                                           |

ROLLER BEARINGS

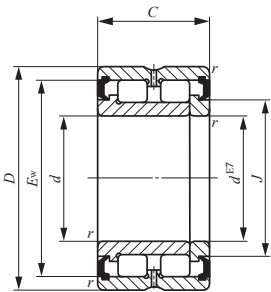
Caged Roller Bearings **With Seal**  
Full Complement Roller Bearings **With Seal**



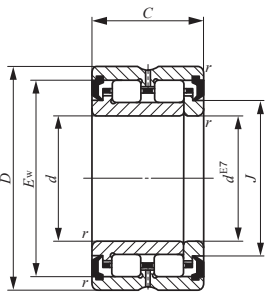
Shaft dia. 85 – 140mm

| Shaft<br>dia.<br>mm | Identification number   |            |                | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |          |          |                                             |          |
|---------------------|-------------------------|------------|----------------|-------------------------|---------------------------|----------|----------|---------------------------------------------|----------|
|                     | Full complement<br>type | Caged type |                |                         | <i>d</i>                  | <i>D</i> | <i>C</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | <i>J</i> |
| 85                  | NAG 4917UU              | —          | —              | 1 190                   | 85                        | 120      | 35       | 1.5                                         | 96       |
|                     | —                       | —          | TRU 8511850UU  | 1 530                   | 85                        | 118      | 50       | 1                                           | 94.5     |
|                     | —                       | NAU 4917UU | —              | 1 150                   | 85                        | 120      | 35       | 1.5                                         | 96       |
|                     | —                       | —          | TRU 8512045UU  | 1 500                   | 85                        | 120      | 45       | 1.5                                         | 96.5     |
| 90                  | NAG 4918UU              | —          | —              | 1 250                   | 90                        | 125      | 35       | 1.5                                         | 101      |
|                     | —                       | NAU 4918UU | —              | 1 210                   | 90                        | 125      | 35       | 1.5                                         | 101      |
|                     | —                       | —          | TRU 9012550UU  | 1 740                   | 90                        | 125      | 50       | 1.5                                         | 101      |
| 95                  | NAG 4919UU              | —          | —              | 1 300                   | 95                        | 130      | 35       | 1.5                                         | 106      |
|                     | —                       | NAU 4919UU | —              | 1 270                   | 95                        | 130      | 35       | 1.5                                         | 106      |
| 100                 | NAG 4920UU              | —          | —              | 1 850                   | 100                       | 140      | 40       | 1.5                                         | 114.5    |
|                     | —                       | —          | TRU 10013550UU | 1 900                   | 100                       | 135      | 50       | 1.5                                         | 112      |
|                     | —                       | NAU 4920UU | —              | 1 770                   | 100                       | 140      | 40       | 1.5                                         | 114.5    |
| 105                 | —                       | —          | TRU 10515350UU | 2 890                   | 105                       | 153      | 50       | 1.5                                         | 120      |
| 110                 | NAG 4922UU              | —          | —              | 2 010                   | 110                       | 150      | 40       | 1.5                                         | 123      |
|                     | —                       | NAU 4922UU | —              | 1 930                   | 110                       | 150      | 40       | 1.5                                         | 123      |
| 120                 | NAG 4924UU              | —          | —              | 2 780                   | 120                       | 165      | 45       | 1.5                                         | 136      |
|                     | —                       | NAU 4924UU | —              | 2 680                   | 120                       | 165      | 45       | 1.5                                         | 136      |
| 125                 | —                       | —          | TRU 12517860UU | 4 490                   | 125                       | 178      | 60       | 1.5                                         | 143.5    |
| 130                 | NAG 4926UU              | —          | —              | 3 750                   | 130                       | 180      | 50       | 2                                           | 147      |
|                     | —                       | NAU 4926UU | —              | 3 610                   | 130                       | 180      | 50       | 2                                           | 147      |
| 135                 | —                       | —          | TRU 13518860UU | 4 790                   | 135                       | 188      | 60       | 1.5                                         | 154      |
| 140                 | NAG 4928UU              | —          | —              | 3 990                   | 140                       | 190      | 50       | 2                                           | 157.5    |
|                     | —                       | NAU 4928UU | —              | 3 840                   | 140                       | 190      | 50       | 2                                           | 157.5    |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The outer ring has an oil groove and two oil holes.  
2. The bearings with seals are provided with prepacked grease.



NAG49 ... UU



NAU49 ... UU  
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| <i>E<sub>w</sub></i> | Basic dynamic<br>load rating<br><i>C</i> | Basic static<br>load rating<br><i>C<sub>0</sub></i> | Allowable<br>rotational<br>speed <sup>(2)</sup> |
|----------------------|------------------------------------------|-----------------------------------------------------|-------------------------------------------------|
|                      | N                                        | N                                                   | min <sup>-1</sup>                               |
| 110                  | 111 000                                  | 200 000                                             | 1 500                                           |
| 107.5                | 114 000                                  | 222 000                                             | 2 000                                           |
| 110                  | 75 400                                   | 120 000                                             | 2 000                                           |
| 110                  | 110 000                                  | 215 000                                             | 2 000                                           |
| 115.5                | 114 000                                  | 211 000                                             | 1 400                                           |
| 115.5                | 79 500                                   | 130 000                                             | 1 900                                           |
| 114                  | 119 000                                  | 240 000                                             | 1 900                                           |
| 120.5                | 117 000                                  | 222 000                                             | 1 300                                           |
| 120.5                | 81 000                                   | 136 000                                             | 1 800                                           |
| 129.5                | 152 000                                  | 292 000                                             | 1 200                                           |
| 125.5                | 124 000                                  | 264 000                                             | 1 700                                           |
| 129.5                | 106 000                                  | 181 000                                             | 1 700                                           |
| 138                  | 159 000                                  | 286 000                                             | 1 600                                           |
| 138.5                | 161 000                                  | 322 000                                             | 1 100                                           |
| 138.5                | 113 000                                  | 200 000                                             | 1 600                                           |
| 153.5                | 208 000                                  | 431 000                                             | 1 000                                           |
| 153.5                | 146 000                                  | 268 000                                             | 1 400                                           |
| 162                  | 211 000                                  | 408 000                                             | 1 400                                           |
| 165.5                | 240 000                                  | 495 000                                             | 950                                             |
| 165.5                | 166 000                                  | 304 000                                             | 1 300                                           |
| 172.5                | 220 000                                  | 442 000                                             | 1 300                                           |
| 176                  | 249 000                                  | 531 000                                             | 900                                             |
| 176                  | 174 000                                  | 327 000                                             | 1 200                                           |

ROLLER BEARINGS

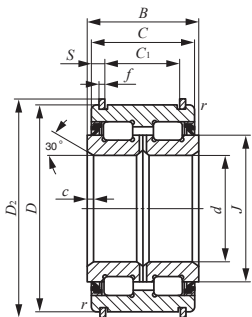
Roller Bearings for Sheaves



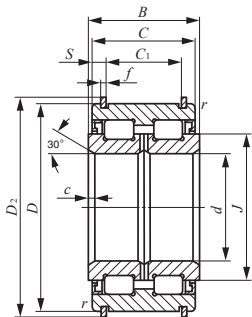
Shaft dia. 40 – 170mm

| Shaft<br>dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br><br>kg | Boundary dimensions<br>mm |          |                       |          |          |                       |          |
|---------------------|-----------------------|--------------|--------------------------|---------------------------|----------|-----------------------|----------|----------|-----------------------|----------|
|                     | Sealed type           | Shield type  |                          | <i>d</i>                  | <i>D</i> | <i>D</i> <sub>2</sub> | <i>B</i> | <i>C</i> | <i>C</i> <sub>1</sub> | <i>S</i> |
| 40                  | NAS 5008UUNR          | NAS 5008ZZNR | 0.55                     | 40                        | 68       | 71.8                  | 38       | 37       | 28                    | 4.5      |
| 45                  | NAS 5009UUNR          | NAS 5009ZZNR | 0.70                     | 45                        | 75       | 78.8                  | 40       | 39       | 30                    | 4.5      |
| 50                  | NAS 5010UUNR          | NAS 5010ZZNR | 0.75                     | 50                        | 80       | 83.8                  | 40       | 39       | 30                    | 4.5      |
| 55                  | NAS 5011UUNR          | NAS 5011ZZNR | 1.15                     | 55                        | 90       | 94.8                  | 46       | 45       | 34                    | 5.5      |
| 60                  | NAS 5012UUNR          | NAS 5012ZZNR | 1.20                     | 60                        | 95       | 99.8                  | 46       | 45       | 34                    | 5.5      |
| 65                  | NAS 5013UUNR          | NAS 5013ZZNR | 1.30                     | 65                        | 100      | 104.8                 | 46       | 45       | 34                    | 5.5      |
| 70                  | NAS 5014UUNR          | NAS 5014ZZNR | 1.90                     | 70                        | 110      | 114.5                 | 54       | 53       | 42                    | 5.5      |
| 75                  | NAS 5015UUNR          | NAS 5015ZZNR | 2.00                     | 75                        | 115      | 119.5                 | 54       | 53       | 42                    | 5.5      |
| 80                  | NAS 5016UUNR          | NAS 5016ZZNR | 2.65                     | 80                        | 125      | 129.5                 | 60       | 59       | 48                    | 5.5      |
| 85                  | NAS 5017UUNR          | NAS 5017ZZNR | 2.80                     | 85                        | 130      | 134.5                 | 60       | 59       | 48                    | 5.5      |
| 90                  | NAS 5018UUNR          | NAS 5018ZZNR | 3.70                     | 90                        | 140      | 145.4                 | 67       | 66       | 54                    | 6        |
| 95                  | NAS 5019UUNR          | NAS 5019ZZNR | 3.90                     | 95                        | 145      | 150.4                 | 67       | 66       | 54                    | 6        |
| 100                 | NAS 5020UUNR          | NAS 5020ZZNR | 4.05                     | 100                       | 150      | 155.4                 | 67       | 66       | 54                    | 6        |
| 110                 | NAS 5022UUNR          | NAS 5022ZZNR | 6.50                     | 110                       | 170      | 175.4                 | 80       | 79       | 65                    | 7        |
| 120                 | NAS 5024UUNR          | NAS 5024ZZNR | 6.95                     | 120                       | 180      | 188.4                 | 80       | 79       | 65                    | 7        |
| 130                 | NAS 5026UUNR          | NAS 5026ZZNR | 10.5                     | 130                       | 200      | 208.4                 | 95       | 94       | 77                    | 8.5      |
| 140                 | NAS 5028UUNR          | NAS 5028ZZNR | 11.0                     | 140                       | 210      | 218.4                 | 95       | 94       | 77                    | 8.5      |
| 150                 | NAS 5030UUNR          | NAS 5030ZZNR | 13.5                     | 150                       | 225      | 233.4                 | 100      | 99       | 81                    | 9        |
| 160                 | NAS 5032UUNR          | NAS 5032ZZNR | 16.5                     | 160                       | 240      | 248.4                 | 109      | 108      | 89                    | 9.5      |
| 170                 | NAS 5034UUNR          | NAS 5034ZZNR | 22.5                     | 170                       | 260      | 270                   | 122      | 121      | 99                    | 11       |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The inner ring has an oil groove and two oil holes.  
2. Roller Bearings for Sheaves are provided with prepacked grease.



NAS50 ... UUNR



NAS50 ... ZZNR

|          |          |                                          |          | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|----------|----------|------------------------------------------|----------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| <i>f</i> | <i>c</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>J</i> |                                               |                                                           |                                                                      |
| 2        | 1.5      | 0.6                                      | 50       | 79 500                                        | 116 000                                                   | 2 500                                                                |
| 2        | 1.5      | 0.6                                      | 56       | 95 500                                        | 144 000                                                   | 2 000                                                                |
| 2        | 1.5      | 0.6                                      | 61       | 100 000                                       | 158 000                                                   | 2 000                                                                |
| 2.5      | 2        | 0.6                                      | 68       | 118 000                                       | 193 000                                                   | 1 800                                                                |
| 2.5      | 2        | 0.6                                      | 73       | 123 000                                       | 208 000                                                   | 1 700                                                                |
| 2.5      | 2        | 0.6                                      | 78       | 128 000                                       | 224 000                                                   | 1 600                                                                |
| 2.5      | 2        | 0.6                                      | 84       | 171 000                                       | 284 000                                                   | 1 400                                                                |
| 2.5      | 2        | 0.6                                      | 91       | 179 000                                       | 308 000                                                   | 1 300                                                                |
| 2.5      | 2        | 0.6                                      | 97       | 251 000                                       | 428 000                                                   | 1 300                                                                |
| 2.5      | 2        | 0.6                                      | 101      | 257 000                                       | 446 000                                                   | 1 200                                                                |
| 2.5      | 2.5      | 0.6                                      | 110      | 305 000                                       | 540 000                                                   | 1 100                                                                |
| 2.5      | 2.5      | 0.6                                      | 114      | 312 000                                       | 562 000                                                   | 1 100                                                                |
| 2.5      | 2.5      | 0.6                                      | 118      | 318 000                                       | 584 000                                                   | 1 000                                                                |
| 2.5      | 3        | 1                                        | 130      | 384 000                                       | 697 000                                                   | 900                                                                  |
| 3        | 3        | 1                                        | 139.5    | 400 000                                       | 750 000                                                   | 850                                                                  |
| 3        | 3        | 1                                        | 156      | 537 000                                       | 1 000 000                                                 | 750                                                                  |
| 3        | 3        | 1                                        | 167      | 543 000                                       | 1 070 000                                                 | 700                                                                  |
| 3        | 3.5      | 1                                        | 176.5    | 623 000                                       | 1 210 000                                                 | 650                                                                  |
| 3        | 3.5      | 1.5                                      | 188.5    | 720 000                                       | 1 390 000                                                 | 650                                                                  |
| 4        | 3.5      | 1.5                                      | 204.5    | 857 000                                       | 1 730 000                                                 | 600                                                                  |

ROLLER BEARINGS

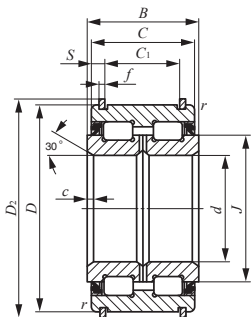
Roller Bearings for Sheaves



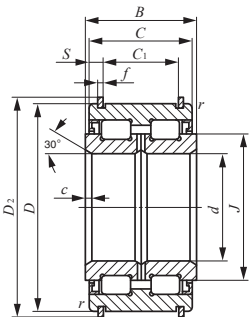
Shaft dia. 180 – 280mm

| Shaft<br>dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br><br>kg | Boundary dimensions<br>mm |          |                       |          |          |                       |          |
|---------------------|-----------------------|--------------|--------------------------|---------------------------|----------|-----------------------|----------|----------|-----------------------|----------|
|                     | Sealed type           | Shield type  |                          | <i>d</i>                  | <i>D</i> | <i>D</i> <sub>2</sub> | <i>B</i> | <i>C</i> | <i>C</i> <sub>1</sub> | <i>S</i> |
| 180                 | NAS 5036UUNR          | NAS 5036ZZNR | 30.0                     | 180                       | 280      | 294                   | 136      | 135      | 110                   | 12.5     |
| 190                 | NAS 5038UUNR          | NAS 5038ZZNR | 31.5                     | 190                       | 290      | 306                   | 136      | 135      | 110                   | 12.5     |
| 200                 | NAS 5040UUNR          | NAS 5040ZZNR | 40.5                     | 200                       | 310      | 326                   | 150      | 149      | 120                   | 14.5     |
| 220                 | NAS 5044UUNR          | NAS 5044ZZNR | 52.0                     | 220                       | 340      | 356                   | 160      | 159      | 130                   | 14.5     |
| 240                 | NAS 5048UUNR          | NAS 5048ZZNR | 55.5                     | 240                       | 360      | 376                   | 160      | 159      | 130                   | 14.5     |
| 260                 | NAS 5052UUNR          | NAS 5052ZZNR | 85.0                     | 260                       | 400      | 416                   | 190      | 189      | 154                   | 17.5     |
| 280                 | NAS 5056UUNR          | NAS 5056ZZNR | 90.9                     | 280                       | 420      | 440                   | 190      | 189      | 154                   | 17.5     |
|                     |                       |              |                          |                           |          |                       |          |          |                       |          |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to grease lubrication. Considering that the axial load acts under practical operating conditions, up to 1/10 of this value is recommended for actual use.  
Remarks1. The inner ring has an oil groove and two oil holes.  
2. Roller Bearings for Sheaves are provided with prepacked grease.



NAS50 ··· UUNR



NAS50 ··· ZZNR

|          |          |                                          |          | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|----------|----------|------------------------------------------|----------|-----------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| <i>f</i> | <i>c</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>J</i> |                                               |                                                           |                                                                      |
| 5        | 3.5      | 1.5                                      | 217      | 1 070 000                                     | 2 140 000                                                 | 550                                                                  |
| 5        | 3.5      | 1.5                                      | 225      | 1 120 000                                     | 2 230 000                                                 | 500                                                                  |
| 5        | 3.5      | 1.5                                      | 242      | 1 310 000                                     | 2 650 000                                                 | 500                                                                  |
| 6        | 4        | 1.5                                      | 260      | 1 510 000                                     | 3 110 000                                                 | 450                                                                  |
| 6        | 4        | 1.5                                      | 278.5    | 1 570 000                                     | 3 350 000                                                 | 400                                                                  |
| 7        | 5        | 2                                        | 312      | 2 130 000                                     | 4 510 000                                                 | 350                                                                  |
| 7        | 5        | 2                                        | 335      | 2 210 000                                     | 4 860 000                                                 | 350                                                                  |
|          |          |                                          |          |                                               |                                                           |                                                                      |

E  
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# THRUST BEARINGS

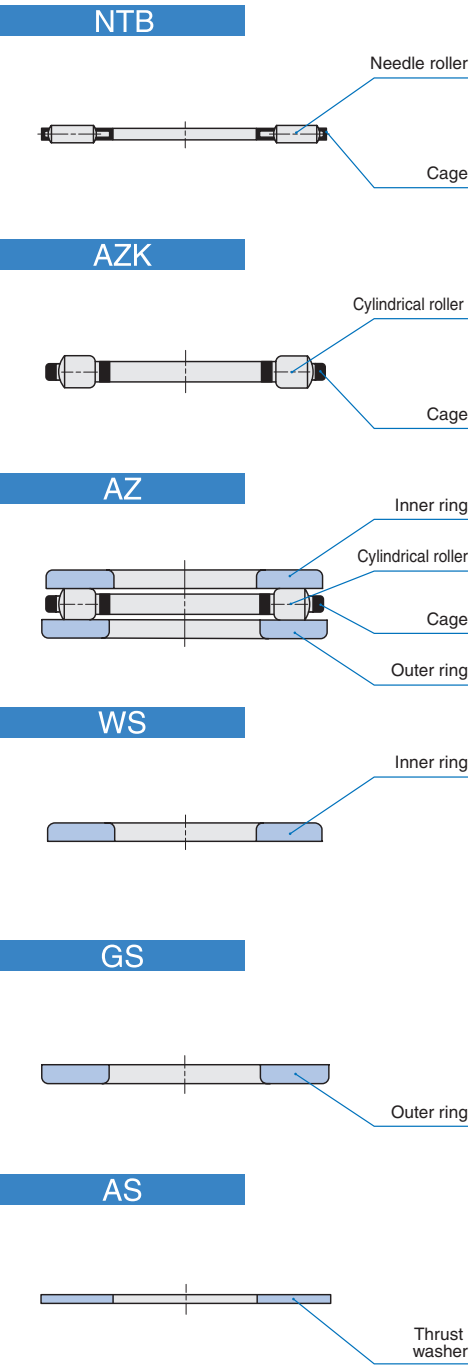
- Thrust Needle Roller Bearings
- Thrust Roller Bearings



## Structure and Features

IKO Thrust Bearings consist of a precisely made cage and rollers. They have high rigidity and high load capacities and can be used in small spaces. Thrust Needle Roller Bearings incorporate needle rollers, while Thrust Roller Bearings incorporate cylindrical rollers. Various types of raceway rings are available, and suitable bearings can be selected according to the operating conditions. When the bearing mounting surfaces of a machine are heat-treated and finished by grinding as raceways, Thrust Bearings can be used without raceway rings allowing the machine to be made more compact. They are most suited to applications where high accuracy is required at high speeds and under fluctuating heavy loads, such as driving mechanisms for automobiles, machine tools, and high-pressure pumps.

### Structures of Thrust Bearings



F  
NTB  
AS  
AZK  
WS·GS

Types

In IKO Thrust Bearings, the types shown in Table 1 are available.

Table 1.1 Type of bearing

| Type       | Thrust needle roller bearings | Thrust roller bearings        |                            |
|------------|-------------------------------|-------------------------------|----------------------------|
|            |                               | Without inner and outer rings | With inner and outer rings |
| Model code | NTB                           | AZK                           | AZ                         |

Table 1.2 Type of bearing ring

| Type       | Inner ring | Outer ring | Thrust washer |
|------------|------------|------------|---------------|
| Model code | WS         | GS         | AS            |

Thrust Needle Roller Bearings

These bearings consist of a cage made from a steel plate, which is precisely press formed and surface-hardened, and needle rollers with a diameter variation within 2 μm. They have a rigid structure and a high lubricant-retaining capacity. As they have the lowest sectional height compared with other thrust bearings, they can be used instead of conventional thrust washers and can withstand high-speed rotations with a low coefficient of friction. Specially designed thin inner rings (WS) and outer rings (GS), and especially thin (1 mm thick) thrust washers (AS), are available for use in various applications. These bearings are generally used by utilizing their inner surface as the guide surface.

Thrust Roller Bearings

In this series, the caged cylindrical rollers AZK and the complete bearings AZ in which AZK are combined with an inner ring (WS) and an outer ring (GS) are available. The cage has a special precise structure which is highly rigid, and cylindrical rollers are outwardly arranged and guided by the cage with exact precision to enable them to withstand heavy loads even at high rotational speeds. Owing to the high accuracy of the bearing height *T*, they are suitable for use in machine tools, ultra-high pressure pumps, etc. These bearings are generally used by utilizing their inner surface as the guide surface.

Identification Number

The identification number of Thrust Bearings consists of a model code, dimensions and a classification symbol. Some examples are shown below.

**Examples of identification number**

**Example 1 (In case of NTB or AS)**

|                         | Model code | Dimensions |
|-------------------------|------------|------------|
|                         | NTB        | 25 42      |
| Type of bearing         |            |            |
| Bore diameter (25mm)    |            |            |
| Outside diameter (42mm) |            |            |

**Example 2 (In case of AZ or AZK)**

|                                         | Model code | Dimensions | Classification symbol |
|-----------------------------------------|------------|------------|-----------------------|
|                                         | AZ         | 25 42 11   | P5                    |
| Type of bearing                         |            |            |                       |
| Bore diameter (25mm)                    |            |            |                       |
| Outside diameter (42mm)                 |            |            |                       |
| Bearing height (11mm)                   |            |            |                       |
| Accuracy class <sup>(1)</sup> (Class 5) |            |            |                       |

**Example 3 (In case of WS or GS)**

|                          | Model code | Dimensions | Classification symbol |
|--------------------------|------------|------------|-----------------------|
|                          | WS         | 25 42      | P5                    |
| Type of bearing ring     |            |            |                       |
| Bore diameter (25mm)     |            |            |                       |
| Outside diameter (42mm)  |            |            |                       |
| Accuracy class (Class 5) |            |            |                       |

Note<sup>(1)</sup> Not applicable to the model AZK.

Accuracy

The accuracy of Thrust Bearings is based on JIS B 1514-2, -3 as shown in Table 2.

Table 2.1 Tolerances

| Item                          |     | Dimension        | Dimension symbol     | Tolerance                        |                                  |
|-------------------------------|-----|------------------|----------------------|----------------------------------|----------------------------------|
| Type of bearing               |     |                  |                      |                                  |                                  |
| Thrust needle roller bearings | NTB | Bore diameter    | <i>d</i>             | E11                              |                                  |
|                               |     | Outside diameter | <i>D</i>             | c12                              |                                  |
|                               |     | Width            | <i>D<sub>w</sub></i> | Equivalent to JIS B 1506 Class 2 |                                  |
| Thrust roller bearings        | AZK | Bore diameter    | <i>d<sub>c</sub></i> | As per Table 2.2                 |                                  |
|                               |     | Outside diameter | <i>D<sub>c</sub></i> |                                  |                                  |
|                               |     | Width            | <i>D<sub>w</sub></i> | $1 \leq D_w \leq 10$             | Equivalent to JIS B 1506 Class 2 |
|                               | AZ  | Height           | <i>T</i>             | $10 < D_w \leq 30$               | Equivalent to JIS B 1506 Class 3 |
| Inner rings                   | WS  | Bore diameter    | <i>d</i>             | As per Table 2.4                 |                                  |
|                               |     | Outside diameter | <i>D</i>             | b12                              |                                  |
|                               |     | Width            | <i>B</i>             | h11                              |                                  |
| Outer rings                   | GS  | Bore diameter    | <i>d</i>             | B12                              |                                  |
|                               |     | Outside diameter | <i>D</i>             | As per Table 2.4                 |                                  |
|                               |     | Width            | <i>B</i>             | h11                              |                                  |
| Thrust washers                | AS  | Bore diameter    | <i>d</i>             | E12                              |                                  |
|                               |     | Outside diameter | <i>D</i>             | e12                              |                                  |
|                               |     | Width            | <i>s</i>             | ± 50                             |                                  |

Table 2.2 Tolerances of bore and outside diameters for AZK series

| Nominal dimension mm |       | $\Delta_{dc}$<br>Cage bore diameter deviation |     | $\Delta_{Dc}$<br>Cage outside diameter deviation |        |
|----------------------|-------|-----------------------------------------------|-----|--------------------------------------------------|--------|
| Over                 | Incl. | High                                          | Low | High                                             | Low    |
| —                    | 50    | + 100                                         | 0   | 0                                                | — 300  |
| 50                   | 100   | + 200                                         | 0   | 0                                                | — 400  |
| 100                  | 200   | + 300                                         | 0   | 0                                                | — 500  |
| 200                  | 300   | + 500                                         | 0   | 0                                                | — 700  |
| 300                  | 400   | + 700                                         | 0   | 0                                                | — 1000 |
| 400                  | 500   | —                                             | —   | 0                                                | — 1200 |

Table 2.3 Tolerances of height for AZ series

| <i>d</i><br>Nominal bearing bore dia. mm |       | $\Delta_{Ts}$<br>Deviation of an actual bearing height |       |
|------------------------------------------|-------|--------------------------------------------------------|-------|
| Over                                     | Incl. | High                                                   | Low   |
| —                                        | 18    | 0                                                      | — 75  |
| 18                                       | 30    | 0                                                      | — 75  |
| 30                                       | 50    | 0                                                      | — 100 |
| 50                                       | 80    | 0                                                      | — 125 |
| 80                                       | 120   | 0                                                      | — 150 |
| 120                                      | 180   | 0                                                      | — 175 |
| 180                                      | 250   | 0                                                      | — 200 |
| 250                                      | 315   | 0                                                      | — 225 |
| 315                                      | 400   | 0                                                      | — 300 |
| 400                                      | 500   | 0                                                      | — 400 |

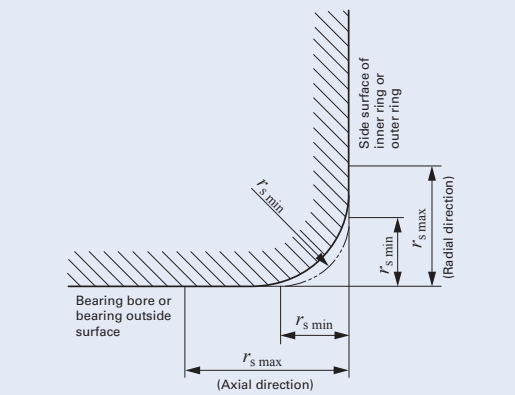
Table 2.4 Tolerances and allowable values for WS and GS

unit:  $\mu\text{m}$

| $d$ or $D$ <sup>(1)</sup><br>Nominal bearing bore<br>dia. or outside dia.<br><br>mm |       | Inner ring                                                     |      |                                                                       | Outer ring                                                        |      |                                                                          | Inner ring or outer ring                                          |         |         |
|-------------------------------------------------------------------------------------|-------|----------------------------------------------------------------|------|-----------------------------------------------------------------------|-------------------------------------------------------------------|------|--------------------------------------------------------------------------|-------------------------------------------------------------------|---------|---------|
|                                                                                     |       | $\Delta_{dmp}$<br>Single plane mean bore<br>diameter deviation |      | $V_{dsp}$<br>Bore diameter<br>variation in a sin-<br>gle radial plane | $\Delta_{Dmp}$<br>Single plane mean outside<br>diameter deviation |      | $V_{Dsp}$<br>Outside diameter<br>variation in a sin-<br>gle radial plane | $S_i$ or $S_e$ <sup>(2)</sup><br>Bearing ring thickness variation |         |         |
|                                                                                     |       | High                                                           | Low  | Max.                                                                  | High                                                              | Low  | Max.                                                                     | Class 0                                                           | Class 6 | Class 5 |
| Over                                                                                | Incl. |                                                                |      |                                                                       |                                                                   |      |                                                                          | Max.                                                              |         |         |
| —                                                                                   | 18    | 0                                                              | — 8  | 6                                                                     | 0                                                                 | — 11 | 8                                                                        | 10                                                                | 5       | 3       |
| 18                                                                                  | 30    | 0                                                              | — 10 | 8                                                                     | 0                                                                 | — 13 | 10                                                                       | 10                                                                | 5       | 3       |
| 30                                                                                  | 50    | 0                                                              | — 12 | 9                                                                     | 0                                                                 | — 16 | 12                                                                       | 10                                                                | 6       | 3       |
| 50                                                                                  | 80    | 0                                                              | — 15 | 11                                                                    | 0                                                                 | — 19 | 14                                                                       | 10                                                                | 7       | 4       |
| 80                                                                                  | 120   | 0                                                              | — 20 | 15                                                                    | 0                                                                 | — 22 | 17                                                                       | 15                                                                | 8       | 4       |
| 120                                                                                 | 180   | 0                                                              | — 25 | 19                                                                    | 0                                                                 | — 25 | 19                                                                       | 15                                                                | 9       | 5       |
| 180                                                                                 | 250   | 0                                                              | — 30 | 23                                                                    | 0                                                                 | — 30 | 23                                                                       | 20                                                                | 10      | 5       |
| 250                                                                                 | 315   | 0                                                              | — 35 | 26                                                                    | 0                                                                 | — 35 | 26                                                                       | 25                                                                | 13      | 7       |
| 315                                                                                 | 400   | 0                                                              | — 40 | 30                                                                    | 0                                                                 | — 40 | 30                                                                       | 30                                                                | 15      | 7       |
| 400                                                                                 | 500   | 0                                                              | — 45 | 34                                                                    | 0                                                                 | — 45 | 34                                                                       | 30                                                                | 18      | 9       |

Notes<sup>(1)</sup>  $d$  for  $\Delta_{dmp}$  and  $V_{dsp}$ , and  $D$  for  $\Delta_{Dmp}$  and  $V_{Dsp}$ , respectively.  
 $d$  for thickness variations of inner and outer rings .  
<sup>(2)</sup>  $d_i$  for thickness variations of rings for NAX(I) and NBX(I) .

Table 2.5 Permissible limit values for chamfer dimension



unit: mm

| $r_s$ min | Radial and axial directions |  |
|-----------|-----------------------------|--|
|           | $r_s$ max                   |  |
| 0.3       | 0.8                         |  |
| 0.6       | 1.5                         |  |
| 1         | 2.2                         |  |
| 1.1       | 2.7                         |  |
| 1.5       | 3.5                         |  |
| 2         | 4                           |  |
| 2.1       | 4.5                         |  |
| 3         | 5.5                         |  |
| 4         | 6.5                         |  |
| 5         | 8                           |  |

Fit

The recommended fits for Thrust Bearings are shown in Table 3.

Table 3 Recommended fits

| Type of bearing               |     | Tolerance class |              |
|-------------------------------|-----|-----------------|--------------|
|                               |     | Shaft           | Housing bore |
| Thrust needle roller bearings | NTB | h8              | —            |
|                               | AZK | h6              | —            |
| Thrust roller bearings        | AZ  | h6              | H7           |
|                               | WS  | h6              | —            |
| Inner rings                   | WS  | h6              | —            |
| Outer rings                   | GS  | —               | H7           |
| Thrust washers                | AS  | h8              | —            |

Mounting

When mounting Thrust Bearings, the following items should be considered.

- ① When inner and outer rings are not used, the hardness of the raceway surfaces should be 58 ~ 64HRC, the effective hardening depth should be adequate, and the surface roughness should be less than  $0.2\mu\text{m}R_a$ .
- ② When mounting inner and outer rings to shaft and housing bore, dimensions related to mounting should be based on the dimension tables. Also, the mounting surfaces should be finished at right angles to the center axis and they should be sufficiently rigid.
- ③ To avoid elastic deformation, the thrust washer AS must be seated uniformly on its mating surface. A small warp in an AS washer will be corrected automatically when an axial load is applied.
- ④ Thrust Roller Bearings are combinations of a copper alloy component and cylindrical rollers. When handling the AZK itself, care should be taken to prevent deformations, blemishes, etc.

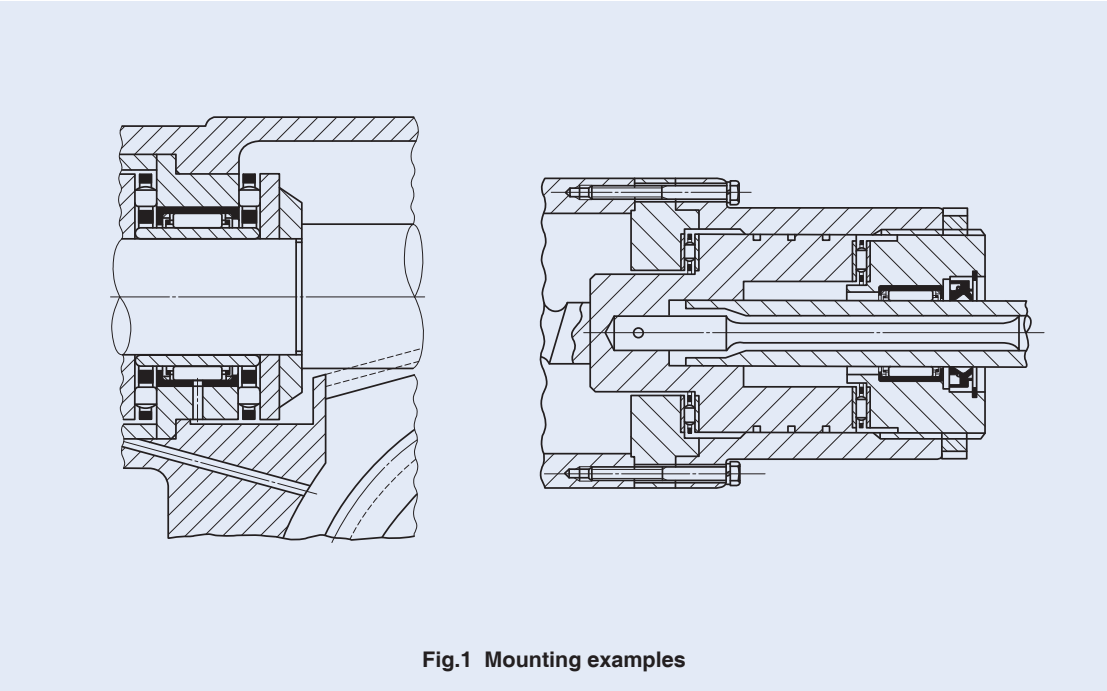
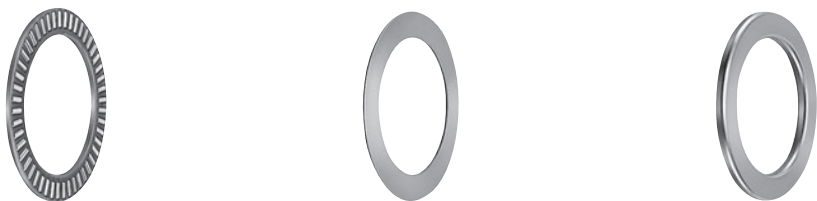


Fig.1 Mounting examples

THRUST BEARINGS

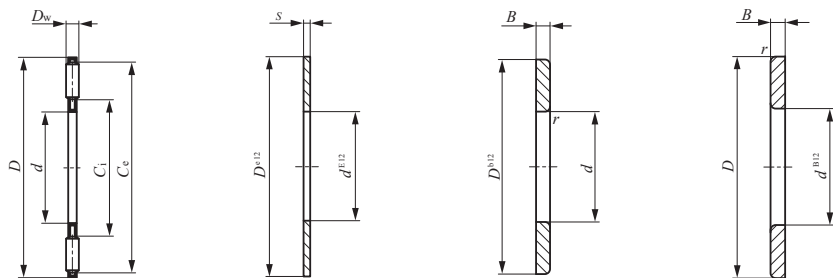
Thrust Needle Roller Bearings



Shaft dia. 10 – 85mm

| Shaft dia.<br>mm | Identification number        |               |               |               |            |            |               |
|------------------|------------------------------|---------------|---------------|---------------|------------|------------|---------------|
|                  | Thrust needle roller bearing | Mass (Ref.) g | Thrust washer | Mass (Ref.) g | Inner ring | Outer ring | Mass (Ref.) g |
| 10               | NTB 1024                     | 3.3           | AS 1024       | 2.9           | WS 1024    | GS 1024    | 8             |
| 12               | NTB 1226                     | 3.8           | AS 1226       | 3.2           | WS 1226    | GS 1226    | 8.9           |
| 15               | NTB 1528                     | 4.1           | AS 1528       | 3.4           | WS 1528    | GS 1528    | 9.3           |
| 16               | NTB 1629                     | 4.3           | AS 1629       | 3.6           | WS 1629    | GS 1629    | 9.8           |
| 17               | NTB 1730                     | 4.5           | AS 1730       | 3.7           | WS 1730    | GS 1730    | 10.2          |
| 18               | NTB 1831                     | 4.7           | AS 1831       | 3.9           | WS 1831    | GS 1831    | 10.7          |
| 20               | NTB 2035                     | 6.1           | AS 2035       | 5             | WS 2035    | GS 2035    | 13.8          |
| 25               | NTB 2542                     | 8.2           | AS 2542       | 6.9           | WS 2542    | GS 2542    | 21            |
| 30               | NTB 3047                     | 9.4           | AS 3047       | 7.9           | WS 3047    | GS 3047    | 24            |
| 35               | NTB 3552                     | 10.6          | AS 3552       | 8.9           | WS 3552    | GS 3552    | 31.5          |
| 40               | NTB 40603                    | 22            | AS 4060       | 12.1          | WS 4060    | GS 4060    | 42.5          |
| 45               | NTB 4565                     | 24.5          | AS 4565       | 13.3          | WS 4565    | GS 4565    | 53.5          |
| 50               | NTB 5070                     | 26.5          | AS 5070       | 14.5          | WS 5070    | GS 5070    | 58.5          |
| 55               | NTB 5578                     | 33.5          | AS 5578       | 18.5          | WS 5578    | GS 5578    | 93            |
| 60               | NTB 6085                     | 38.5          | AS 6085       | 22            | WS 6085    | GS 6085    | 105           |
| 65               | NTB 6590                     | 41.5          | AS 6590       | 23.5          | WS 6590    | GS 6590    | 124           |
| 70               | NTB 7095                     | 61            | AS 7095       | 25            | WS 7095    | GS 7095    | 132           |
| 75               | NTB 75100                    | 65            | AS 75100      | 26.5          | WS 75100   | GS 75100   | 153           |
| 80               | NTB 80105                    | 68.5          | AS 80105      | 28            | WS 80105   | GS 80105   | 162           |
| 85               | NTB 85110                    | 72            | AS 85110      | 29.5          | WS 85110   | GS 85110   | 170           |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 25% of this value is allowable.



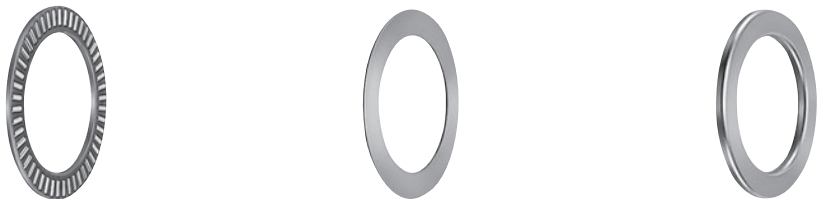
NTB AS WS GS

| Boundary dimensions mm |          |                       |          |          |                                          |                       |                       | Basic dynamic load rating <i>C</i> | Basic static load rating <i>C</i> <sub>0</sub> | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|-----------------------|----------|----------|------------------------------------------|-----------------------|-----------------------|------------------------------------|------------------------------------------------|-------------------------------------------|
| <i>d</i>               | <i>D</i> | <i>D</i> <sub>w</sub> | <i>s</i> | <i>B</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>C</i> <sub>i</sub> | <i>C</i> <sub>e</sub> | N                                  | N                                              | min <sup>-1</sup>                         |
| 10                     | 24       | 2                     | 1        | 2.75     | 0.3                                      | 14                    | 22                    | 7 820                              | 23 900                                         | 15 000                                    |
| 12                     | 26       | 2                     | 1        | 2.75     | 0.3                                      | 16                    | 24                    | 8 340                              | 26 900                                         | 13 000                                    |
| 15                     | 28       | 2                     | 1        | 2.75     | 0.3                                      | 18                    | 26                    | 8 830                              | 29 900                                         | 12 000                                    |
| 16                     | 29       | 2                     | 1        | 2.75     | 0.3                                      | 19                    | 27                    | 9 070                              | 31 400                                         | 11 000                                    |
| 17                     | 30       | 2                     | 1        | 2.75     | 0.3                                      | 20                    | 28                    | 9 320                              | 32 900                                         | 11 000                                    |
| 18                     | 31       | 2                     | 1        | 2.75     | 0.3                                      | 21                    | 29                    | 9 550                              | 34 400                                         | 10 000                                    |
| 20                     | 35       | 2                     | 1        | 2.75     | 0.3                                      | 23                    | 33                    | 11 700                             | 46 500                                         | 9 000                                     |
| 25                     | 42       | 2                     | 1        | 3        | 0.6                                      | 29                    | 40                    | 14 400                             | 64 700                                         | 7 500                                     |
| 30                     | 47       | 2                     | 1        | 3        | 0.6                                      | 34                    | 45                    | 15 400                             | 73 300                                         | 6 500                                     |
| 35                     | 52       | 2                     | 1        | 3.5      | 0.6                                      | 39                    | 50                    | 16 300                             | 81 900                                         | 5 500                                     |
| 40                     | 60       | 3                     | 1        | 3.5      | 0.6                                      | 45                    | 57                    | 24 200                             | 108 000                                        | 5 000                                     |
| 45                     | 65       | 3                     | 1        | 4        | 0.6                                      | 50                    | 62                    | 25 900                             | 121 000                                        | 4 500                                     |
| 50                     | 70       | 3                     | 1        | 4        | 0.6                                      | 55                    | 67                    | 27 600                             | 135 000                                        | 4 000                                     |
| 55                     | 78       | 3                     | 1        | 5        | 0.6                                      | 61                    | 75                    | 32 400                             | 171 000                                        | 4 000                                     |
| 60                     | 85       | 3                     | 1        | 4.75     | 1                                        | 66                    | 82                    | 38 200                             | 219 000                                        | 3 500                                     |
| 65                     | 90       | 3                     | 1        | 5.25     | 1                                        | 71                    | 87                    | 40 100                             | 237 000                                        | 3 000                                     |
| 70                     | 95       | 4                     | 1        | 5.25     | 1                                        | 75                    | 91                    | 47 400                             | 244 000                                        | 3 000                                     |
| 75                     | 100      | 4                     | 1        | 5.75     | 1                                        | 80                    | 96                    | 48 400                             | 256 000                                        | 3 000                                     |
| 80                     | 105      | 4                     | 1        | 5.75     | 1                                        | 85                    | 101                   | 49 500                             | 267 000                                        | 2 500                                     |
| 85                     | 110      | 4                     | 1        | 5.75     | 1                                        | 90                    | 106                   | 50 300                             | 279 000                                        | 2 500                                     |

F  
NTB  
AS  
AZK  
WS-GS

THRUST BEARINGS

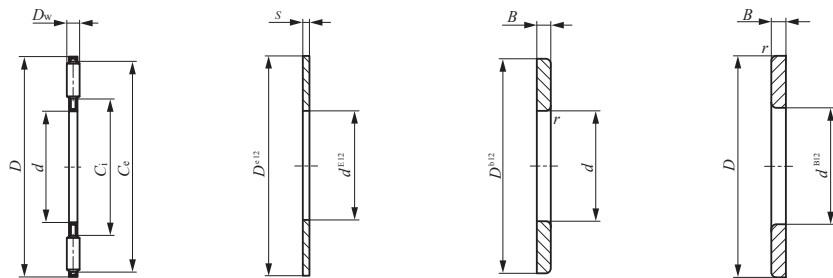
Thrust Needle Roller Bearings



Shaft dia. 90 – 130mm

| Shaft dia.<br>mm | Identification number        |               |               |               |            |            |               |
|------------------|------------------------------|---------------|---------------|---------------|------------|------------|---------------|
|                  | Thrust needle roller bearing | Mass (Ref.) g | Thrust washer | Mass (Ref.) g | Inner ring | Outer ring | Mass (Ref.) g |
| 90               | NTB 90120                    | 92            | AS 90120      | 38            | WS 90120   | GS 90120   | 250           |
| 100              | NTB 100135                   | 119           | AS 100135     | 50            | WS 100135  | GS 100135  | 350           |
| 110              | NTB 110145                   | 129           | —             | —             | WS 110145  | GS 110145  | 380           |
| 120              | NTB 120155                   | 139           | —             | —             | WS 120155  | GS 120155  | 410           |
| 130              | NTB 130170                   | 225           | —             | —             | WS 130170  | GS 130170  | 660           |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 25% of this value is allowable.



NTB AS WS GS

| Boundary dimensions mm |          |                       |          |          |                                          |                       |                       | Basic dynamic load rating <i>C</i> | Basic static load rating <i>C</i> <sub>0</sub> | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|-----------------------|----------|----------|------------------------------------------|-----------------------|-----------------------|------------------------------------|------------------------------------------------|-------------------------------------------|
| <i>d</i>               | <i>D</i> | <i>D</i> <sub>w</sub> | <i>s</i> | <i>B</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>C</i> <sub>i</sub> | <i>C</i> <sub>e</sub> | N                                  | N                                              | min <sup>-1</sup>                         |
| 90                     | 120      | 4                     | 1        | 6.5      | 1                                        | 96                    | 116                   | 64 500                             | 394 000                                        | 2 500                                     |
| 100                    | 135      | 4                     | 1        | 7        | 1                                        | 107                   | 131                   | 80 300                             | 541 000                                        | 2 000                                     |
| 110                    | 145      | 4                     | —        | 7        | 1                                        | 117                   | 141                   | 83 200                             | 578 000                                        | 2 000                                     |
| 120                    | 155      | 4                     | —        | 7        | 1                                        | 127                   | 151                   | 87 900                             | 634 000                                        | 1 800                                     |
| 130                    | 170      | 5                     | —        | 9        | 1                                        | 137                   | 165                   | 120 000                            | 839 000                                        | 1 700                                     |

F  
NTB  
AS  
AZK  
WS-GS

THRUST BEARINGS

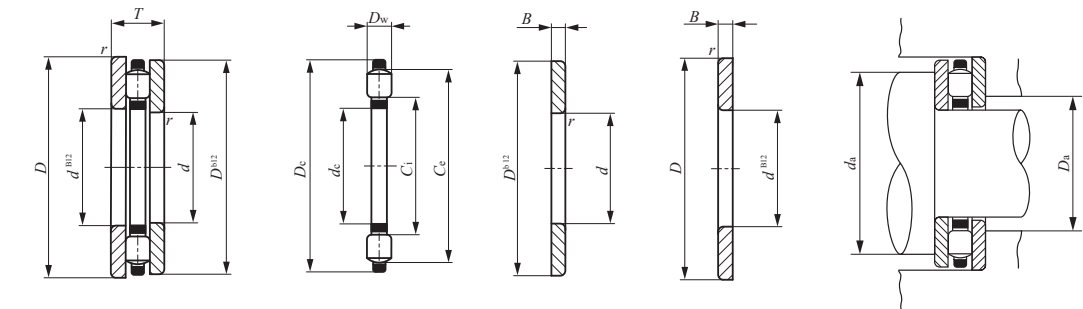
Thrust Roller Bearings



Shaft dia. 10 – 65mm

| Shaft dia.<br>mm | Identification number |               |                       |               |            |            |               |  |
|------------------|-----------------------|---------------|-----------------------|---------------|------------|------------|---------------|--|
|                  | Thrust roller bearing | Mass (Ref.) g | Thrust roller bearing | Mass (Ref.) g | Inner ring | Outer ring | Mass (Ref.) g |  |
| 10               | AZ 10249              | 24.6          | AZK 10243.5           | 8.6           | WS 1024    | GS 1024    | 8             |  |
| 12               | AZ 12269              | 26.5          | AZK 12263.5           | 8.7           | WS 1226    | GS 1226    | 8.9           |  |
| 15               | AZ 15289              | 28            | AZK 15283.5           | 9.4           | WS 1528    | GS 1528    | 9.3           |  |
| 17               | AZ 17309              | 30.5          | AZK 17303.5           | 10.1          | WS 1730    | GS 1730    | 10.2          |  |
| 20               | AZ 203510             | 45.5          | AZK 20354.5           | 17.9          | WS 2035    | GS 2035    | 13.8          |  |
| 25               | AZ 254211             | 70            | AZK 25425             | 28            | WS 2542    | GS 2542    | 21            |  |
| 30               | AZ 304711             | 79            | AZK 30475             | 31            | WS 3047    | GS 3047    | 24            |  |
|                  | AZ 305216             | 160           | AZK 30527.5           | 70            | WS 3052    | GS 3052    | 45            |  |
| 35               | AZ 355212             | 99            | AZK 35525             | 36            | WS 3552    | GS 3552    | 31.5          |  |
|                  | AZ 356218             | 260           | AZK 35627.5           | 98            | WS 3562    | GS 3562    | 81            |  |
| 40               | AZ 406013             | 139           | AZK 40606             | 54            | WS 4060    | GS 4060    | 42.5          |  |
|                  | AZ 406819             | 310           | AZK 40689             | 132           | WS 4068    | GS 4068    | 89            |  |
| 45               | AZ 456514             | 169           | AZK 45656             | 62            | WS 4565    | GS 4565    | 53.5          |  |
|                  | AZ 457320             | 360           | AZK 45739             | 144           | WS 4573    | GS 4573    | 108           |  |
| 50               | AZ 507014             | 185           | AZK 50706             | 68            | WS 5070    | GS 5070    | 58.5          |  |
|                  | AZ 507822             | 430           | AZK 507811            | 194           | WS 5078    | GS 5078    | 118           |  |
| 55               | AZ 557816             | 275           | AZK 55786             | 89            | WS 5578    | GS 5578    | 93            |  |
|                  | AZ 559025             | 725           | AZK 559011            | 275           | WS 5590    | GS 5590    | 225           |  |
| 60               | AZ 608517             | 345           | AZK 60857.5           | 135           | WS 6085    | GS 6085    | 105           |  |
|                  | AZ 609526             | 770           | AZK 609511            | 290           | WS 6095    | GS 6095    | 240           |  |
|                  | AZ 6013026            | 2 090         | AZK 6013010           | 790           | WS 60130   | GS 60130   | 650           |  |
| 65               | AZ 659018             | 380           | AZK 65907.5           | 132           | WS 6590    | GS 6590    | 124           |  |
|                  | AZ 6510027            | 860           | AZK 6510011           | 310           | WS 65100   | GS 65100   | 275           |  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 25% of this value is allowable.



| Boundary dimensions mm |          |          |                      |                      |                      |          |                                         |                      |                      |                           |                           | Standard mounting dimensions mm | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|----------------------|----------------------|----------------------|----------|-----------------------------------------|----------------------|----------------------|---------------------------|---------------------------|---------------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>d</i>               | <i>D</i> | <i>T</i> | <i>d<sub>c</sub></i> | <i>D<sub>c</sub></i> | <i>D<sub>w</sub></i> | <i>B</i> | <i>r<sub>s min</sub></i> <sup>(1)</sup> | <i>C<sub>i</sub></i> | <i>C<sub>e</sub></i> | <i>d<sub>a</sub> Min.</i> | <i>D<sub>a</sub> Max.</i> | <i>C</i><br>N                   | <i>C<sub>0</sub></i><br>N |                          | min <sup>-1</sup>                         |
| 10                     | 24       | 9        | 10.04                | 23.6                 | 3.5                  | 2.75     | 0.3                                     | 13                   | 21                   | 21                        | 13                        | 8 990                           | 19 100                    | 18 000                   |                                           |
| 12                     | 26       | 9        | 12.04                | 25.6                 | 3.5                  | 2.75     | 0.3                                     | 15                   | 23                   | 23                        | 16                        | 10 400                          | 23 900                    | 16 000                   |                                           |
| 15                     | 28       | 9        | 15.04                | 27.6                 | 3.5                  | 2.75     | 0.3                                     | 17                   | 25                   | 25                        | 18                        | 10 200                          | 23 900                    | 14 000                   |                                           |
| 17                     | 30       | 9        | 17.04                | 29.6                 | 3.5                  | 2.75     | 0.3                                     | 19                   | 27                   | 27                        | 20                        | 11 400                          | 28 600                    | 13 000                   |                                           |
| 20                     | 35       | 10       | 20.04                | 34.6                 | 4.5                  | 2.75     | 0.3                                     | 22                   | 33                   | 33                        | 23                        | 19 000                          | 48 700                    | 11 000                   |                                           |
| 25                     | 42       | 11       | 25.05                | 41.6                 | 5                    | 3        | 0.6                                     | 28                   | 39                   | 39                        | 28                        | 22 700                          | 60 700                    | 9 000                    |                                           |
| 30                     | 47       | 11       | 30.05                | 46.5                 | 5                    | 3        | 0.6                                     | 33                   | 44                   | 44                        | 33                        | 27 400                          | 81 000                    | 8 000                    |                                           |
| 30                     | 52       | 16       | 30.05                | 51.5                 | 7.5                  | 4.25     | 0.6                                     | 35                   | 49                   | 48                        | 36                        | 38 400                          | 95 700                    | 7 500                    |                                           |
| 35                     | 52       | 12       | 35.05                | 51.5                 | 5                    | 3.5      | 0.6                                     | 38                   | 49                   | 49                        | 39                        | 29 100                          | 91 100                    | 7 000                    |                                           |
| 35                     | 62       | 18       | 35.05                | 61.5                 | 7.5                  | 5.25     | 1                                       | 42                   | 58                   | 57                        | 43                        | 47 900                          | 135 000                   | 6 500                    |                                           |
| 40                     | 60       | 13       | 40.05                | 59.5                 | 6                    | 3.5      | 0.6                                     | 44                   | 57                   | 57                        | 44                        | 41 700                          | 133 000                   | 6 000                    |                                           |
| 40                     | 68       | 19       | 40.05                | 67.5                 | 9                    | 5        | 1                                       | 45                   | 64                   | 64                        | 46                        | 68 700                          | 195 000                   | 5 500                    |                                           |
| 45                     | 65       | 14       | 45.05                | 64.5                 | 6                    | 4        | 0.6                                     | 49                   | 62                   | 62                        | 49                        | 40 800                          | 133 000                   | 5 500                    |                                           |
| 45                     | 73       | 20       | 45.05                | 72.5                 | 9                    | 5.5      | 1                                       | 50                   | 69                   | 69                        | 51                        | 75 700                          | 227 000                   | 5 000                    |                                           |
| 50                     | 70       | 14       | 50.05                | 69.5                 | 6                    | 4        | 0.6                                     | 54                   | 67                   | 67                        | 54                        | 43 300                          | 148 000                   | 5 000                    |                                           |
| 50                     | 78       | 22       | 50.05                | 77.5                 | 11                   | 5.5      | 1                                       | 55                   | 74                   | 73                        | 56                        | 84 300                          | 232 000                   | 4 500                    |                                           |
| 55                     | 78       | 16       | 55.05                | 77.5                 | 6                    | 5        | 0.6                                     | 59                   | 75                   | 75                        | 60                        | 51 700                          | 192 000                   | 4 500                    |                                           |
| 55                     | 90       | 25       | 55.05                | 89.5                 | 11                   | 7        | 1                                       | 63                   | 85                   | 84                        | 63                        | 108 000                         | 332 000                   | 4 000                    |                                           |
| 60                     | 85       | 17       | 60.05                | 84.5                 | 7.5                  | 4.75     | 1                                       | 65                   | 81                   | 81                        | 66                        | 64 600                          | 224 000                   | 4 000                    |                                           |
| 60                     | 95       | 26       | 60.05                | 94.5                 | 11                   | 7.5      | 1                                       | 68                   | 90                   | 89                        | 68                        | 106 000                         | 332 000                   | 4 000                    |                                           |
| 60                     | 130      | 26       | 60.05                | 129.5                | 10                   | 8        | 1.5                                     | 79                   | 119                  | 119                       | 80                        | 158 000                         | 634 000                   | 3 000                    |                                           |
| 65                     | 90       | 18       | 65.05                | 89.5                 | 7.5                  | 5.25     | 1                                       | 70                   | 86                   | 86                        | 71                        | 68 300                          | 247 000                   | 4 000                    |                                           |
| 65                     | 100      | 27       | 65.05                | 99.5                 | 11                   | 8        | 1                                       | 73                   | 95                   | 94                        | 73                        | 116 000                         | 379 000                   | 3 500                    |                                           |

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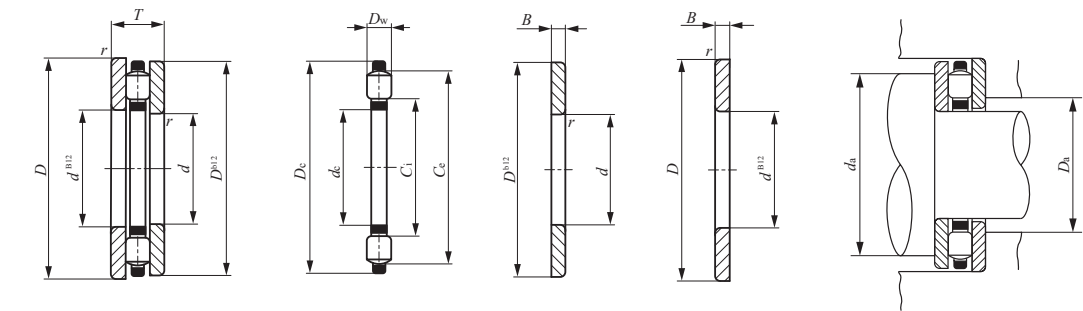
Thrust Roller Bearings



Shaft dia. 70 – 130mm

| Shaft dia.<br>mm | Identification number |               |                       |               |            |            |               |
|------------------|-----------------------|---------------|-----------------------|---------------|------------|------------|---------------|
|                  | Thrust roller bearing | Mass (Ref.) g | Thrust roller bearing | Mass (Ref.) g | Inner ring | Outer ring | Mass (Ref.) g |
| 70               | AZ 709518             | 420           | AZK 70957.5           | 156           | WS 7095    | GS 7095    | 132           |
|                  | AZ 7010527            | 905           | AZK 7010511           | 325           | WS 70105   | GS 70105   | 290           |
|                  | AZ 7014026            | 2 250         | AZK 7014010           | 890           | WS 70140   | GS 70140   | 680           |
| 75               | AZ 7510019            | 465           | AZK 751007.5          | 159           | WS 75100   | GS 75100   | 153           |
|                  | AZ 7511027            | 960           | AZK 7511011           | 340           | WS 75110   | GS 75110   | 310           |
| 80               | AZ 8010519            | 495           | AZK 801057.5          | 171           | WS 80105   | GS 80105   | 162           |
|                  | AZ 8011528            | 1 060         | AZK 8011511           | 370           | WS 80115   | GS 80115   | 345           |
|                  | AZ 8015026            | 2 500         | AZK 8015010           | 920           | WS 80150   | GS 80150   | 790           |
| 85               | AZ 8511019            | 530           | AZK 851107.5          | 190           | WS 85110   | GS 85110   | 170           |
|                  | AZ 8512531            | 1 460         | AZK 8512512           | 510           | WS 85125   | GS 85125   | 475           |
| 90               | AZ 9012022            | 790           | AZK 901209            | 290           | WS 90120   | GS 90120   | 250           |
|                  | AZ 9013535            | 2 040         | AZK 9013514           | 750           | WS 90135   | GS 90135   | 645           |
|                  | AZ 9016026            | 2 710         | AZK 9016010           | 1 000         | WS 90160   | GS 90160   | 855           |
| 100              | AZ 10013525           | 1 190         | AZK 10013511          | 490           | WS 100135  | GS 100135  | 350           |
|                  | AZ 10015038           | 2 720         | AZK 10015015          | 980           | WS 100150  | GS 100150  | 870           |
|                  | AZ 10019039           | 5 960         | AZK 10019015          | 2 120         | WS 100190  | GS 100190  | 1 920         |
| 110              | AZ 11014525           | 1 350         | AZK 11014511          | 590           | WS 110145  | GS 110145  | 380           |
|                  | AZ 11016040           | 3 220         | AZK 11016017          | 1 320         | WS 110160  | GS 110160  | 950           |
|                  | AZ 11020039           | 6 400         | AZK 11020015          | 2 280         | WS 110200  | GS 110200  | 2 060         |
| 120              | AZ 12015525           | 1 450         | AZK 12015511          | 630           | WS 120155  | GS 120155  | 410           |
|                  | AZ 12017542           | 4 020         | AZK 12017518          | 1 640         | WS 120175  | GS 120175  | 1 190         |
|                  | AZ 12022039           | 7 730         | AZK 12022015          | 2 730         | WS 120220  | GS 120220  | 2 500         |
| 130              | AZ 13017030           | 2 180         | AZK 13017012          | 860           | WS 130170  | GS 130170  | 660           |
|                  | AZ 13018542           | 4 300         | AZK 13018518          | 1 760         | WS 130185  | GS 130185  | 1 270         |
|                  | AZ 13023039           | 8 240         | AZK 13023015          | 2 940         | WS 130230  | GS 130230  | 2 650         |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 25% of this value is allowable.



AZ                      AZK                      WS                      GS

| Boundary dimensions mm |          |          |                      |                      |                      |          |                                         |                      |                      |  | Standard mounting dimensions mm |                           | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|----------------------|----------------------|----------------------|----------|-----------------------------------------|----------------------|----------------------|--|---------------------------------|---------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>d</i>               | <i>D</i> | <i>T</i> | <i>d<sub>c</sub></i> | <i>D<sub>c</sub></i> | <i>D<sub>w</sub></i> | <i>B</i> | <i>r<sub>s min</sub></i> <sup>(1)</sup> | <i>C<sub>i</sub></i> | <i>C<sub>e</sub></i> |  | <i>d<sub>a</sub></i> Min.       | <i>d<sub>a</sub></i> Max. | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 70                     | 95       | 18       | 70.05                | 94.5                 | 7.5                  | 5.25     | 1                                       | 75                   | 91                   |  | 91                              | 76                        | 72 000                    | 269 000                  | 3 500                                     |
| 70                     | 105      | 27       | 70.05                | 104.5                | 11                   | 8        | 1                                       | 78                   | 100                  |  | 99                              | 78                        | 114 000                   | 379 000                  | 3 500                                     |
| 70                     | 140      | 26       | 70.05                | 139.5                | 10                   | 8        | 1.1                                     | 89                   | 129                  |  | 129                             | 90                        | 169 000                   | 713 000                  | 3 000                                     |
| 75                     | 100      | 19       | 75.05                | 99.5                 | 7.5                  | 5.75     | 1                                       | 80                   | 96                   |  | 96                              | 81                        | 71 100                    | 269 000                  | 3 500                                     |
| 75                     | 110      | 27       | 75.05                | 109.5                | 11                   | 8        | 1                                       | 83                   | 105                  |  | 104                             | 83                        | 123 000                   | 427 000                  | 3 000                                     |
| 80                     | 105      | 19       | 80.05                | 104.5                | 7.5                  | 5.75     | 1                                       | 85                   | 101                  |  | 101                             | 86                        | 74 500                    | 292 000                  | 3 000                                     |
| 80                     | 115      | 28       | 80.05                | 114.5                | 11                   | 8.5      | 1                                       | 88                   | 110                  |  | 109                             | 88                        | 122 000                   | 427 000                  | 3 000                                     |
| 80                     | 150      | 26       | 80.05                | 149.5                | 10                   | 8        | 1.5                                     | 99                   | 139                  |  | 139                             | 100                       | 180 000                   | 792 000                  | 2 500                                     |
| 85                     | 110      | 19       | 85.05                | 109.5                | 7.5                  | 5.75     | 1                                       | 90                   | 106                  |  | 106                             | 91                        | 77 800                    | 314 000                  | 3 000                                     |
| 85                     | 125      | 31       | 85.05                | 124.5                | 12                   | 9.5      | 1                                       | 95                   | 119                  |  | 118                             | 95                        | 145 000                   | 513 000                  | 3 000                                     |
| 90                     | 120      | 22       | 90.05                | 119.5                | 9                    | 6.5      | 1                                       | 97                   | 116                  |  | 115                             | 97                        | 99 700                    | 390 000                  | 3 000                                     |
| 90                     | 135      | 35       | 90.05                | 134.5                | 14                   | 10.5     | 1.1                                     | 100                  | 129                  |  | 128                             | 101                       | 181 000                   | 626 000                  | 2 500                                     |
| 90                     | 160      | 26       | 90.05                | 159.5                | 10                   | 8        | 1.5                                     | 109                  | 149                  |  | 149                             | 110                       | 189 000                   | 871 000                  | 2 500                                     |
| 100                    | 135      | 25       | 100.05               | 134.5                | 11                   | 7        | 1                                       | 108                  | 130                  |  | 129                             | 108                       | 136 000                   | 522 000                  | 2 500                                     |
| 100                    | 150      | 38       | 100.05               | 149.5                | 15                   | 11.5     | 1.1                                     | 112                  | 143                  |  | 142                             | 113                       | 219 000                   | 796 000                  | 2 500                                     |
| 100                    | 190      | 39       | 100.1                | 189.3                | 15                   | 12       | 1.5                                     | 119                  | 179                  |  | 177                             | 120                       | 333 000                   | 1 420 000                | 2 000                                     |
| 110                    | 145      | 25       | 110.1                | 144.5                | 11                   | 7        | 1                                       | 118                  | 140                  |  | 139                             | 118                       | 142 000                   | 569 000                  | 2 500                                     |
| 110                    | 160      | 40       | 110.1                | 159.5                | 17                   | 11.5     | 1.1                                     | 120                  | 154                  |  | 153                             | 121                       | 282 000                   | 1 030 000                | 2 000                                     |
| 110                    | 200      | 39       | 110.1                | 199.3                | 15                   | 12       | 2                                       | 129                  | 188                  |  | 187                             | 130                       | 388 000                   | 1 770 000                | 2 000                                     |
| 120                    | 155      | 25       | 120.1                | 154.5                | 11                   | 7        | 1                                       | 128                  | 150                  |  | 149                             | 128                       | 149 000                   | 617 000                  | 2 000                                     |
| 120                    | 175      | 42       | 120.1                | 174.5                | 18                   | 12       | 1.1                                     | 132                  | 168                  |  | 167                             | 133                       | 313 000                   | 1 160 000                | 2 000                                     |
| 120                    | 220      | 39       | 120.1                | 219                  | 15                   | 12       | 2.1                                     | 141                  | 207                  |  | 206                             | 142                       | 415 000                   | 1 980 000                | 1 800                                     |
| 130                    | 170      | 30       | 130.1                | 169.5                | 12                   | 9        | 1                                       | 140                  | 164                  |  | 163                             | 140                       | 176 000                   | 741 000                  | 2 000                                     |
| 130                    | 185      | 42       | 130.1                | 184.5                | 18                   | 12       | 1.5                                     | 142                  | 178                  |  | 177                             | 143                       | 333 000                   | 1 290 000                | 1 900                                     |
| 130                    | 230      | 39       | 130.1                | 229                  | 15                   | 12       | 2.1                                     | 151                  | 217                  |  | 216                             | 152                       | 440 000                   | 2 180 000                | 1 700                                     |

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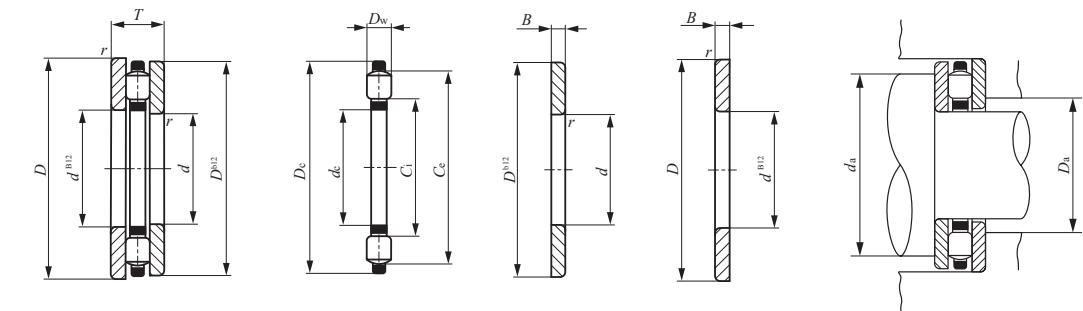
Thrust Roller Bearings



Shaft dia. 140 – 280mm

| Shaft dia.<br>mm | Identification number |               |                       |               |            |            |               |
|------------------|-----------------------|---------------|-----------------------|---------------|------------|------------|---------------|
|                  | Thrust roller bearing | Mass (Ref.) g | Thrust roller bearing | Mass (Ref.) g | Inner ring | Outer ring | Mass (Ref.) g |
| 140              | AZ 14018031           | 2 410         | AZK 14018012          | 920           | WS 140180  | GS 140180  | 745           |
|                  | AZ 14019542           | 4 560         | AZK 14019518          | 1 860         | WS 140195  | GS 140195  | 1 350         |
|                  | AZ 14024039           | 8 680         | AZK 14024015          | 3 100         | WS 140240  | GS 140240  | 2 790         |
| 150              | AZ 15019031           | 2 560         | AZK 15019012          | 980           | WS 150190  | GS 150190  | 790           |
|                  | AZ 15020542           | 4 840         | AZK 15020518          | 1 980         | WS 150205  | GS 150205  | 1 430         |
|                  | AZ 15025039           | 9 140         | AZK 15025015          | 3 260         | WS 150250  | GS 150250  | 2 940         |
| 160              | AZ 16020031           | 2 710         | AZK 16020012          | 1 030         | WS 160200  | GS 160200  | 840           |
|                  | AZ 16027039           | 10 800        | AZK 16027015          | 3 840         | WS 160270  | GS 160270  | 3 480         |
| 170              | AZ 17023045           | 6 220         | AZK 17023019          | 2 420         | WS 170230  | GS 170230  | 1 900         |
|                  | AZ 17028039           | 11 300        | AZK 17028015          | 4 020         | WS 170280  | GS 170280  | 3 640         |
| 180              | AZ 18024045           | 6 540         | AZK 18024019          | 2 540         | WS 180240  | GS 180240  | 2 000         |
|                  | AZ 18031039           | 14 600        | AZK 18031015          | 5 200         | WS 180310  | GS 180310  | 4 700         |
| 190              | AZ 19025548           | 8 060         | AZK 19025520          | 3 100         | WS 190255  | GS 190255  | 2 480         |
|                  | AZ 19032039           | 15 000        | AZK 19032015          | 5 280         | WS 190320  | GS 190320  | 4 860         |
| 200              | AZ 20026548           | 8 430         | AZK 20026520          | 3 250         | WS 200265  | GS 200265  | 2 590         |
|                  | AZ 20034039           | 17 200        | AZK 20034015          | 6 120         | WS 200340  | GS 200340  | 5 540         |
| 220              | AZ 22029050           | 10 400        | AZK 22029022          | 4 280         | WS 220290  | GS 220290  | 3 060         |
|                  | AZ 22036052           | 24 000        | AZK 22036020          | 8 000         | WS 220360  | GS 220360  | 8 000         |
| 240              | AZ 24031554           | 13 200        | AZK 24031524          | 5 520         | WS 240315  | GS 240315  | 3 840         |
|                  | AZ 24038052           | 26 500        | AZK 24038020          | 9 440         | WS 240380  | GS 240380  | 8 530         |
| 260              | AZ 26034055           | 15 400        | AZK 26034025          | 6 600         | WS 260340  | GS 260340  | 4 400         |
|                  | AZ 26042080           | 51 600        | AZK 26042030          | 18 200        | WS 260420  | GS 260420  | 16 700        |
| 280              | AZ 28044080           | 54 600        | AZK 28044030          | 19 200        | WS 280440  | GS 280440  | 17 700        |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 25% of this value is allowable.



| Boundary dimensions mm |          |          |                      |                      |                      |          |                                         |                      |                      |     | Standard mounting dimensions mm |                           | Basic dynamic load rating | Basic static load rating | Allowable rotational speed <sup>(2)</sup> |
|------------------------|----------|----------|----------------------|----------------------|----------------------|----------|-----------------------------------------|----------------------|----------------------|-----|---------------------------------|---------------------------|---------------------------|--------------------------|-------------------------------------------|
| <i>d</i>               | <i>D</i> | <i>T</i> | <i>d<sub>c</sub></i> | <i>D<sub>c</sub></i> | <i>D<sub>w</sub></i> | <i>B</i> | <i>r<sub>s min</sub></i> <sup>(1)</sup> | <i>C<sub>i</sub></i> | <i>C<sub>e</sub></i> |     | <i>d<sub>a</sub></i> Min.       | <i>D<sub>a</sub></i> Max. | <i>C</i> N                | <i>C<sub>0</sub></i> N   | min <sup>-1</sup>                         |
| 140                    | 180      | 31       | 140.1                | 179.5                | 12                   | 9.5      | 1                                       | 150                  | 174                  | 173 | 150                             | 150                       | 184 000                   | 798 000                  | 1 900                                     |
| 140                    | 195      | 42       | 140.1                | 194.5                | 18                   | 12       | 1.5                                     | 152                  | 188                  | 187 | 153                             | 153                       | 353 000                   | 1 420 000                | 1 800                                     |
| 140                    | 240      | 39       | 140.1                | 239                  | 15                   | 12       | 2.1                                     | 161                  | 227                  | 226 | 162                             | 162                       | 435 000                   | 2 180 000                | 1 600                                     |
| 150                    | 190      | 31       | 150.1                | 189.5                | 12                   | 9.5      | 1                                       | 160                  | 184                  | 183 | 160                             | 160                       | 181 000                   | 798 000                  | 1 800                                     |
| 150                    | 205      | 42       | 150.1                | 204.5                | 18                   | 12       | 1.5                                     | 162                  | 198                  | 197 | 163                             | 163                       | 349 000                   | 1 420 000                | 1 700                                     |
| 150                    | 250      | 39       | 150.1                | 249                  | 15                   | 12       | 2.1                                     | 171                  | 237                  | 236 | 172                             | 172                       | 459 000                   | 2 380 000                | 1 500                                     |
| 160                    | 200      | 31       | 160.1                | 199.5                | 12                   | 9.5      | 1                                       | 170                  | 194                  | 193 | 170                             | 170                       | 189 000                   | 855 000                  | 1 700                                     |
| 160                    | 270      | 39       | 160.1                | 269                  | 15                   | 12       | 3                                       | 183                  | 256                  | 255 | 184                             | 184                       | 519 000                   | 2 850 000                | 1 400                                     |
| 170                    | 230      | 45       | 170.1                | 229                  | 19                   | 13       | 1.5                                     | 183                  | 221                  | 220 | 184                             | 184                       | 406 000                   | 1 730 000                | 1 500                                     |
| 170                    | 280      | 39       | 170.1                | 279                  | 15                   | 12       | 3                                       | 193                  | 266                  | 265 | 194                             | 194                       | 543 000                   | 3 070 000                | 1 300                                     |
| 180                    | 240      | 45       | 180.1                | 239                  | 19                   | 13       | 1.5                                     | 193                  | 231                  | 230 | 194                             | 194                       | 426 000                   | 1 870 000                | 1 400                                     |
| 180                    | 310      | 39       | 180.1                | 308                  | 15                   | 12       | 3                                       | 204                  | 294                  | 293 | 205                             | 205                       | 619 000                   | 3 710 000                | 1 200                                     |
| 190                    | 255      | 48       | 190.1                | 254                  | 20                   | 14       | 2                                       | 205                  | 245                  | 244 | 206                             | 206                       | 470 000                   | 2 080 000                | 1 300                                     |
| 190                    | 320      | 39       | 190.1                | 318                  | 15                   | 12       | 4                                       | 214                  | 304                  | 303 | 215                             | 215                       | 647 000                   | 3 980 000                | 1 200                                     |
| 200                    | 265      | 48       | 200.15               | 264                  | 20                   | 14       | 2                                       | 215                  | 255                  | 254 | 216                             | 216                       | 465 000                   | 2 080 000                | 1 300                                     |
| 200                    | 340      | 39       | 200.15               | 338                  | 15                   | 12       | 4                                       | 227                  | 323                  | 322 | 228                             | 228                       | 710 000                   | 4 580 000                | 1 100                                     |
| 220                    | 290      | 50       | 220.15               | 289                  | 22                   | 14       | 2                                       | 236                  | 280                  | 278 | 237                             | 237                       | 557 000                   | 2 530 000                | 1 300                                     |
| 220                    | 360      | 52       | 220.15               | 358                  | 20                   | 16       | 4                                       | 246                  | 343                  | 342 | 247                             | 247                       | 943 000                   | 5 520 000                | 1 000                                     |
| 240                    | 315      | 54       | 240.15               | 314                  | 24                   | 15       | 2                                       | 256                  | 304                  | 302 | 257                             | 257                       | 695 000                   | 3 250 000                | 1 100                                     |
| 240                    | 380      | 52       | 240.15               | 378                  | 20                   | 16       | 4                                       | 266                  | 363                  | 362 | 267                             | 267                       | 977 000                   | 5 910 000                | 1 000                                     |
| 260                    | 340      | 55       | 260.15               | 339                  | 25                   | 15       | 2.1                                     | 278                  | 328                  | 326 | 279                             | 279                       | 739 000                   | 3 510 000                | 1 000                                     |
| 260                    | 420      | 80       | 260.15               | 418                  | 30                   | 25       | 5                                       | 289                  | 402                  | 400 | 291                             | 291                       | 1 430 000                 | 7 490 000                | 900                                       |
| 280                    | 440      | 80       | 280.15               | 438                  | 30                   | 25       | 5                                       | 309                  | 422                  | 420 | 311                             | 311                       | 1 420 000                 | 7 490 000                | 800                                       |

F  
NTB  
AS  
AZK  
WS·GS

# COMBINED TYPE NEEDLE ROLLER BEARINGS

- Needle Roller Bearings with Thrust Ball Bearing
- Needle Roller Bearings with Thrust Roller Bearing
- Needle Roller Bearings with Angular Contact Ball Bearing
- Needle Roller Bearings with Three-point Contact Ball Bearing



## Structure and Features

IKO Combined Type Needle Roller Bearings are combinations of a radial bearing and a thrust bearing. Caged needle roller bearings are used as radial bearings and thrust ball bearings or thrust roller bearings are used as thrust bearings. They are compact and very economical, and can be subjected to radial loads and axial loads simultaneously. They are widely used for machine tools, textile machinery, and industrial machinery.

## Types

The types of Combined Type Needle Roller Bearings shown in Table 1 are available.

Table 1.1 Type of bearing

| Type            | Combined with thrust ball bearing |                 | Combined with thrust roller bearing |                 |
|-----------------|-----------------------------------|-----------------|-------------------------------------|-----------------|
|                 | Without inner ring                | With inner ring | Without inner ring                  | With inner ring |
| —               | NAX                               | NAXI            | NBX                                 | NBXI            |
| With dust cover | NAX ... Z                         | NAXI ... Z      | NBX ... Z                           | NBXI ... Z      |

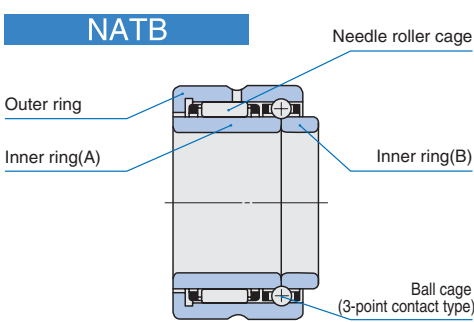
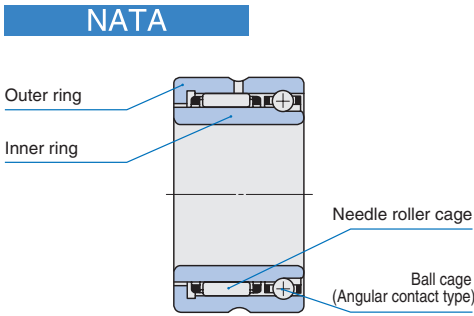
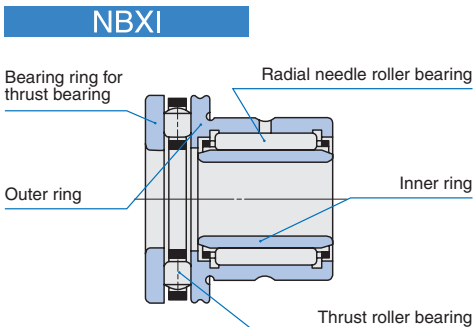
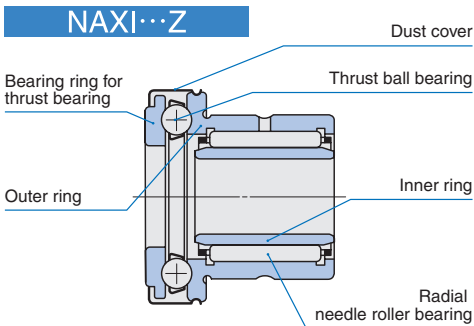
Table 1.2 Type of bearing

| Type       | Combined with angular contact ball bearing | Combined with three-point contact ball bearing |
|------------|--------------------------------------------|------------------------------------------------|
| Model code | NATA                                       | NATB                                           |

## Needle Roller Bearings with Thrust Ball Bearing

In this series, needle roller bearings are combined with thrust ball bearings to receive thrust loads. In bearings with a dust cover, the dust cover is formed from a thin steel plate and fixed to a groove cut on the outer cylindrical surface of the outer ring collar. The cover forms a labyrinth with the thrust raceway ring, and is therefore effective in preventing leakage of grease and penetration of dust and dirt. In the case of bearings without an inner ring, the tolerances of roller set bore diameter  $F_w$  are shown in Table 14 on page A33. Therefore, the required radial internal clearances can be selected by combining the bearings with shafts that have been heat-treated and finished by grinding as shown in Table 23 on page A42 and Table 26 on page A44.

### Structures of Combined Type Needle Roller Bearings



G  
NAX  
NBX  
NATA  
NATB

Needle Roller Bearings with Thrust Roller Bearing

In this series, needle roller bearings are combined with thrust roller bearings to receive thrust loads. Their axial load ratings are greater than those of bearings that are combined with thrust ball bearings. Also, elastic deformation of the rolling contact surfaces under load is minimal. Furthermore, the thrust bearing section is finished to high accuracy, and therefore high rotational accuracy is obtained in the case of both vertical and horizontal shafts. Like the needle roller bearings with thrust ball bearing, this series also includes bearings with a dust cover and bearings with an inner ring.

Needle Roller Bearings with Angular Contact Ball Bearing

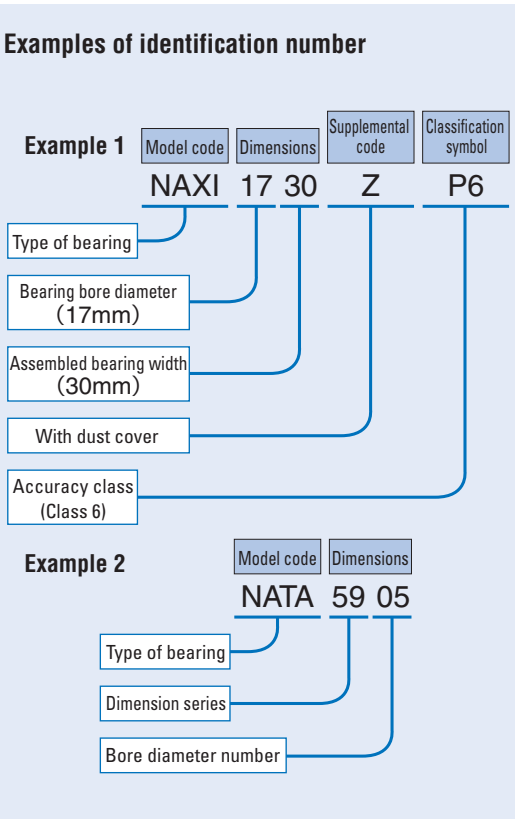
In this series, caged needle roller bearings are combined with angular contact ball bearings to receive thrust loads. These bearings conform to the international dimension series #59, which is based on the ISO Standard. They can withstand heavy radial loads and unidirectional axial loads simultaneously. When the axial load exceeds 25% of the radial load, the radial load will be induced in the angular contact ball bearing, and bearing life will be affected. The relationship between the two loads must therefore be taken into careful consideration.

Needle Roller Bearings with Three-point Contact Ball Bearing

These bearings can withstand heavy radial loads and bi-directional axial loads at the same time during high-speed rotation. Since the non-interchangeable inner rings are separated at the center of the ball raceway surface, they must be firmly tightened against the shaft in the axial direction. The axial clearance of this bearing is 0.1 ~ 0.3 mm, and like NATA59, the axial load should not exceed 25% of the radial load.

Identification Number

The identification number of Combined Type Needle Roller Bearings consists of a model code, dimensions, any supplemental codes and a classification symbol. Some examples are shown below.



Accuracy

Dimensional accuracy and rotational accuracy of Combined Type Needle Roller Bearings are based on Table 2 below and Tables 12 and 13 on page A31. The tolerances for the smallest single roller set bore diameter of bearings without inner ring are based on Table 14 on page A33. Thickness variations of thrust rings of NAX(I) and NBX(I) are based on Table 2.4 on page F5. Bore diameter of the small width inner ring of NATB59 is made for a transition fit with k5 tolerance shaft.

Table 2 Tolerances unit: mm

| Type of bearing                                | Item                                         | Dimension | Dimension symbol | Tolerance   |
|------------------------------------------------|----------------------------------------------|-----------|------------------|-------------|
| NAX(I) <sup>(1)</sup><br>NBX(I) <sup>(1)</sup> | Bore dia. of bearing ring for thrust bearing |           | $d_i$            | E7          |
|                                                | Assembled bearing width                      |           | $L$              | 0<br>- 0.25 |
|                                                | Bearing height of thrust bearing             |           | $H$              | 0<br>- 0.20 |
| NATB59                                         | Width of inner ring                          |           | $B$              | 0<br>- 0.3  |

Note<sup>(1)</sup> Also applicable to bearings with dust cover

Clearance

Combined Type Needle Roller Bearings are manufactured to have the radial internal clearance CN shown in Table 18 on page A37.

Fit

The recommended fits for Combined Type Needle Roller Bearings are shown in Table 3.

Table 3 Recommended fits

| Type of bearing                                | Tolerance class    |                   |                   |
|------------------------------------------------|--------------------|-------------------|-------------------|
|                                                | Shaft              |                   | Housing bore      |
|                                                | Without inner ring | With inner ring   |                   |
| NAX(I) <sup>(1)</sup><br>NBX(I) <sup>(1)</sup> | h5, k5             | k5                | K6, M6            |
| NATA59<br>NATB59                               | —                  | k5 <sup>(2)</sup> | M6 <sup>(2)</sup> |

Notes<sup>(1)</sup> The housing bore for the thrust bearing must be machined to be more than 0.5 mm larger than the outside diameters  $D_1$  and  $D_2$  to ensure that it does not incur radial loads.  
<sup>(2)</sup> If the fit is made tighter than specified in this table, radial loads will act upon the thrust bearing, limiting its function.

Lubrication

Grease is not prepacked in Combined Type Needle Roller Bearings, so perform proper lubrication for use. Operating without lubrication will increase the wear of the rolling contact surfaces and shorten the bearing life.

Oil Hole

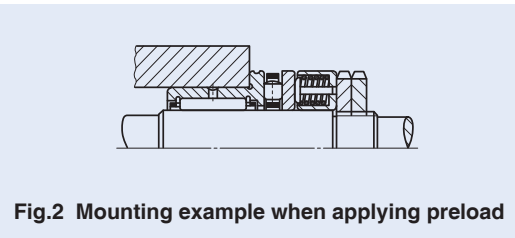
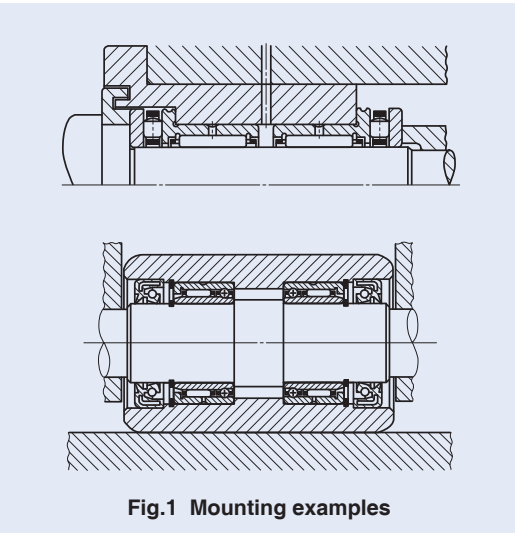
The outer ring of Combined Type Needle Roller Bearings has an oil groove and an oil hole. When outer rings with multiple oil holes or inner rings with oil hole(s) are required, please contact IKO.

Rating Life

In Combined Type Needle Roller Bearings, caged needle roller bearings are subjected to radial loads while thrust bearings receive axial loads. Therefore, it is necessary to calculate their lives respectively (page A17).

Mounting

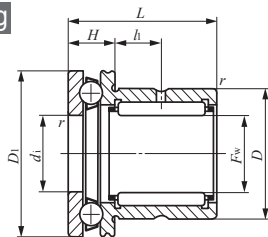
Fig.1 shows mounting examples of Combined Type Needle Roller Bearings. When applying preload to the NAX and NBX models, it is recommended that thrust raceway rings are not tightened directly with nuts, but are tightened using springs as shown in Fig. 2. Mounting two NATA models symmetrically allows them to be subjected to two-way axial loads. When mounting these models, an axial clearance of 0.2 ~ 0.3 mm should be provided in the angular contact ball bearings so that radial loads are not applied to the angular contact ball bearings. Dimensions related to mounting should be based on the table of dimensions.



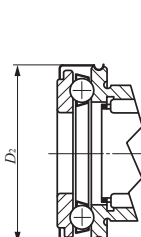
COMBINED TYPE NEEDLE ROLLER BEARINGS

Needle Roller Bearings with Thrust Ball Bearing  
Needle Roller Bearings with Thrust Roller Bearing

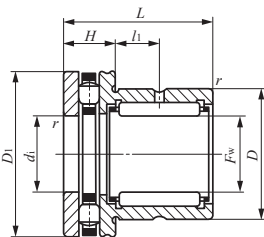
Without Inner Ring  
Without Inner Ring



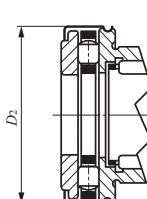
NAX



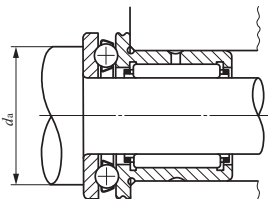
NAX ... Z



NBX



NBX ... Z



Shaft dia. 10 – 70mm

| Shaft dia.<br>mm | Identification number |                     |                 |                     |          |                     |                 |                     |
|------------------|-----------------------|---------------------|-----------------|---------------------|----------|---------------------|-----------------|---------------------|
|                  |                       | Mass<br>(Ref.)<br>g | With dust cover | Mass<br>(Ref.)<br>g |          | Mass<br>(Ref.)<br>g | With dust cover | Mass<br>(Ref.)<br>g |
| 10               | NAX 1023              | 38.5                | NAX 1023Z       | 40                  | —        | —                   | —               | —                   |
| 12               | NAX 1223              | 43.5                | NAX 1223Z       | 45.5                | —        | —                   | —               | —                   |
| 15               | NAX 1523              | 47.5                | NAX 1523Z       | 48.5                | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 1523 | 54                  | NBX 1523Z       | 55                  |
| 17               | NAX 1725              | 54                  | NAX 1725Z       | 56                  | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 1725 | 61                  | NBX 1725Z       | 63                  |
| 20               | NAX 2030              | 85.5                | NAX 2030Z       | 89                  | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 2030 | 94                  | NBX 2030Z       | 97.5                |
| 25               | NAX 2530              | 131                 | NAX 2530Z       | 135                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 2530 | 143                 | NBX 2530Z       | 147                 |
| 30               | NAX 3030              | 145                 | NAX 3030Z       | 151                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 3030 | 160                 | NBX 3030Z       | 166                 |
| 35               | NAX 3530              | 169                 | NAX 3530Z       | 176                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 3530 | 186                 | NBX 3530Z       | 193                 |
| 40               | NAX 4032              | 219                 | NAX 4032Z       | 227                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 4032 | 240                 | NBX 4032Z       | 248                 |
| 45               | NAX 4532              | 264                 | NAX 4532Z       | 273                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 4532 | 293                 | NBX 4532Z       | 302                 |
| 50               | NAX 5035              | 287                 | NAX 5035Z       | 297                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 5035 | 315                 | NBX 5035Z       | 325                 |
| 60               | NAX 6040              | 417                 | NAX 6040Z       | 454                 | —        | —                   | —               | —                   |
|                  | —                     | —                   | —               | —                   | NBX 6040 | 501                 | NBX 6040Z       | 538                 |
| 70               | NAX 7040              | 555                 | NAX 7040Z       | 606                 | —        | —                   | —               | —                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 70% of this value is allowable in the NAX series, and a maximum of 25% of this value is allowable in the NBX series.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

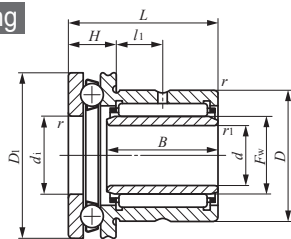
| Boundary dimensions<br>mm |          |                       |                       |          |          |                       |                                          |                       |    | Standard mounting<br>dimension<br><i>d</i> <sub>a</sub><br>Min.<br>mm | Basic dynamic load rating<br><i>C</i> |            | Basic static load rating<br><i>C</i> <sub>0</sub> |            | Allowable<br>rotational<br>speed <sup>(2)</sup><br>min <sup>-1</sup> |
|---------------------------|----------|-----------------------|-----------------------|----------|----------|-----------------------|------------------------------------------|-----------------------|----|-----------------------------------------------------------------------|---------------------------------------|------------|---------------------------------------------------|------------|----------------------------------------------------------------------|
| <i>F</i> <sub>w</sub>     | <i>D</i> | <i>D</i> <sub>1</sub> | <i>D</i> <sub>2</sub> | <i>L</i> | <i>H</i> | <i>l</i> <sub>1</sub> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | <i>d</i> <sub>i</sub> |    |                                                                       | Radial<br>N                           | Axial<br>N | Radial<br>N                                       | Axial<br>N |                                                                      |
| 10                        | 19       | 24                    | 25                    | 23       | 9        | 6.5                   | 0.3                                      | 10                    | 18 |                                                                       | 8 230                                 | 10 000     | 9 190                                             | 11 100     | 9 500                                                                |
| 12                        | 21       | 26                    | 27                    | 23       | 9        | 6.5                   | 0.3                                      | 12                    | 20 |                                                                       | 9 250                                 | 9 670      | 11 200                                            | 11 100     | 9 000                                                                |
| 15                        | 24       | 28                    | 29                    | 23       | 9        | 6.5                   | 0.3                                      | 15                    | 23 |                                                                       | 12 300                                | 9 930      | 14 900                                            | 12 200     | 8 500                                                                |
| 15                        | 24       | 28                    | 29                    | 23       | 9        | 6.5                   | 0.3                                      | 15                    | 26 |                                                                       | 12 300                                | 10 200     | 14 900                                            | 23 900     | 14 000                                                               |
| 17                        | 26       | 30                    | 31                    | 25       | 9        | 8                     | 0.3                                      | 17                    | 25 |                                                                       | 12 900                                | 10 800     | 16 300                                            | 14 500     | 8 500                                                                |
| 17                        | 26       | 30                    | 31                    | 25       | 9        | 8                     | 0.3                                      | 17                    | 28 |                                                                       | 12 900                                | 11 400     | 16 300                                            | 28 600     | 13 000                                                               |
| 20                        | 30       | 35                    | 36                    | 30       | 10       | 10.5                  | 0.3                                      | 20                    | 29 |                                                                       | 17 600                                | 14 200     | 25 400                                            | 19 700     | 7 500                                                                |
| 20                        | 30       | 35                    | 36                    | 30       | 10       | 10.5                  | 0.3                                      | 20                    | 33 |                                                                       | 17 600                                | 19 000     | 25 400                                            | 48 700     | 11 000                                                               |
| 25                        | 37       | 42                    | 43                    | 30       | 11       | 9.5                   | 0.6                                      | 25                    | 35 |                                                                       | 20 000                                | 19 600     | 32 100                                            | 29 700     | 7 000                                                                |
| 25                        | 37       | 42                    | 43                    | 30       | 11       | 9.5                   | 0.6                                      | 25                    | 40 |                                                                       | 20 000                                | 22 700     | 32 100                                            | 60 700     | 9 000                                                                |
| 30                        | 42       | 47                    | 48                    | 30       | 11       | 9.5                   | 0.6                                      | 30                    | 40 |                                                                       | 25 100                                | 20 400     | 40 100                                            | 33 600     | 6 500                                                                |
| 30                        | 42       | 47                    | 48                    | 30       | 11       | 9.5                   | 0.6                                      | 30                    | 45 |                                                                       | 25 100                                | 27 400     | 40 100                                            | 81 000     | 8 000                                                                |
| 35                        | 47       | 52                    | 53                    | 30       | 12       | 9                     | 0.6                                      | 35                    | 45 |                                                                       | 26 900                                | 21 200     | 46 200                                            | 37 600     | 6 000                                                                |
| 35                        | 47       | 52                    | 53                    | 30       | 12       | 9                     | 0.6                                      | 35                    | 50 |                                                                       | 26 900                                | 29 100     | 46 200                                            | 91 100     | 7 000                                                                |
| 40                        | 52       | 60                    | 61                    | 32       | 13       | 10                    | 0.6                                      | 40                    | 52 |                                                                       | 29 400                                | 26 900     | 54 100                                            | 50 000     | 5 500                                                                |
| 40                        | 52       | 60                    | 61                    | 32       | 13       | 10                    | 0.6                                      | 40                    | 57 |                                                                       | 29 400                                | 41 700     | 54 100                                            | 133 000    | 6 000                                                                |
| 45                        | 58       | 65                    | 66.5                  | 32       | 14       | 9                     | 0.6                                      | 45                    | 57 |                                                                       | 31 000                                | 27 900     | 60 200                                            | 55 100     | 5 000                                                                |
| 45                        | 58       | 65                    | 66.5                  | 32       | 14       | 9                     | 0.6                                      | 45                    | 62 |                                                                       | 31 000                                | 40 800     | 60 200                                            | 133 000    | 5 500                                                                |
| 50                        | 62       | 70                    | 71.5                  | 35       | 14       | 10                    | 0.6                                      | 50                    | 62 |                                                                       | 42 200                                | 28 800     | 83 400                                            | 60 100     | 4 500                                                                |
| 50                        | 62       | 70                    | 71.5                  | 35       | 14       | 10                    | 0.6                                      | 50                    | 67 |                                                                       | 42 200                                | 43 300     | 83 400                                            | 148 000    | 5 000                                                                |
| 60                        | 72       | 85                    | 86.5                  | 40       | 17       | 12                    | 1                                        | 60                    | 75 |                                                                       | 47 500                                | 41 400     | 103 000                                           | 89 700     | 4 000                                                                |
| 60                        | 72       | 85                    | 86.5                  | 40       | 17       | 12                    | 1                                        | 60                    | 82 |                                                                       | 47 500                                | 64 600     | 103 000                                           | 224 000    | 4 000                                                                |
| 70                        | 85       | 95                    | 96.5                  | 40       | 18       | 11                    | 1                                        | 70                    | 85 |                                                                       | 55 500                                | 43 100     | 120 000                                           | 101 000    | 3 500                                                                |

G  
NAX  
NBX  
NATA  
NATB

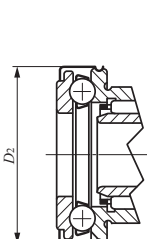
COMBINED TYPE NEEDLE ROLLER BEARINGS

Needle Roller Bearings with Thrust Ball Bearing  
Needle Roller Bearings with Thrust Roller Bearing

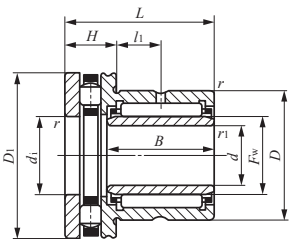
With Inner Ring  
With Inner Ring



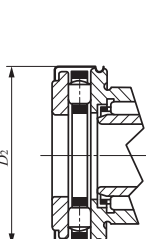
NAXI



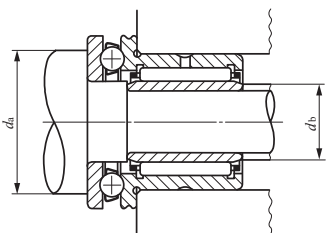
NAXI ... Z



NBXI



NBXI ... Z



Shaft dia. 7 – 60mm

| Shaft dia.<br>mm | Identification number |                     |                 |                     |           |                     |                 |                     |    |    |                |
|------------------|-----------------------|---------------------|-----------------|---------------------|-----------|---------------------|-----------------|---------------------|----|----|----------------|
|                  |                       | Mass<br>(Ref.)<br>g | With dust cover | Mass<br>(Ref.)<br>g |           | Mass<br>(Ref.)<br>g | With dust cover | Mass<br>(Ref.)<br>g | d  | D  | D <sub>1</sub> |
| 7                | NAXI 723              | 43.5                | NAXI 723Z       | 45                  | —         | —                   | —               | —                   | 7  | 19 | 24             |
| 9                | NAXI 923              | 49.5                | NAXI 923Z       | 51.5                | —         | —                   | —               | —                   | 9  | 21 | 26             |
| 12               | NAXI 1223             | 55.5                | NAXI 1223Z      | 56.5                | —         | —                   | —               | —                   | 12 | 24 | 28             |
|                  | —                     | —                   | —               | —                   | NBXI 1223 | 62                  | NBXI 1223Z      | 63                  | 12 | 24 | 28             |
| 14               | NAXI 1425             | 63.5                | NAXI 1425Z      | 65.5                | —         | —                   | —               | —                   | 14 | 26 | 30             |
|                  | —                     | —                   | —               | —                   | NBXI 1425 | 70.5                | NBXI 1425Z      | 72.5                | 14 | 26 | 30             |
| 17               | NAXI 1730             | 99                  | NAXI 1730Z      | 103                 | —         | —                   | —               | —                   | 17 | 30 | 35             |
|                  | —                     | —                   | —               | —                   | NBXI 1730 | 108                 | NBXI 1730Z      | 111                 | 17 | 30 | 35             |
| 20               | NAXI 2030             | 159                 | NAXI 2030Z      | 163                 | —         | —                   | —               | —                   | 20 | 37 | 42             |
|                  | —                     | —                   | —               | —                   | NBXI 2030 | 171                 | NBXI 2030Z      | 175                 | 20 | 37 | 42             |
| 25               | NAXI 2530             | 179                 | NAXI 2530Z      | 185                 | —         | —                   | —               | —                   | 25 | 42 | 47             |
|                  | —                     | —                   | —               | —                   | NBXI 2530 | 194                 | NBXI 2530Z      | 200                 | 25 | 42 | 47             |
| 30               | NAXI 3030             | 208                 | NAXI 3030Z      | 215                 | —         | —                   | —               | —                   | 30 | 47 | 52             |
|                  | —                     | —                   | —               | —                   | NBXI 3030 | 225                 | NBXI 3030Z      | 232                 | 30 | 47 | 52             |
| 35               | NAXI 3532             | 265                 | NAXI 3532Z      | 273                 | —         | —                   | —               | —                   | 35 | 52 | 60             |
|                  | —                     | —                   | —               | —                   | NBXI 3532 | 286                 | NBXI 3532Z      | 294                 | 35 | 52 | 60             |
| 40               | NAXI 4032             | 315                 | NAXI 4032Z      | 324                 | —         | —                   | —               | —                   | 40 | 58 | 65             |
|                  | —                     | —                   | —               | —                   | NBXI 4032 | 344                 | NBXI 4032Z      | 353                 | 40 | 58 | 65             |
| 45               | NAXI 4535             | 358                 | NAXI 4535Z      | 368                 | —         | —                   | —               | —                   | 45 | 62 | 70             |
|                  | —                     | —                   | —               | —                   | NBXI 4535 | 386                 | NBXI 4535Z      | 396                 | 45 | 62 | 70             |
| 50               | NAXI 5040             | 582                 | NAXI 5040Z      | 619                 | —         | —                   | —               | —                   | 50 | 72 | 85             |
|                  | —                     | —                   | —               | —                   | NBXI 5040 | 666                 | NBXI 5040Z      | 703                 | 50 | 72 | 85             |
| 60               | NAXI 6040             | 750                 | NAXI 6040Z      | 801                 | —         | —                   | —               | —                   | 60 | 85 | 95             |

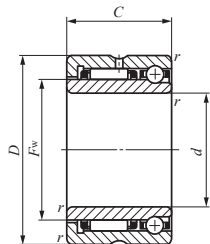
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$  or  $r_1$   
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 70% of this value is allowable in the NAXI series, and a maximum of 25% of this value is allowable in the NBXI series.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

| Boundary dimensions<br>mm |     |      |     |       |             |              |       |       |       | Standard mounting<br>dimensions<br>mm |      | Basic dynamic load rating<br>$C$ |            | Basic static load rating<br>$C_0$ |            | Allowable<br>rotational<br>speed <sup>(2)</sup> | Assembled inner ring |
|---------------------------|-----|------|-----|-------|-------------|--------------|-------|-------|-------|---------------------------------------|------|----------------------------------|------------|-----------------------------------|------------|-------------------------------------------------|----------------------|
| $D_2$                     | $L$ | $B$  | $H$ | $l_1$ | $r_{s\min}$ | $r_{ls\min}$ | $F_w$ | $d_i$ | $d_a$ | $d_b$                                 | Min. | Radial<br>N                      | Axial<br>N | Radial<br>N                       | Axial<br>N | min <sup>-1</sup>                               |                      |
| 25                        | 23  | 16   | 9   | 6.5   | 0.3         | 0.2          | 10    | 10    | 18    | 9                                     |      | 8 230                            | 10 000     | 9 190                             | 11 100     | 9 500                                           | LRT 71016            |
| 27                        | 23  | 16   | 9   | 6.5   | 0.3         | 0.3          | 12    | 12    | 20    | 11                                    |      | 9 250                            | 9 670      | 11 200                            | 11 100     | 9 000                                           | LRT 91216            |
| 29                        | 23  | 16.5 | 9   | 6.5   | 0.3         | 0.3          | 15    | 15    | 23    | 14                                    |      | 12 300                           | 9 930      | 14 900                            | 12 200     | 8 500                                           | LRT 121516           |
| 29                        | 23  | 16.5 | 9   | 6.5   | 0.3         | 0.3          | 15    | 15    | 26    | 14                                    |      | 12 300                           | 10 200     | 14 900                            | 23 900     | 14 000                                          | LRT 121516           |
| 31                        | 25  | 17   | 9   | 8     | 0.3         | 0.3          | 17    | 17    | 25    | 16                                    |      | 12 900                           | 10 800     | 16 300                            | 14 500     | 8 500                                           | LRT 141717           |
| 31                        | 25  | 17   | 9   | 8     | 0.3         | 0.3          | 17    | 17    | 28    | 16                                    |      | 12 900                           | 11 400     | 16 300                            | 28 600     | 13 000                                          | LRT 141717           |
| 36                        | 30  | 20.5 | 10  | 10.5  | 0.3         | 0.3          | 20    | 20    | 29    | 19                                    |      | 17 600                           | 14 200     | 25 400                            | 19 700     | 7 500                                           | LRT 172020           |
| 36                        | 30  | 20.5 | 10  | 10.5  | 0.3         | 0.3          | 20    | 20    | 33    | 19                                    |      | 17 600                           | 19 000     | 25 400                            | 48 700     | 11 000                                          | LRT 172020           |
| 43                        | 30  | 20.5 | 11  | 9.5   | 0.6         | 0.3          | 25    | 25    | 35    | 24                                    |      | 20 000                           | 19 600     | 32 100                            | 29 700     | 7 000                                           | LRT 202520           |
| 43                        | 30  | 20.5 | 11  | 9.5   | 0.6         | 0.3          | 25    | 25    | 40    | 24                                    |      | 20 000                           | 22 700     | 32 100                            | 60 700     | 9 000                                           | LRT 202520           |
| 48                        | 30  | 20.5 | 11  | 9.5   | 0.6         | 0.3          | 30    | 30    | 40    | 29                                    |      | 25 100                           | 20 400     | 40 100                            | 33 600     | 6 500                                           | LRT 253020           |
| 48                        | 30  | 20.5 | 11  | 9.5   | 0.6         | 0.3          | 30    | 30    | 45    | 29                                    |      | 25 100                           | 27 400     | 40 100                            | 81 000     | 8 000                                           | LRT 253020           |
| 53                        | 30  | 20   | 12  | 9     | 0.6         | 0.3          | 35    | 35    | 45    | 34                                    |      | 26 900                           | 21 200     | 46 200                            | 37 600     | 6 000                                           | LRT 303520           |
| 53                        | 30  | 20   | 12  | 9     | 0.6         | 0.3          | 35    | 35    | 50    | 34                                    |      | 26 900                           | 29 100     | 46 200                            | 91 100     | 7 000                                           | LRT 303520           |
| 61                        | 32  | 20   | 13  | 10    | 0.6         | 0.3          | 40    | 40    | 52    | 39                                    |      | 29 400                           | 26 900     | 54 100                            | 50 000     | 5 500                                           | LRT 354020           |
| 61                        | 32  | 20   | 13  | 10    | 0.6         | 0.3          | 40    | 40    | 57    | 39                                    |      | 29 400                           | 41 700     | 54 100                            | 133 000    | 6 000                                           | LRT 354020           |
| 66.5                      | 32  | 20   | 14  | 9     | 0.6         | 0.3          | 45    | 45    | 57    | 44                                    |      | 31 000                           | 27 900     | 60 200                            | 55 100     | 5 000                                           | LRT 404520           |
| 66.5                      | 32  | 20   | 14  | 9     | 0.6         | 0.3          | 45    | 45    | 62    | 44                                    |      | 31 000                           | 40 800     | 60 200                            | 133 000    | 5 500                                           | LRT 404520           |
| 71.5                      | 35  | 25   | 14  | 10    | 0.6         | 0.3          | 50    | 50    | 62    | 49                                    |      | 42 200                           | 28 800     | 83 400                            | 60 100     | 4 500                                           | LRT 455025           |
| 71.5                      | 35  | 25   | 14  | 10    | 0.6         | 0.3          | 50    | 50    | 67    | 49                                    |      | 42 200                           | 43 300     | 83 400                            | 148 000    | 5 000                                           | LRT 455025           |
| 86.5                      | 40  | 25.5 | 17  | 12    | 1           | 1            | 60    | 60    | 75    | 59                                    |      | 47 500                           | 41 400     | 103 000                           | 89 700     | 4 000                                           | LRT 506025           |
| 86.5                      | 40  | 25.5 | 17  | 12    | 1           | 1            | 60    | 60    | 82    | 59                                    |      | 47 500                           | 64 600     | 103 000                           | 224 000    | 4 000                                           | LRT 506025           |
| 96.5                      | 40  | 25.5 | 18  | 11    | 1           | 1            | 70    | 70    | 85    | 68                                    |      | 55 500                           | 43 100     | 120 000                           | 101 000    | 3 500                                           | LRT 607025           |

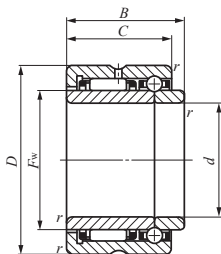
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COMBINED TYPE NEEDLE ROLLER BEARINGS

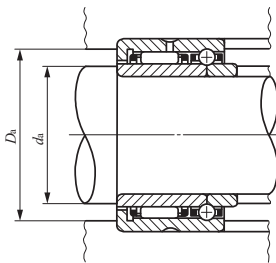
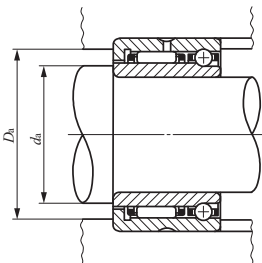
Needle Roller Bearings with Angular Contact Ball Bearing  
Needle Roller Bearings with Three-point Contact Ball Bearing



NATA59



NATB59



Shaft dia. 15 – 70mm

| Shaft dia.<br>mm | Identification number |                     |                          |                     | Boundary dimensions<br>mm |     |    |    |                   |       |
|------------------|-----------------------|---------------------|--------------------------|---------------------|---------------------------|-----|----|----|-------------------|-------|
|                  | Angular contact type  | Mass<br>(Ref.)<br>g | Three-point contact type | Mass<br>(Ref.)<br>g | d                         | D   | C  | B  | $r_{s\min}^{(1)}$ | $F_w$ |
| 15               | NATA 5902             | 50.5                | NATB 5902                | 53                  | 15                        | 28  | 18 | 20 | 0.3               | 20    |
| 17               | NATA 5903             | 55.5                | NATB 5903                | 58.5                | 17                        | 30  | 18 | 20 | 0.3               | 22    |
| 20               | NATA 5904             | 111                 | NATB 5904                | 115                 | 20                        | 37  | 23 | 25 | 0.3               | 25    |
| 25               | NATA 5905             | 131                 | NATB 5905                | 136                 | 25                        | 42  | 23 | 25 | 0.3               | 30    |
| 30               | NATA 5906             | 151                 | NATB 5906                | 157                 | 30                        | 47  | 23 | 25 | 0.3               | 35    |
| 35               | NATA 5907             | 250                 | NATB 5907                | 260                 | 35                        | 55  | 27 | 30 | 0.6               | 42    |
| 40               | NATA 5908             | 355                 | NATB 5908                | 375                 | 40                        | 62  | 30 | 34 | 0.6               | 48    |
| 45               | NATA 5909             | 410                 | NATB 5909                | 435                 | 45                        | 68  | 30 | 34 | 0.6               | 55    |
| 50               | NATA 5910             | 420                 | NATB 5910                | 445                 | 50                        | 72  | 30 | 34 | 0.6               | 58    |
| 55               | NATA 5911             | 585                 | NATB 5911                | 615                 | 55                        | 80  | 34 | 38 | 1                 | 63    |
| 60               | NATA 5912             | 625                 | NATB 5912                | 660                 | 60                        | 85  | 34 | 38 | 1                 | 68    |
| 65               | NATA 5913             | 665                 | NATB 5913                | 710                 | 65                        | 90  | 34 | 38 | 1                 | 75    |
| 70               | NATA 5914             | 1 070               | NATB 5914                | 1 130               | 70                        | 100 | 40 | 45 | 1                 | 80    |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
<sup>(2)</sup> Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.  
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

| Standard mounting dimensions<br>mm |       | Basic dynamic load rating<br>$C$ |        | Basic static load rating<br>$C_0$ |        | Allowable<br>rotational<br>speed <sup>(2)</sup><br><br>min <sup>-1</sup> |
|------------------------------------|-------|----------------------------------|--------|-----------------------------------|--------|--------------------------------------------------------------------------|
| $d_a$                              | $D_a$ | Radial                           | Axial  | Radial                            | Axial  |                                                                          |
| Min.                               | Max.  | N                                | N      | N                                 | N      |                                                                          |
| 17                                 | 26    | 7 710                            | 1 900  | 10 200                            | 2 920  | 20 000                                                                   |
| 19                                 | 28    | 8 220                            | 2 050  | 11 500                            | 3 340  | 18 000                                                                   |
| 22                                 | 35    | 14 300                           | 3 810  | 18 400                            | 6 110  | 16 000                                                                   |
| 27                                 | 40    | 15 800                           | 4 300  | 22 100                            | 7 520  | 13 000                                                                   |
| 32                                 | 45    | 17 700                           | 4 550  | 26 800                            | 8 460  | 11 000                                                                   |
| 39                                 | 51    | 24 000                           | 4 890  | 42 100                            | 9 870  | 9 500                                                                    |
| 44                                 | 58    | 30 600                           | 5 350  | 60 400                            | 11 800 | 8 500                                                                    |
| 49                                 | 64    | 32 600                           | 5 450  | 68 500                            | 12 700 | 7 000                                                                    |
| 54                                 | 68    | 33 600                           | 5 660  | 72 500                            | 13 600 | 7 000                                                                    |
| 60                                 | 75    | 39 500                           | 10 400 | 74 400                            | 24 700 | 6 500                                                                    |
| 65                                 | 80    | 41 800                           | 10 700 | 82 200                            | 26 700 | 6 000                                                                    |
| 70                                 | 85    | 43 800                           | 11 000 | 90 200                            | 28 700 | 5 500                                                                    |
| 75                                 | 95    | 56 400                           | 13 500 | 127 000                           | 35 000 | 5 000                                                                    |

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# INNER RINGS

- Inner Rings for Shell Type Needle Roller Bearings
- Inner Rings for General Usage



## Structure and Features

IKO Inner Rings are heat-treated and finished by grinding to a high degree of accuracy. In the case of needle roller bearings, normally, the shafts are heat-treated and finished by grinding, and used as the raceway surfaces. However, when it is impossible to make shaft surfaces according to the specified surface hardness or surface roughness, inner rings are used.

Inner rings include those for Shell Type Needle Roller Bearings and those for general use and are available in a variety of dimensions. When shafts move axially or seals are used adjacent to bearings, wide inner rings can be selected.

Inner rings can also be used economically as bushings without requiring any additional machining.

## Types

For Inner Rings, the types shown in Table 1 are available.

Table 1.1 Inner Rings for Shell Type Needle Roller Bearings

| Series        |     | Model codes of assembled bearings |
|---------------|-----|-----------------------------------|
| Metric series | IRT | TA...Z, TLA...Z                   |
|               |     | TAM, TLAM, YT, YTL                |
| Inch series   | IRB | BA...Z, BHA...Z                   |
|               |     | BAM, BHAM, YB, YBH                |

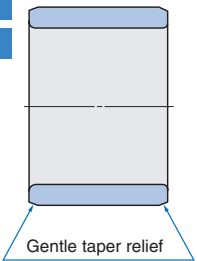
Remark For Inner Rings for Shell Type Needle Roller Bearings with Seal, please consult IKO.

Table 1.2 Inner Rings for General Usage

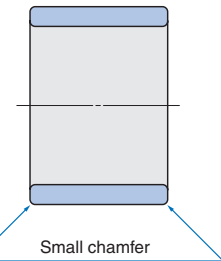
| Series        |          | Model codes of assembled bearings                   |
|---------------|----------|-----------------------------------------------------|
| Metric series | LRT      | RNA 49, RNA 69<br>RNA 48, TAF, TR<br>RNAF, NAX, NBX |
|               | LRTZ     | RNA 49...UU, RNA 69...UU<br>GTR                     |
| Inch series   | LRB      | BR                                                  |
|               | LRBZ...B | BR...UU                                             |

### Shapes of Inner Rings

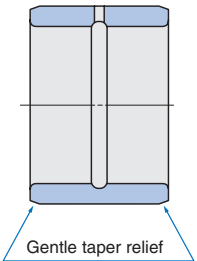
IRT  
IRB  
LRT



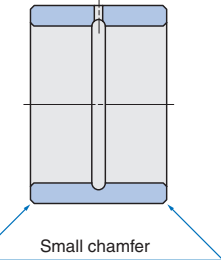
LRTZ



LRB



LRBZ...B



H  
IRT  
IRB  
LRT  
LRB



INNER RINGS

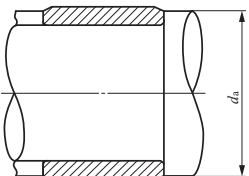
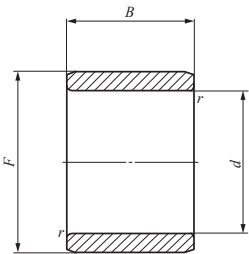
Inner Rings for Shell Type Needle Roller Bearings



Shaft dia. 7 – 17mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |                     |           |
|------------------|-----------------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|---------------------|-----------|
|                  |                       |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. | TA ··· Z<br>(TAM)  | TLA ··· Z<br>(TLAM) | YT<br>YTL |
| 7                | IRT 710               | 3.2                 | 7                         | 10       | 10.5     | 0.3                                         | 9                                 | 9.7  | TA 1010Z           | TLA 1010Z           | —         |
|                  | IRT 712               | 3.9                 | 7                         | 10       | 12.5     | 0.3                                         | 9                                 | 9.7  | TA 1012Z           | TLA 1012Z           | —         |
|                  | IRT 715               | 4.8                 | 7                         | 10       | 15.5     | 0.3                                         | 9                                 | 9.7  | TA 1015Z           | TLA 1015Z           | —         |
| 8                | IRT 810               | 5.1                 | 8                         | 12       | 10.5     | 0.3                                         | 10                                | 11   | —                  | TLA 1210Z           | YTL 1210  |
|                  | IRT 812               | 6                   | 8                         | 12       | 12.5     | 0.3                                         | 10                                | 11   | TA 1212Z           | TLA 1212Z           | YT 1212   |
|                  | IRT 815               | 7.5                 | 8                         | 12       | 15.5     | 0.3                                         | 10                                | 11   | TA 1215Z           | —                   | —         |
| 10               | IRT 1012              | 5.2                 | 10                        | 13       | 12.5     | 0.3                                         | 12                                | 12.7 | —                  | TLA 1312Z           | —         |
|                  | IRT 1012-2            | 7.2                 | 10                        | 14       | 12.5     | 0.3                                         | 12                                | 13   | —                  | TLA 1412Z           | —         |
|                  | IRT 1016-2            | 9.6                 | 10                        | 14       | 16.5     | 0.3                                         | 12                                | 13   | TA 1416Z           | TLA 1416Z           | —         |
|                  | IRT 1020-2            | 11.9                | 10                        | 14       | 20.5     | 0.3                                         | 12                                | 13   | TA 1420Z           | —                   | —         |
|                  | IRT 1010-1            | 7.9                 | 10                        | 15       | 10.5     | 0.3                                         | 12                                | 14   | TA 1510Z           | —                   | —         |
|                  | IRT 1012-1            | 9.4                 | 10                        | 15       | 12.5     | 0.3                                         | 12                                | 14   | TA 1512Z           | TLA 1512Z           | —         |
|                  | IRT 1015-1            | 11.7                | 10                        | 15       | 15.5     | 0.3                                         | 12                                | 14   | TA 1515Z           | —                   | —         |
|                  | IRT 1020-1            | 15.5                | 10                        | 15       | 20.5     | 0.3                                         | 12                                | 14   | TA 1520Z           | —                   | —         |
|                  | IRT 1025-1            | 19.3                | 10                        | 15       | 25.5     | 0.3                                         | 12                                | 14   | TA 1525Z           | —                   | —         |
|                  | IRT 1212              | 6.1                 | 12                        | 15       | 12.5     | 0.3                                         | 14                                | 14.5 | TA 1512Z           | TLA 1512Z           | —         |
| 12               | IRT 1216              | 8.1                 | 12                        | 15       | 16.5     | 0.3                                         | 14                                | 14.5 | —                  | TLA 1516Z           | —         |
|                  | IRT 1222              | 11                  | 12                        | 15       | 22.5     | 0.3                                         | 14                                | 14.5 | —                  | TLA 1522Z           | —         |
|                  | IRT 1212-1            | 8.5                 | 12                        | 16       | 12.5     | 0.3                                         | 14                                | 15   | —                  | TLA 1612Z           | —         |
|                  | IRT 1216-1            | 11.2                | 12                        | 16       | 16.5     | 0.3                                         | 14                                | 15   | TA 1616Z           | TLA 1616Z           | —         |
|                  | IRT 1220-1            | 13.9                | 12                        | 16       | 20.5     | 0.3                                         | 14                                | 15   | TA 1620Z           | —                   | —         |
|                  | IRT 1222-1            | 15.2                | 12                        | 16       | 22.5     | 0.3                                         | 14                                | 15   | —                  | TLA 1622Z           | —         |
|                  | IRT 1215-2            | 13.6                | 12                        | 17       | 15.5     | 0.3                                         | 14                                | 16   | TA 1715Z           | —                   | YT 1715   |
|                  | IRT 1220-2            | 18                  | 12                        | 17       | 20.5     | 0.3                                         | 14                                | 16   | TA 1720Z           | —                   | —         |
|                  | IRT 1225-2            | 22.5                | 12                        | 17       | 25.5     | 0.3                                         | 14                                | 16   | TA 1725Z           | —                   | YT 1725   |
|                  | IRT 1512              | 7.5                 | 15                        | 18       | 12.5     | 0.3                                         | 17                                | 17.5 | —                  | TLA 1812Z           | —         |
| 15               | IRT 1513              | 8.1                 | 15                        | 18       | 13.5     | 0.3                                         | 17                                | 17.5 | TA 1813Z           | —                   | —         |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



IRT

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |                     |           |
|------------------|-----------------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|---------------------|-----------|
|                  |                       |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. | TA ··· Z<br>(TAM)  | TLA ··· Z<br>(TLAM) | YT<br>YTL |
| 15               | IRT 1515              | 9.3                 | 15                        | 18       | 15.5     | 0.3                                         | 17                                | 17.5 | TA 1815Z           | —                   | —         |
|                  | IRT 1516              | 9.9                 | 15                        | 18       | 16.5     | 0.3                                         | 17                                | 17.5 | —                  | TLA 1816Z           | —         |
|                  | IRT 1517              | 10.5                | 15                        | 18       | 17.5     | 0.3                                         | 17                                | 17.5 | TA 1817Z           | —                   | —         |
|                  | IRT 1519              | 11.7                | 15                        | 18       | 19.5     | 0.3                                         | 17                                | 17.5 | TA 1819Z           | —                   | —         |
|                  | IRT 1520              | 12.3                | 15                        | 18       | 20.5     | 0.3                                         | 17                                | 17.5 | TA 1820Z           | —                   | —         |
|                  | IRT 1525              | 15.2                | 15                        | 18       | 25.5     | 0.3                                         | 17                                | 17.5 | TA 1825Z           | —                   | —         |
|                  | IRT 1516-1            | 13.6                | 15                        | 19       | 16.5     | 0.3                                         | 17                                | 18   | TA 1916Z           | —                   | —         |
|                  | IRT 1520-1            | 16.8                | 15                        | 19       | 20.5     | 0.3                                         | 17                                | 18   | TA 1920Z           | —                   | —         |
|                  | IRT 1515-2            | 16.4                | 15                        | 20       | 15.5     | 0.3                                         | 17                                | 19   | TA 2015Z           | —                   | YT 2015   |
|                  | IRT 1520-2            | 21.5                | 15                        | 20       | 20.5     | 0.3                                         | 17                                | 19   | TA 2020Z           | TLA 2020Z           | YT 202820 |
|                  | IRT 1525-2            | 27                  | 15                        | 20       | 25.5     | 0.3                                         | 17                                | 19   | TA 202820Z         | —                   | —         |
|                  | IRT 1530-2            | 32                  | 15                        | 20       | 30.5     | 0.3                                         | 17                                | 19   | TA 2025Z           | —                   | YT 2025   |
|                  | IRT 1530Z             | 32                  | 15                        | 20       | 30.5     | 0.3                                         | 17                                | 19   | TA 2030Z           | TLA 2030Z           | —         |
| 17               | IRT 1716              | 11.1                | 17                        | 20       | 16.5     | 0.3                                         | 19                                | 19.5 | —                  | TLA 2016Z           | —         |
|                  | IRT 1720              | 13.7                | 17                        | 20       | 20.5     | 0.3                                         | 19                                | 19.5 | TA 2020Z           | TLA 2020Z           | YT 202820 |
|                  | IRT 1730              | 20.5                | 17                        | 20       | 30.5     | 0.3                                         | 19                                | 19.5 | TA 202820Z         | —                   | —         |
|                  | IRT 1716-1            | 15.1                | 17                        | 21       | 16.5     | 0.3                                         | 19                                | 20   | TA 2030Z           | TLA 2030Z           | —         |
|                  | IRT 1720-1            | 18.8                | 17                        | 21       | 20.5     | 0.3                                         | 19                                | 20   | TA 2116Z           | —                   | YT 2116   |
|                  | IRT 1710-2            | 12.4                | 17                        | 22       | 10.5     | 0.3                                         | 19                                | 21   | TA 2120Z           | —                   | YT 2120   |
|                  | IRT 1715-2            | 18.3                | 17                        | 22       | 15.5     | 0.3                                         | 19                                | 21   | TA 2210Z           | —                   | —         |
|                  | IRT 1716-2            | 19.4                | 17                        | 22       | 16.5     | 0.3                                         | 19                                | 21   | TA 2215Z           | —                   | —         |
|                  | IRT 1720-2            | 24                  | 17                        | 22       | 20.5     | 0.3                                         | 19                                | 21   | TA 223016Z         | TLA 2216Z           | YT 223016 |
|                  | IRT 1725-2            | 30                  | 17                        | 22       | 25.5     | 0.3                                         | 19                                | 21   | TA 2220Z           | TLA 2220Z           | YT 223020 |
|                  | IRT 1730-2            | 36                  | 17                        | 22       | 30.5     | 0.3                                         | 19                                | 21   | TA 223020Z         | —                   | —         |
|                  | IRT 1725Z             | 30                  | 17                        | 22       | 25.5     | 0.3                                         | 19                                | 21   | TA 2225Z           | —                   | —         |
|                  | IRT 1730Z             | 36                  | 17                        | 22       | 30.5     | 0.3                                         | 19                                | 21   | TA 2230Z           | —                   | —         |
|                  | IRT 1716Z             | 11.1                | 17                        | 20       | 16.5     | 0.3                                         | 19                                | 19.5 | —                  | —                   | —         |
|                  | IRT 1720Z             | 13.7                | 17                        | 20       | 20.5     | 0.3                                         | 19                                | 19.5 | —                  | —                   | —         |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

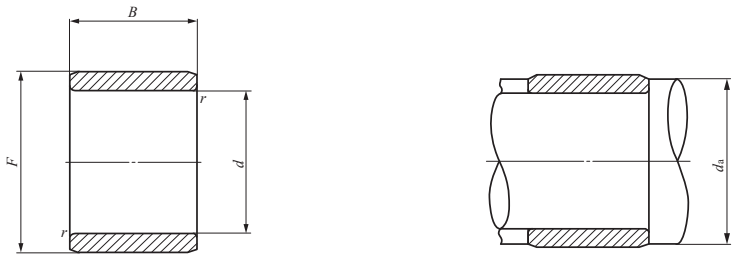
Inner Rings for Shell Type Needle Roller Bearings



Shaft dia. 20 – 45mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |                   |           |
|------------------|-----------------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|-------------------|-----------|
|                  |                       |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. | TA···Z<br>(TAM)    | TLA···Z<br>(TLAM) | YT<br>YTL |
| 20               | IRT 2016              | 17.5                | 20                        | 24       | 16.5     | 0.3                                         | 22                                | 23   | TA 243216Z         | —                 | YT 243216 |
|                  | IRT 2020              | 22                  | 20                        | 24       | 20.5     | 0.3                                         | 22                                | 23   | TA 2420Z           | —                 | YT 243220 |
|                  |                       |                     |                           |          |          |                                             |                                   |      | TA 243220Z         |                   |           |
|                  | IRT 2028              | 30.5                | 20                        | 24       | 28.5     | 0.3                                         | 22                                | 23   | TA 2428Z           | —                 | YT 2428   |
|                  | IRT 2010-1            | 14.3                | 20                        | 25       | 10.5     | 0.3                                         | 22                                | 24   | TA 2510Z           | —                 | YT 2510   |
|                  | IRT 2015-1            | 21                  | 20                        | 25       | 15.5     | 0.3                                         | 22                                | 24   | TA 2515Z           | —                 | YT 2515   |
|                  | IRT 2020-1            | 28                  | 20                        | 25       | 20.5     | 0.3                                         | 22                                | 24   | TA 2520Z           | TLA 2520Z         | YT 2520   |
|                  | IRT 2025-1            | 34.5                | 20                        | 25       | 25.5     | 0.3                                         | 22                                | 24   | TA 2525Z           | —                 | YT 2525   |
|                  | IRT 2026-1            | 36                  | 20                        | 25       | 26.5     | 0.3                                         | 22                                | 24   | —                  | TLA 2526Z         | YTL 2526  |
|                  | IRT 2030-1            | 41.5                | 20                        | 25       | 30.5     | 0.3                                         | 22                                | 24   | TA 2530Z           | —                 | —         |
| 22               | IRT 2038-1            | 52.5                | 20                        | 25       | 38.5     | 0.3                                         | 22                                | 24   | —                  | TLAW 2538Z        | —         |
|                  | IRT 2216              | 19.1                | 22                        | 26       | 16.5     | 0.3                                         | 24                                | 25   | TA 2616Z           | —                 | YT 2616   |
|                  | IRT 2220              | 24                  | 22                        | 26       | 20.5     | 0.3                                         | 24                                | 25   | TA 2620Z           | —                 | YT 2620   |
|                  | IRT 2220-1            | 37                  | 22                        | 28       | 20.5     | 0.3                                         | 24                                | 27   | TA 2820Z           | TLA 2820Z         | YT 2820   |
|                  | IRT 2230-1            | 55.5                | 22                        | 28       | 30.5     | 0.3                                         | 24                                | 27   | TA 2830Z           | —                 | —         |
|                  | IRT 2520              | 26.5                | 25                        | 29       | 20.5     | 0.3                                         | 27                                | 28   | TA 2920Z           | —                 | YT 2920   |
|                  | IRT 2530              | 40                  | 25                        | 29       | 30.5     | 0.3                                         | 27                                | 28   | TA 2930Z           | —                 | —         |
|                  | IRT 2515-1            | 25.5                | 25                        | 30       | 15.5     | 0.3                                         | 27                                | 29   | TA 3015Z           | —                 | —         |
|                  | IRT 2520-1            | 34                  | 25                        | 30       | 20.5     | 0.3                                         | 27                                | 29   | TA 3020Z           | TLA 3020Z         | —         |
|                  | IRT 2525-1            | 42.5                | 25                        | 30       | 25.5     | 0.3                                         | 27                                | 29   | TA 3025Z           | —                 | —         |
| 25               | IRT 2526-1            | 44                  | 25                        | 30       | 26.5     | 0.3                                         | 27                                | 29   | —                  | TLA 3026Z         | —         |
|                  | IRT 2530-1            | 50.5                | 25                        | 30       | 30.5     | 0.3                                         | 27                                | 29   | TA 3030Z           | —                 | —         |
|                  | IRT 2538-1            | 64                  | 25                        | 30       | 38.5     | 0.3                                         | 27                                | 29   | —                  | TLAW 3038Z        | —         |
|                  | IRT 2820              | 29.5                | 28                        | 32       | 20.5     | 0.3                                         | 30                                | 31   | TA 3220Z           | —                 | YT 3220   |
|                  | IRT 2830              | 44                  | 28                        | 32       | 30.5     | 0.3                                         | 30                                | 31   | TA 3230Z           | —                 | —         |
|                  | IRT 3012              | 24.5                | 30                        | 35       | 12.5     | 0.6                                         | 34                                | 34.5 | TA 3512Z           | TLA 3512Z         | —         |
|                  | IRT 3015              | 30.5                | 30                        | 35       | 15.5     | 0.6                                         | 34                                | 34.5 | TA 3515Z           | —                 | —         |
|                  |                       |                     |                           |          |          |                                             |                                   |      |                    |                   |           |
|                  |                       |                     |                           |          |          |                                             |                                   |      |                    |                   |           |
|                  |                       |                     |                           |          |          |                                             |                                   |      |                    |                   |           |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



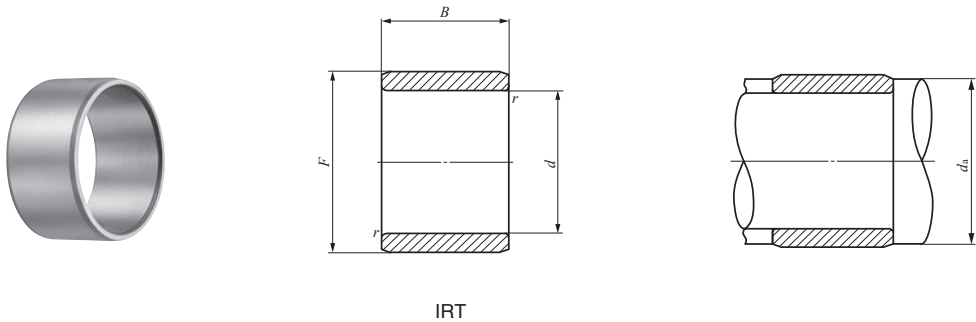
IRT

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |                   |           |
|------------------|-----------------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|-------------------|-----------|
|                  |                       |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. | TA···Z<br>(TAM)    | TLA···Z<br>(TLAM) | YT<br>YTL |
| 30               | IRT 3020              | 40                  | 30                        | 35       | 20.5     | 0.6                                         | 34                                | 34.5 | TA 3520Z           | TLA 3520Z         | —         |
|                  | IRT 3025              | 50                  | 30                        | 35       | 25.5     | 0.6                                         | 34                                | 34.5 | TA 3525Z           | —                 | —         |
|                  | IRT 3030              | 60                  | 30                        | 35       | 30.5     | 0.6                                         | 34                                | 34.5 | TA 3530Z           | —                 | —         |
| 32               | IRT 3220              | 42.5                | 32                        | 37       | 20.5     | 0.6                                         | 36                                | 36.5 | TA 3720Z           | —                 | YT 3720   |
|                  | IRT 3230              | 63.5                | 32                        | 37       | 30.5     | 0.6                                         | 36                                | 36.5 | TA 3730Z           | —                 | —         |
|                  | IRT 3215-1            | 39.5                | 32                        | 38       | 15.5     | 0.6                                         | 36                                | 37   | TA 3815Z           | —                 | —         |
|                  | IRT 3220-1            | 52                  | 32                        | 38       | 20.5     | 0.6                                         | 36                                | 37   | TA 3820Z           | —                 | —         |
|                  | IRT 3225-1            | 64.5                | 32                        | 38       | 25.5     | 0.6                                         | 36                                | 37   | TA 3825Z           | —                 | —         |
|                  | IRT 3230-1            | 77.5                | 32                        | 38       | 30.5     | 0.6                                         | 36                                | 37   | TA 3830Z           | —                 | —         |
|                  | IRT 3245-1            | 115                 | 32                        | 38       | 45.5     | 0.6                                         | 36                                | 37   | TAW 3845Z          | —                 | —         |
| 35               | IRT 3515              | 35                  | 35                        | 40       | 15.5     | 0.6                                         | 39                                | 39.5 | TA 4015Z           | —                 | YT 4015   |
|                  | IRT 3520              | 46.5                | 35                        | 40       | 20.5     | 0.6                                         | 39                                | 39.5 | TA 4020Z           | TLA 4020Z         | —         |
|                  | IRT 3525              | 58                  | 35                        | 40       | 25.5     | 0.6                                         | 39                                | 39.5 | TA 4025Z           | —                 | YT 4025   |
|                  | IRT 3530              | 69                  | 35                        | 40       | 30.5     | 0.6                                         | 39                                | 39.5 | TA 4030Z           | —                 | —         |
|                  | IRT 3540              | 91.5                | 35                        | 40       | 40.5     | 0.6                                         | 39                                | 39.5 | TA 4040Z           | —                 | —         |
| 40               | IRT 4020              | 52.5                | 40                        | 45       | 20.5     | 0.6                                         | 44                                | 45.5 | TA 4520Z           | TLA 4520Z         | YT 4520   |
|                  | IRT 4025              | 65.5                | 40                        | 45       | 25.5     | 0.6                                         | 44                                | 45.5 | TA 4525Z           | —                 | YT 4525   |
|                  | IRT 4030              | 78.5                | 40                        | 45       | 30.5     | 0.6                                         | 44                                | 45.5 | TA 4530Z           | —                 | —         |
|                  | IRT 4040              | 104                 | 40                        | 45       | 40.5     | 0.6                                         | 44                                | 45.5 | TA 4540Z           | —                 | —         |
| 45               | IRT 4512              | 36                  | 45                        | 50       | 12.5     | 0.6                                         | 49                                | 49.5 | TA 5012Z           | —                 | —         |
|                  | IRT 4515              | 44.5                | 45                        | 50       | 15.5     | 0.6                                         | 49                                | 49.5 | TA 5015Z           | —                 | —         |
|                  | IRT 4520              | 59                  | 45                        | 50       | 20.5     | 0.6                                         | 49                                | 49.5 | TA 5020Z           | TLA 5020Z         | —         |
|                  | IRT 4525              | 73                  | 45                        | 50       | 25.5     | 0.6                                         | 49                                | 49.5 | TA 5025Z           | TLA 5025Z         | —         |
|                  | IRT 4530              | 87.5                | 45                        | 50       | 30.5     | 0.6                                         | 49                                | 49.5 | TA 5030Z           | —                 | —         |
|                  | IRT 4540              | 116                 | 45                        | 50       | 40.5     | 0.6                                         | 49                                | 49.5 | TA 5040Z           | —                 | —         |
|                  | IRT 4545              | 131                 | 45                        | 50       | 45.5     | 0.6                                         | 49                                | 49.5 | TAW 5045Z          | —                 | —         |
|                  |                       |                     |                           |          |          |                                             |                                   |      |                    |                   |           |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

Inner Rings for Shell Type Needle Roller Bearings

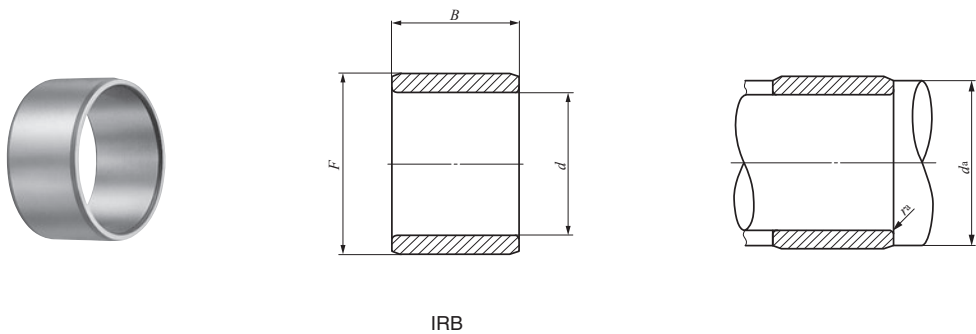


Shaft dia. 50 — 60mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |    |      |                                      | Standard mounting<br>dimension mm |                        | Assembled bearings |                   |           |
|------------------|-----------------------|---------------------|---------------------------|----|------|--------------------------------------|-----------------------------------|------------------------|--------------------|-------------------|-----------|
|                  |                       |                     | d                         | F  | B    | <sup>(1)</sup><br>r <sub>s min</sub> | d <sub>a</sub><br>Min.            | d <sub>a</sub><br>Max. | TA···Z<br>(TAM)    | TLA···Z<br>(TLAM) | YT<br>YTL |
| 50               | IRT 5020-1            | 65                  | 50                        | 55 | 20.5 | 0.6                                  | 54                                | 54.5                   | TA 5520Z           | TLA 5520Z         | —         |
|                  | IRT 5025-1            | 81                  | 50                        | 55 | 25.5 | 0.6                                  | 54                                | 54.5                   | TA 5525Z           | TLA 5525Z         | —         |
|                  | IRT 5030-1            | 96.5                | 50                        | 55 | 30.5 | 0.6                                  | 54                                | 54.5                   | TA 5530Z           | —                 | —         |
|                  | IRT 5040-1            | 128                 | 50                        | 55 | 40.5 | 0.6                                  | 54                                | 54.5                   | TA 5540Z           | —                 | —         |
|                  | IRT 5045-1            | 144                 | 50                        | 55 | 45.5 | 0.6                                  | 54                                | 54.5                   | TAW 5545Z          | —                 | —         |
|                  | IRT 5050-1            | 160                 | 50                        | 55 | 50.5 | 0.6                                  | 54                                | 54.5                   | TAW 5550Z          | —                 | —         |
|                  | IRT 5025              | 169                 | 50                        | 60 | 25.5 | 1.5                                  | 58                                | 59                     | TA 6025Z           | —                 | —         |
|                  | IRT 5030              | 205                 | 50                        | 60 | 30.5 | 1.5                                  | 58                                | 59                     | TA 6030Z           | —                 | —         |
|                  | IRT 5040              | 270                 | 50                        | 60 | 40.5 | 1.5                                  | 58                                | 59                     | TA 6040Z           | —                 | —         |
|                  | IRT 5045              | 300                 | 50                        | 60 | 45.5 | 1.5                                  | 58                                | 59                     | TAW 6045Z          | —                 | —         |
|                  | IRT 5050              | 335                 | 50                        | 60 | 50.5 | 1.5                                  | 58                                | 59                     | TAW 6050Z          | —                 | —         |
| 52               | IRT 5212              | 86                  | 52                        | 62 | 12.5 | 1.5                                  | 60                                | 60.5                   | TA 6212Z           | —                 | —         |
| 55               | IRT 5525              | 185                 | 55                        | 65 | 25.5 | 1.5                                  | 63                                | 63.5                   | TA 6525Z           | —                 | —         |
|                  | IRT 5530              | 220                 | 55                        | 65 | 30.5 | 1.5                                  | 63                                | 63.5                   | TA 6530Z           | —                 | —         |
|                  | IRT 5545              | 330                 | 55                        | 65 | 45.5 | 1.5                                  | 63                                | 63.5                   | TAW 6545Z          | —                 | —         |
|                  | IRT 5550              | 365                 | 55                        | 65 | 50.5 | 1.5                                  | 63                                | 63.5                   | TAW 6550Z          | —                 | —         |
| 60               | IRT 6025              | 200                 | 60                        | 70 | 25.5 | 1.5                                  | 68                                | 68.5                   | TA 7025Z           | —                 | —         |
|                  | IRT 6030              | 240                 | 60                        | 70 | 30.5 | 1.5                                  | 68                                | 68.5                   | TA 7030Z           | —                 | —         |
|                  | IRT 6040              | 320                 | 60                        | 70 | 40.5 | 1.5                                  | 68                                | 68.5                   | TA 7040Z           | —                 | —         |
|                  | IRT 6050              | 395                 | 60                        | 70 | 50.5 | 1.5                                  | 68                                | 68.5                   | TAW 7050Z          | —                 | —         |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

Inner Rings for Shell Type Needle Roller Bearings **Inch Series**



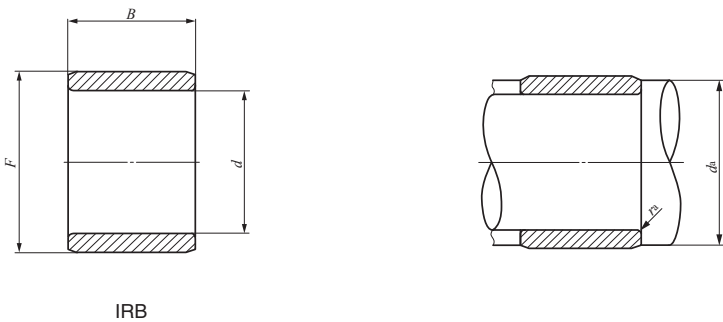
Shaft dia. 7.938 — 15.875mm

| Shaft dia.<br>mm<br>(inch)                 | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm(inch)         |                                          |       | Standard mounting<br>dimensions mm <sup>(1)</sup> |                        |                             | Assembled bearings |                   |           |
|--------------------------------------------|--------------------------|---------------------|-----------------------------------------|------------------------------------------|-------|---------------------------------------------------|------------------------|-----------------------------|--------------------|-------------------|-----------|
|                                            |                          |                     | d                                       | F                                        | B     | d <sub>a</sub><br>Min.                            | d <sub>a</sub><br>Max. | r <sub>as max</sub><br>Max. | BA···Z<br>(BAM)    | BHA···Z<br>(BHAM) | YB<br>YBH |
| 7.938<br>( <sup>5</sup> / <sub>16</sub> )  | IRB 58                   | 8                   | 7.938 ( <sup>5</sup> / <sub>16</sub> )  | 12.700 ( <sup>1</sup> / <sub>2</sub> )   | 13.08 | 11.3                                              | 11.7                   | 0.3                         | BA 88Z             | BHA 88Z           | YB 88     |
| 9.525<br>( <sup>3</sup> / <sub>8</sub> )   | IRB 68                   | 8.9                 | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | 14.288 ( <sup>9</sup> / <sub>16</sub> )  | 13.08 | 12.8                                              | 13.2                   | 0.3                         | BA 98Z             | BHA 98Z           | YB 98     |
|                                            | IRB 68-1                 | 12.6                | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 13.08 | 12.8                                              | 14                     | 0.3                         | BA 108Z            | BHA 108Z          | YB 108    |
|                                            | IRB 612                  | 13.2                | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | 14.288 ( <sup>9</sup> / <sub>16</sub> )  | 19.43 | 12.8                                              | 13.2                   | 0.3                         | BA 912Z            | —                 | YB 912    |
|                                            | IRB 612-1                | 18.8                | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 19.43 | 12.8                                              | 14                     | 0.3                         | BA 1012Z           | BHA 1012Z         | YB 1012   |
| 11.112<br>( <sup>7</sup> / <sub>16</sub> ) | IRB 78                   | 10.1                | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 13.08 | 14.4                                              | 14.8                   | 0.3                         | BA 108Z            | BHA 108Z          | YB 108    |
|                                            | IRB 712                  | 15                  | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 19.43 | 14.4                                              | 14.8                   | 0.3                         | BA 1012Z           | BHA 1012Z         | YB 1012   |
|                                            | IRB 714                  | 17.4                | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 22.60 | 14.4                                              | 14.8                   | 0.3                         | BA 1014Z           | —                 | —         |
|                                            | IRB 716                  | 19.9                | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 25.78 | 14.4                                              | 14.8                   | 0.3                         | BA 1016Z           | BHA 1016Z         | —         |
| 12.700<br>( <sup>1</sup> / <sub>2</sub> )  | IRB 86                   | 8.5                 | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 9.90  | 16.9                                              | 16.9                   | 0.3                         | BA 116Z            | —                 | —         |
|                                            | IRB 88                   | 11.2                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 13.08 | 16.9                                              | 16.9                   | 0.3                         | BA 118Z            | BHA 118Z          | —         |
|                                            | IRB 812                  | 16.7                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 17.462 ( <sup>11</sup> / <sub>16</sub> ) | 19.43 | 16.9                                              | 16.9                   | 0.3                         | BA 1112Z           | BHA 1112Z         | YB 1112   |
|                                            | IRB 88-1                 | 15.8                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 13.08 | 16.9                                              | 17.5                   | 0.6                         | BA 128Z            | —                 | YB 128    |
|                                            | IRB 810-1                | 19.6                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 16.25 | 16.9                                              | 17.5                   | 0.6                         | BA 1210Z           | —                 | YB 1210   |
|                                            | IRB 812-1                | 23.5                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 19.43 | 16.9                                              | 17.5                   | 0.6                         | BA 1212Z           | BHA 1212Z         | YB 1212   |
|                                            | IRB 814-1                | 27.5                | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 22.60 | 16.9                                              | 17.5                   | 0.6                         | BA 1214Z           | —                 | —         |
|                                            | IRB 816-1                | 31                  | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.78 | 16.9                                              | 17.5                   | 0.6                         | BA 1216Z           | —                 | —         |
| 14.288<br>( <sup>9</sup> / <sub>16</sub> ) | IRB 98                   | 17.3                | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 13.08 | 19                                                | 19.6                   | 0.6                         | BA 138Z            | BHA 138Z          | YB 138    |
|                                            | IRB 910                  | 21.5                | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 16.25 | 19                                                | 19.6                   | 0.6                         | BA 1310Z           | BHA 1310Z         | YBH 1310  |
|                                            | IRB 912                  | 26                  | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 19.43 | 19                                                | 19.6                   | 0.6                         | BA 1312Z           | BHA 1312Z         | YBH 1312  |
|                                            | IRB 914                  | 30                  | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 22.60 | 19                                                | 19.6                   | 0.6                         | BA 1314Z           | —                 | —         |
|                                            | IRB 916                  | 34.5                | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 25.78 | 19                                                | 19.6                   | 0.6                         | BA 1316Z           | —                 | —         |
|                                            | IRB 920                  | 43                  | 14.288 ( <sup>9</sup> / <sub>16</sub> ) | 20.638 ( <sup>13</sup> / <sub>16</sub> ) | 32.13 | 19                                                | 19.6                   | 0.6                         | BA 1320Z           | —                 | —         |
| 15.875<br>( <sup>5</sup> / <sub>8</sub> )  | IRB 106                  | 14.5                | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 9.90  | 20.7                                              | 21.2                   | 0.6                         | BA 146Z            | —                 | —         |
|                                            | IRB 108                  | 18.9                | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 13.08 | 20.7                                              | 21.2                   | 0.6                         | BA 148Z            | —                 | YB 148    |
|                                            | IRB 1012                 | 28                  | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 19.43 | 20.7                                              | 21.2                   | 0.6                         | BA 1412Z           | BHA 1412Z         | YB 1412   |

Note<sup>(1)</sup> Maximum allowable fillet corner radius of shaft  
Remark No oil hole is provided.

INNER RINGS

Inner Rings for Shell Type Needle Roller Bearings **Inch Series**



Shaft dia. 15.875 — 63.500mm

| Shaft dia.<br>mm<br>(inch) | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm(inch) |                   |       | Standard mounting dimensions mm <sup>(1)</sup> |      |                             | Assembled bearings |                   |                     |
|----------------------------|-----------------------|---------------------|---------------------------------|-------------------|-------|------------------------------------------------|------|-----------------------------|--------------------|-------------------|---------------------|
|                            |                       |                     | d                               | F                 | B     | d <sub>a</sub><br>Min.                         | Max. | r <sub>as max</sub><br>Max. | BA···Z<br>(BAM)    | BHA···Z<br>(BHAM) | YB<br>YBH           |
|                            |                       |                     |                                 |                   |       |                                                |      |                             |                    |                   |                     |
| 15.875<br>(5/8)            | IRB 1014              | 33                  | 15.875 ( 5/8 )                  | 22.225 ( 7/8 )    | 22.60 | 20.7                                           | 21.2 | 0.6                         | BA 1414Z           | —                 | —                   |
|                            | IRB 1016              | 37.5                | 15.875 ( 5/8 )                  | 22.225 ( 7/8 )    | 25.78 | 20.7                                           | 21.2 | 0.6                         | BA 1416Z           | BHA 1416Z         | YB 1416             |
|                            | IRB 1022              | 51.5                | 15.875 ( 5/8 )                  | 22.225 ( 7/8 )    | 35.30 | 20.7                                           | 21.2 | 0.6                         | BA 1422Z           | —                 | —                   |
| 17.462<br>(11/16)          | IRB 1110              | 25.5                | 17.462 ( 11/16 )                | 23.812 ( 15/16 )  | 16.25 | 22.3                                           | 22.8 | 0.6                         | BA 1510Z           | —                 | —                   |
|                            | IRB 1116              | 40.5                | 17.462 ( 11/16 )                | 23.812 ( 15/16 )  | 25.78 | 22.3                                           | 22.8 | 0.6                         | BA 1516Z           | —                 | —                   |
| 19.050<br>(3/4)            | IRB 128               | 22                  | 19.050 ( 3/4 )                  | 25.400 ( 1 )      | 13.08 | 23.9                                           | 24.4 | 0.6                         | BA 168Z            | BHA 168Z          | YB 168<br>YBH 168   |
|                            | IRB 1212              | 33                  | 19.050 ( 3/4 )                  | 25.400 ( 1 )      | 19.43 | 23.9                                           | 24.4 | 0.6                         | BA 1612Z           | BHA 1612Z         | YB 1612<br>YBH 1612 |
|                            | IRB 1214              | 38.5                | 19.050 ( 3/4 )                  | 25.400 ( 1 )      | 22.60 | 23.9                                           | 24.4 | 0.6                         | BA 1614Z           | BHA 1614Z         | —                   |
|                            | IRB 1216              | 43.5                | 19.050 ( 3/4 )                  | 25.400 ( 1 )      | 25.78 | 23.9                                           | 24.4 | 0.6                         | BA 1616Z           | BHA 1616Z         | YB 1616<br>YBH 1616 |
|                            | IRB 1220              | 54.5                | 19.050 ( 3/4 )                  | 25.400 ( 1 )      | 32.13 | 23.9                                           | 24.4 | 0.6                         | BA 1620Z           | BHA 1620Z         | —                   |
| 20.638<br>(13/16)          | IRB 1316              | 34                  | 20.638 ( 13/16 )                | 25.400 ( 1 )      | 25.78 | 24.9                                           | 24.9 | 0.6                         | BA 1616Z           | BHA 1616Z         | YB 1616<br>YBH 1616 |
| 22.225<br>(7/8)            | IRB 148               | 25                  | 22.225 ( 7/8 )                  | 28.575 ( 1 1/8 )  | 13.08 | 27                                             | 27.5 | 0.6                         | BA 188Z            | —                 | YB 188              |
|                            | IRB 1412              | 37.5                | 22.225 ( 7/8 )                  | 28.575 ( 1 1/8 )  | 19.43 | 27                                             | 27.5 | 0.6                         | BA 1812Z           | BHA 1812Z         | YB 1812             |
|                            | IRB 1416              | 50                  | 22.225 ( 7/8 )                  | 28.575 ( 1 1/8 )  | 25.78 | 27                                             | 27.5 | 0.6                         | BA 1816Z           | BHA 1816Z         | YB 1816             |
|                            | IRB 1420              | 62.5                | 22.225 ( 7/8 )                  | 28.575 ( 1 1/8 )  | 32.13 | 27                                             | 27.5 | 0.6                         | BA 1820Z           | BHA 1820Z         | —                   |
| 25.400<br>(1)              | IRB 168               | 28.5                | 25.400 ( 1 )                    | 31.750 ( 1 1/4 )  | 13.08 | 30                                             | 30.7 | 0.6                         | BA 208Z            | BHA 208Z          | —                   |
|                            | IRB 1610              | 35.5                | 25.400 ( 1 )                    | 31.750 ( 1 1/4 )  | 16.25 | 30                                             | 30.7 | 0.6                         | BA 2010Z           | —                 | YB 2010             |
|                            | IRB 1612              | 42.5                | 25.400 ( 1 )                    | 31.750 ( 1 1/4 )  | 19.43 | 30                                             | 30.7 | 0.6                         | BA 2012Z           | BHA 2012Z         | YB 2012             |
|                            | IRB 1616              | 56                  | 25.400 ( 1 )                    | 31.750 ( 1 1/4 )  | 25.78 | 30                                             | 30.7 | 0.6                         | BA 2016Z           | BHA 2016Z         | YB 2016             |
|                            | IRB 1620              | 70                  | 25.400 ( 1 )                    | 31.750 ( 1 1/4 )  | 32.13 | 30                                             | 30.7 | 0.6                         | BA 2020Z           | BHA 2020Z         | —                   |
|                            | IRB 168-1             | 36.5                | 25.400 ( 1 )                    | 33.338 ( 1 5/16 ) | 13.08 | 30                                             | 32.1 | 0.6                         | BA 218Z            | —                 | —                   |
|                            | IRB 1610-1            | 45.5                | 25.400 ( 1 )                    | 33.338 ( 1 5/16 ) | 16.25 | 30                                             | 32.1 | 0.6                         | BA 2110Z           | —                 | —                   |
|                            | IRB 1612-1            | 54.5                | 25.400 ( 1 )                    | 33.338 ( 1 5/16 ) | 19.43 | 30                                             | 32.1 | 0.6                         | BA 2112Z           | —                 | —                   |
|                            |                       |                     |                                 |                   |       |                                                |      |                             |                    |                   |                     |
|                            |                       |                     |                                 |                   |       |                                                |      |                             |                    |                   |                     |

Note(1) Maximum allowable fillet corner radius of shaft  
Remark No oil hole is provided.

| Shaft dia.<br>mm<br>(inch) | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm(inch) |                  |       | Standard mounting dimensions mm <sup>(1)</sup> |      |                             | Assembled bearings |                   |           |
|----------------------------|-----------------------|---------------------|---------------------------------|------------------|-------|------------------------------------------------|------|-----------------------------|--------------------|-------------------|-----------|
|                            |                       |                     | d                               | F                | B     | d <sub>a</sub><br>Min.                         | Max. | r <sub>as max</sub><br>Max. | BA···Z<br>(BAM)    | BHA···Z<br>(BHAM) | YB<br>YBH |
|                            |                       |                     |                                 |                  |       |                                                |      |                             |                    |                   |           |
| 28.575<br>(1 1/8)          | IRB 188               | 31.5                | 28.575 ( 1 1/8 )                | 34.925 ( 1 3/8 ) | 13.08 | 33.2                                           | 33.9 | 0.6                         | BA 228Z            | BHA 228Z          | YB 228    |
|                            | IRB 1812              | 47                  | 28.575 ( 1 1/8 )                | 34.925 ( 1 3/8 ) | 19.43 | 33.2                                           | 33.9 | 0.6                         | BA 2212Z           | BHA 2212Z         | YB 2212   |
|                            | IRB 1816              | 62.5                | 28.575 ( 1 1/8 )                | 34.925 ( 1 3/8 ) | 25.78 | 33.2                                           | 33.9 | 0.6                         | BA 2216Z           | BHA 2216Z         | —         |
|                            | IRB 1820              | 78                  | 28.575 ( 1 1/8 )                | 34.925 ( 1 3/8 ) | 32.13 | 33.2                                           | 33.9 | 0.6                         | BA 2220Z           | BHA 2220Z         | YB 2220   |
| 31.750<br>(1 1/4)          | IRB 2010              | 43                  | 31.750 ( 1 1/4 )                | 38.100 ( 1 1/2 ) | 16.25 | 37                                             | 37.1 | 0.6                         | BA 2410Z           | —                 | —         |
|                            | IRB 2014              | 60                  | 31.750 ( 1 1/4 )                | 38.100 ( 1 1/2 ) | 22.60 | 37                                             | 37.1 | 0.6                         | BA 2414Z           | —                 | YB 2414   |
|                            | IRB 2016              | 68.5                | 31.750 ( 1 1/4 )                | 38.100 ( 1 1/2 ) | 25.78 | 37                                             | 37.1 | 0.6                         | BA 2416Z           | —                 | YB 2416   |
|                            | IRB 2020              | 85.5                | 31.750 ( 1 1/4 )                | 38.100 ( 1 1/2 ) | 32.13 | 37                                             | 37.1 | 0.6                         | BA 2420Z           | —                 | YB 2420   |
| 34.925<br>(1 3/8)          | IRB 2210              | 47                  | 34.925 ( 1 3/8 )                | 41.275 ( 1 5/8 ) | 16.25 | 40.2                                           | 40.2 | 0.6                         | BA 2610Z           | —                 | YB 2610   |
|                            | IRB 2220              | 93.5                | 34.925 ( 1 3/8 )                | 41.275 ( 1 5/8 ) | 32.13 | 40.2                                           | 40.2 | 0.6                         | BA 2620Z           | —                 | —         |
| 36.512<br>(1 7/16)         | IRB 2316              | 99                  | 36.512 ( 1 7/16 )               | 44.450 ( 1 3/4 ) | 25.78 | 42.5                                           | 43.2 | 0.6                         | BA 2816Z           | —                 | —         |
| 38.100<br>(1 1/2)          | IRB 2412              | 62                  | 38.100 ( 1 1/2 )                | 44.450 ( 1 3/4 ) | 19.43 | 43.3                                           | 43.4 | 0.6                         | BA 2812Z           | —                 | —         |
|                            | IRB 2416              | 81                  | 38.100 ( 1 1/2 )                | 44.450 ( 1 3/4 ) | 25.78 | 43.3                                           | 43.4 | 0.6                         | BA 2816Z           | —                 | YB 2816   |
|                            | IRB 2424              | 121                 | 38.100 ( 1 1/2 )                | 44.450 ( 1 3/4 ) | 38.48 | 43.3                                           | 43.4 | 0.6                         | BA 2824Z           | BHA 2824Z         | —         |
|                            | IRB 248-1             | 64                  | 38.100 ( 1 1/2 )                | 47.625 ( 1 7/8 ) | 13.08 | 44.5                                           | 45.5 | 1                           | BA 308Z            | —                 | —         |
|                            | IRB 2410-1            | 79.5                | 38.100 ( 1 1/2 )                | 47.625 ( 1 7/8 ) | 16.25 | 44.5                                           | 45.5 | 1                           | BA 3010Z           | —                 | —         |
| 41.275<br>(1 5/8)          | IRB 2616              | 136                 | 41.275 ( 1 5/8 )                | 50.800 ( 2 )     | 25.78 | 47.5                                           | 48.5 | 1                           | BA 3216Z           | —                 | —         |
|                            | IRB 2628              | 235                 | 41.275 ( 1 5/8 )                | 50.800 ( 2 )     | 44.83 | 47.5                                           | 48.5 | 1                           | BAW 3228Z          | —                 | —         |
| 42.862<br>(1 11/16)        | IRB 2720              | 146                 | 42.862 ( 1 11/16 )              | 50.800 ( 2 )     | 32.13 | 48.5                                           | 49.5 | 0.6                         | BA 3220Z           | —                 | —         |
| 47.625<br>(1 7/8)          | IRB 3016              | 100                 | 47.625 ( 1 7/8 )                | 53.975 ( 2 1/8 ) | 25.78 | 52.9                                           | 52.9 | 0.6                         | BA 3416Z           | —                 | —         |
|                            | IRB 3024              | 149                 | 47.625 ( 1 7/8 )                | 53.975 ( 2 1/8 ) | 38.48 | 52.9                                           | 52.9 | 0.6                         | BA 3424Z           | —                 | —         |
| 57.150<br>(2 1/4)          | IRB 3616              | 183                 | 57.150 ( 2 1/4 )                | 66.675 ( 2 5/8 ) | 25.78 | 63.5                                           | 64.5 | 1                           | BA 4216Z           | —                 | —         |
| 63.500<br>(2 1/2)          | IRB 4016              | 131                 | 63.500 ( 2 1/2 )                | 69.850 ( 2 3/4 ) | 25.78 | 68.7                                           | 68.8 | 0.6                         | BA 4416Z           | —                 | —         |
|                            | IRB 4020              | 164                 | 63.500 ( 2 1/2 )                | 69.850 ( 2 3/4 ) | 32.13 | 68.7                                           | 68.8 | 0.6                         | BA 4420Z           | —                 | —         |

Note(1) Maximum allowable fillet corner radius of shaft  
Remark No oil hole is provided.

INNER RINGS

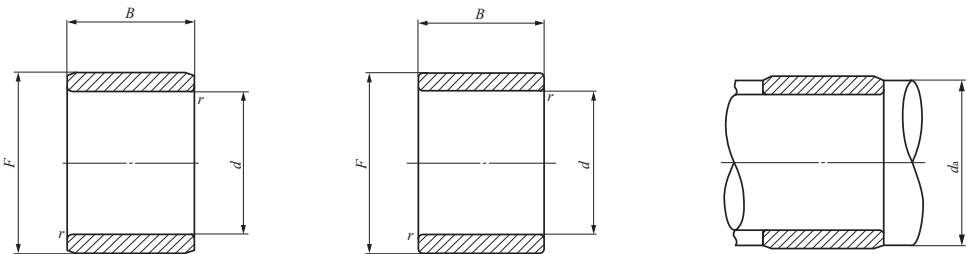
Inner Rings for General Usage



Shaft dia. 5 – 20mm

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |             |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|-------------|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                    |             |
| 5                | LRT 5710              | —           | 1.4                 | 5                         | 7        | 10       | 0.15                                        | 6.2                               | 6.7  | RNA 495            |             |
|                  | LRT 5812              | —           | 2.8                 | 5                         | 8        | 12       | 0.2                                         | 6.6                               | 7.7  | TAF 81512          |             |
|                  | LRT 5816              | —           | 3.8                 | 5                         | 8        | 16       | 0.2                                         | 6.6                               | 7.7  | TAF 81516          |             |
| 6                | LRT 6810              | —           | 1.7                 | 6                         | 8        | 10       | 0.15                                        | 7.2                               | 7.7  | RNA 496            |             |
|                  | LRT 6912              | —           | 3.2                 | 6                         | 9        | 12       | 0.2                                         | 7.6                               | 8.7  | TAF 91612          |             |
|                  | LRT 6916              | —           | 4.3                 | 6                         | 9        | 16       | 0.2                                         | 7.6                               | 8.7  | TAF 91616          |             |
|                  | LRT 61010             | —           | 3.9                 | 6                         | 10       | 10       | 0.3                                         | 8                                 | 9.7  | RNAF 101710        |             |
| 7                | LRT 7910              | —           | 1.9                 | 7                         | 9        | 10       | 0.15                                        | 8.2                               | 8.7  | RNA 497            |             |
|                  | LRT 71012             | —           | 3.6                 | 7                         | 10       | 12       | 0.2                                         | 8.6                               | 9.7  | TAF 101712         |             |
|                  | LRT 71012-1           | —           | 3.6                 | 7                         | 10       | 12       | 0.3                                         | 9                                 | 9.7  | RNAF 102012        |             |
|                  | LRT 71016             | —           | 4.9                 | 7                         | 10       | 16       | 0.2                                         | 8.6                               | 9.7  | TAF 101716         | NAX 1023    |
| 8                | LRT 81011             | —           | 2.4                 | 8                         | 10       | 11       | 0.2                                         | 9.6                               | 9.9  | RNA 498            |             |
| 9                | LRT 91211             | —           | 3.1                 | 9                         | 12       | 11       | 0.3                                         | 11                                | 11.5 | RNA 499            |             |
|                  | LRT 91212             | —           | 4.5                 | 9                         | 12       | 12       | 0.3                                         | 11                                | 11.5 | TAF 121912         | RNAF 122212 |
|                  | LRT 91216             | —           | 6                   | 9                         | 12       | 16       | 0.3                                         | 11                                | 11.5 | TAF 121916         | NAX 1223    |
| 10               | LRT 101412            | —           | 7                   | 10                        | 14       | 12       | 0.3                                         | 12                                | 13   | RNAF 142612        |             |
|                  | LRT 101413            | —           | 7.5                 | 10                        | 14       | 13       | 0.3                                         | 12                                | 13   | RNA 4900           | RNAF 142213 |
|                  | —                     | LRTZ 101414 | 8.2                 | 10                        | 14       | 14       | 0.3                                         | 12                                | 13   | RNA 4900 UU        |             |
|                  | LRT 101416            | —           | 9                   | 10                        | 14       | 16       | 0.3                                         | 12                                | 13   | TAF 142216         |             |
|                  | LRT 101420            | —           | 11.5                | 10                        | 14       | 20       | 0.3                                         | 12                                | 13   | TAF 142220         | RNAFW142220 |
| 12               | LRT 121516            | —           | 8                   | 12                        | 15       | 16.5     | 0.3                                         | 14                                | 14.5 | NAX 1523           | NBX 1523    |
|                  | LRT 121612            | —           | 8.5                 | 12                        | 16       | 12       | 0.3                                         | 14                                | 15   | RNAF 162812        |             |
|                  | LRT 121613            | —           | 8.5                 | 12                        | 16       | 13       | 0.3                                         | 14                                | 15   | RNA 4901           | RNAF 162413 |
|                  | —                     | LRTZ 121614 | 9.6                 | 12                        | 16       | 14       | 0.3                                         | 14                                | 15   | RNA 4901 UU        |             |
|                  | LRT 121616            | —           | 10.5                | 12                        | 16       | 16       | 0.3                                         | 14                                | 15   | TAF 162416         |             |
|                  | LRT 121620            | —           | 13.5                | 12                        | 16       | 20       | 0.3                                         | 14                                | 15   | TAF 162420         | RNAFW162420 |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

LRTZ

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |             |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|-------------|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                    |             |
| 12               | LRT 121622            | —           | 14.5                | 12                        | 16       | 22       | 0.3                                         | 14                                | 15   | RNA 6901           |             |
|                  | —                     | LRTZ 121623 | 15.5                | 12                        | 16       | 23       | 0.3                                         | 14                                | 15   | RNA 6901 UU        |             |
| 14               | LRT 141717            | —           | 9.5                 | 14                        | 17       | 17       | 0.3                                         | 16                                | 16.5 | NAX 1725           | NBX 1725    |
| 15               | LRT 151916            | —           | 12.5                | 15                        | 19       | 16       | 0.3                                         | 17                                | 18   | TAF 192716         |             |
|                  | LRT 151920            | —           | 16                  | 15                        | 19       | 20       | 0.3                                         | 17                                | 18   | TAF 192720         |             |
|                  | LRT 152012            | —           | 12                  | 15                        | 20       | 12       | 0.3                                         | 17                                | 19   | RNAF 203212        |             |
|                  | LRT 152013            | —           | 13.5                | 15                        | 20       | 13       | 0.3                                         | 17                                | 19   | RNA 4902           | RNAF 202813 |
|                  | —                     | LRTZ 152014 | 14.5                | 15                        | 20       | 14       | 0.3                                         | 17                                | 19   | RNA 4902 UU        |             |
|                  | LRT 152020            | —           | 21.5                | 15                        | 20       | 20.5     | 0.3                                         | 17                                | 19   | TR 203320          |             |
|                  | —                     | LRTZ 152020 | 21.5                | 15                        | 20       | 20.5     | 0.3                                         | 17                                | 19   | GTR 203320         |             |
|                  | LRT 152023            | —           | 24                  | 15                        | 20       | 23       | 0.3                                         | 17                                | 19   | RNA 6902           |             |
| 17               | —                     | LRTZ 152024 | 25                  | 15                        | 20       | 24       | 0.3                                         | 17                                | 19   | RNA 6902 UU        |             |
|                  | LRT 152026            | —           | 28                  | 15                        | 20       | 26       | 0.3                                         | 17                                | 19   | RNAFW 202826       |             |
|                  | LRT 172020            | —           | 13.5                | 17                        | 20       | 20.5     | 0.3                                         | 19                                | 19.5 | NAX 2030           | NBX 2030    |
|                  | LRT 172116            | —           | 14.5                | 17                        | 21       | 16       | 0.3                                         | 19                                | 20   | TAF 212916         |             |
|                  | LRT 172120            | —           | 18                  | 17                        | 21       | 20       | 0.3                                         | 19                                | 20   | TAF 212920         |             |
|                  | LRT 172213            | —           | 15.5                | 17                        | 22       | 13       | 0.3                                         | 19                                | 21   | RNA 4903           | RNAF 223013 |
|                  | —                     | LRTZ 172214 | 16.5                | 17                        | 22       | 14       | 0.3                                         | 19                                | 21   | RNA 4903 UU        |             |
|                  | LRT 172216            | —           | 19                  | 17                        | 22       | 16       | 0.3                                         | 19                                | 21   | RNAF 223516        |             |
| 20               | LRT 172223            | —           | 26.5                | 17                        | 22       | 23       | 0.3                                         | 19                                | 21   | RNA 6903           |             |
|                  | —                     | LRTZ 172224 | 28                  | 17                        | 22       | 24       | 0.3                                         | 19                                | 21   | RNA 6903 UU        |             |
|                  | LRT 172225            | —           | 30                  | 17                        | 22       | 25.5     | 0.3                                         | 19                                | 21   | TR 223425          |             |
|                  | —                     | LRTZ 172225 | 30                  | 17                        | 22       | 25.5     | 0.3                                         | 19                                | 21   | GTR 223425         |             |
|                  | LRT 172226            | —           | 31                  | 17                        | 22       | 26       | 0.3                                         | 19                                | 21   | RNAFW 223026       |             |
|                  | LRT 172232            | —           | 38                  | 17                        | 22       | 32       | 0.3                                         | 19                                | 21   | RNAFW 223532       |             |
|                  | LRT 202416            | —           | 16.5                | 20                        | 24       | 16       | 0.3                                         | 22                                | 23   | TAF 243216         |             |
|                  | LRT 202420            | —           | 20.5                | 20                        | 24       | 20       | 0.3                                         | 22                                | 23   | TAF 243220         |             |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

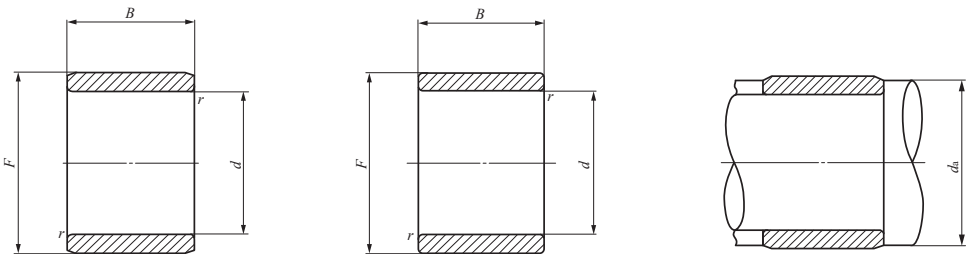
Inner Rings for General Usage



Shaft dia. 20 – 32mm

| Shaft<br>dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings   |
|---------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|----------------------|
|                     |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                      |
| 20                  | LRT 202516            | —           | 22                  | 20                        | 25       | 16       | 0.3                                         | 22                                | 24   | RNAF 253716          |
|                     | LRT 202517            | —           | 23                  | 20                        | 25       | 17       | 0.3                                         | 22                                | 24   | RNA 4904 RNAF 253517 |
|                     | —                     | LRTZ 202518 | 24                  | 20                        | 25       | 18       | 0.3                                         | 22                                | 24   | RNA 4904 UU          |
|                     | LRT 202520            | —           | 28                  | 20                        | 25       | 20.5     | 0.3                                         | 22                                | 24   | TR 253820 NAX 2530   |
|                     | —                     | LRTZ 202520 | 28                  | 20                        | 25       | 20.5     | 0.3                                         | 22                                | 24   | NBX 2530             |
|                     | LRT 202525            | —           | 35                  | 20                        | 25       | 25.5     | 0.3                                         | 22                                | 24   | GTR 253820           |
|                     | —                     | LRTZ 202525 | 35                  | 20                        | 25       | 25.5     | 0.3                                         | 22                                | 24   | TR 253825            |
|                     | LRT 202526            | —           | 36                  | 20                        | 25       | 26       | 0.3                                         | 22                                | 24   | GTR 253825           |
|                     | LRT 202530            | —           | 40.5                | 20                        | 25       | 30       | 0.3                                         | 22                                | 24   | RNAFW 253526         |
|                     | —                     | LRTZ 202531 | 41.5                | 20                        | 25       | 31       | 0.3                                         | 22                                | 24   | RNA 6904             |
| 22                  | LRT 202532            | —           | 44                  | 20                        | 25       | 32       | 0.3                                         | 22                                | 24   | RNA 6904 UU          |
|                     | —                     | —           | 44                  | 20                        | 25       | 32       | 0.3                                         | 22                                | 24   | RNAFW 253732         |
|                     | LRT 222616            | —           | 17.5                | 22                        | 26       | 16       | 0.3                                         | 24                                | 25   | TAF 263416           |
|                     | LRT 222620            | —           | 24                  | 22                        | 26       | 20       | 0.3                                         | 24                                | 25   | TAF 263420           |
|                     | LRT 222817            | —           | 30.5                | 22                        | 28       | 17       | 0.3                                         | 24                                | 27   | RNA 49/22            |
|                     | —                     | LRTZ 222818 | 32                  | 22                        | 28       | 18       | 0.3                                         | 24                                | 27   | RNA 49/22 UU         |
|                     | LRT 222830            | —           | 55                  | 22                        | 28       | 30       | 0.3                                         | 24                                | 27   | RNA 69/22            |
|                     | —                     | LRTZ 222831 | 55                  | 22                        | 28       | 31       | 0.3                                         | 24                                | 27   | RNA 69/22 UU         |
|                     | LRT 252920            | —           | 25                  | 25                        | 29       | 20       | 0.3                                         | 27                                | 28   | TAF 293820           |
|                     | LRT 252930            | —           | 38                  | 25                        | 29       | 30       | 0.3                                         | 27                                | 28   | TAF 293830           |
| 25                  | LRT 253016            | —           | 28                  | 25                        | 30       | 16       | 0.3                                         | 27                                | 29   | RNAF 304216          |
|                     | LRT 253017            | —           | 28.5                | 25                        | 30       | 17       | 0.3                                         | 27                                | 29   | RNA 4905 RNAF 304017 |
|                     | —                     | LRTZ 253018 | 29.5                | 25                        | 30       | 18       | 0.3                                         | 27                                | 29   | RNA 4905 UU          |
|                     | LRT 253020            | —           | 34                  | 25                        | 30       | 20.5     | 0.3                                         | 27                                | 29   | NAX 3030 NBX 3030    |
|                     | LRT 253025            | —           | 42                  | 25                        | 30       | 25.5     | 0.3                                         | 27                                | 29   | TR 304425            |
|                     | —                     | LRTZ 253025 | 42                  | 25                        | 30       | 25.5     | 0.3                                         | 27                                | 29   | GTR 304425           |
|                     | LRT 253026            | —           | 44.5                | 25                        | 30       | 26       | 0.3                                         | 27                                | 29   | RNAFW 304026         |
|                     | LRT 253030            | —           | 49                  | 25                        | 30       | 30       | 0.3                                         | 27                                | 29   | RNA 6905             |
|                     | —                     | —           | —                   | —                         | —        | —        | —                                           | —                                 | —    | —                    |
|                     | —                     | —           | —                   | —                         | —        | —        | —                                           | —                                 | —    | —                    |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

LRTZ

| Shaft<br>dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings   |
|---------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|----------------------|
|                     |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                      |
| 25                  | —                     | LRTZ 253031 | 51                  | 25                        | 30       | 31       | 0.3                                         | 27                                | 29   | RNA 6905 UU          |
|                     | LRT 253032            | —           | 54                  | 25                        | 30       | 32       | 0.3                                         | 27                                | 29   | RNAFW 304232         |
| 28                  | LRT 283217            | —           | 24.5                | 28                        | 32       | 17       | 0.3                                         | 30                                | 31   | RNA 49/28            |
|                     | —                     | LRTZ 283218 | 25.5                | 28                        | 32       | 18       | 0.3                                         | 30                                | 31   | RNA 49/28 UU         |
|                     | LRT 283220            | —           | 28.5                | 28                        | 32       | 20       | 0.3                                         | 30                                | 31   | TAF 324220           |
|                     | LRT 283230            | —           | 43                  | 28                        | 32       | 30       | 0.3                                         | 30                                | 31   | RNA 69/28 TAF 324230 |
|                     | —                     | LRTZ 283230 | 43                  | 28                        | 32       | 30.5     | 0.3                                         | 30                                | 31   | GTR 324530           |
|                     | —                     | LRTZ 283231 | 44                  | 28                        | 32       | 31       | 0.3                                         | 30                                | 31   | RNA 69/28 UU         |
| 30                  | LRT 303516            | —           | 31.5                | 30                        | 35       | 16       | 0.3                                         | 32                                | 34   | RNAF 354716          |
|                     | LRT 303517            | —           | 33.5                | 30                        | 35       | 17       | 0.3                                         | 32                                | 34   | RNA 4906 RNAF 354517 |
|                     | —                     | LRTZ 303518 | 35                  | 30                        | 35       | 18       | 0.3                                         | 32                                | 34   | RNA 4906 UU          |
|                     | LRT 303520            | —           | 38.5                | 30                        | 35       | 20       | 0.3                                         | 32                                | 34   | TAF 354520 NAX 3530  |
|                     | —                     | —           | —                   | —                         | —        | —        | —                                           | —                                 | —    | NBX 3530             |
|                     | LRT 303526            | —           | 52                  | 30                        | 35       | 26       | 0.3                                         | 32                                | 34   | RNAFW 354526         |
|                     | LRT 303530            | —           | 59                  | 30                        | 35       | 30       | 0.3                                         | 32                                | 34   | RNA 6906 TAF 354530  |
|                     | LRT 303530-1          | —           | 59                  | 30                        | 35       | 30.5     | 0.3                                         | 32                                | 34   | TR 354830            |
|                     | —                     | LRTZ 303530 | 59                  | 30                        | 35       | 30.5     | 0.3                                         | 32                                | 34   | GTR 354830           |
|                     | —                     | LRTZ 303531 | 61                  | 30                        | 35       | 31       | 0.3                                         | 32                                | 34   | RNA 6906 UU          |
| 32                  | LRT 303532            | —           | 64                  | 30                        | 35       | 32       | 0.3                                         | 32                                | 34   | RNAFW 354732         |
|                     | LRT 323720            | —           | 43.5                | 32                        | 37       | 20       | 0.3                                         | 34                                | 36   | TAF 374720           |
|                     | LRT 323730            | —           | 63                  | 32                        | 37       | 30       | 0.3                                         | 34                                | 36   | TAF 374730           |
|                     | LRT 323830            | —           | 77                  | 32                        | 38       | 30.5     | 0.6                                         | 36                                | 37   | TR 385230            |
|                     | —                     | LRTZ 323830 | 77                  | 32                        | 38       | 30.5     | 0.6                                         | 36                                | 37   | GTR 385230           |
|                     | LRT 324020            | —           | 69                  | 32                        | 40       | 20       | 0.6                                         | 36                                | 39   | RNA 49/32            |
|                     | —                     | LRTZ 324021 | 72.5                | 32                        | 40       | 21       | 0.6                                         | 36                                | 39   | RNA 49/32 UU         |
|                     | LRT 324036            | —           | 123                 | 32                        | 40       | 36       | 0.6                                         | 36                                | 39   | RNA 69/32            |
|                     | —                     | LRTZ 324037 | 130                 | 32                        | 40       | 37       | 0.6                                         | 36                                | 39   | RNA 69/32 UU         |
|                     | —                     | —           | —                   | —                         | —        | —        | —                                           | —                                 | —    | —                    |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

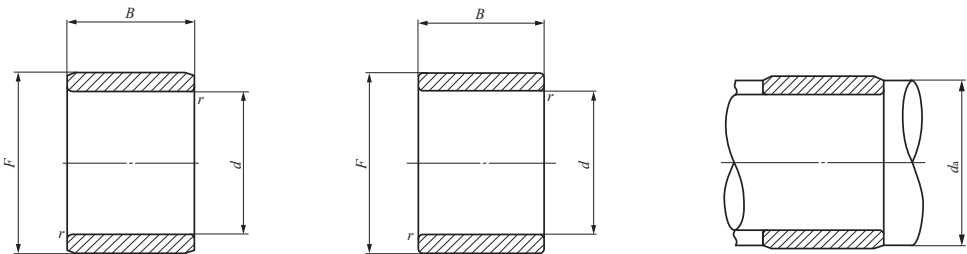
Inner Rings for General Usage



Shaft dia. 35 — 50mm

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                            |  | Standard mounting<br>dimension mm |      | Assembled bearings     |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|--------------------------------------------|--|-----------------------------------|------|------------------------|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r<sub>s</sub> min</i> |  | Min.                              | Max. |                        |
| 35               | LRT 354017            | —           | 39                  | 35                        | 40       | 17       | 0.3                                        |  | 37                                | 39   | RNAF 405017            |
|                  | LRT 354020            | —           | 46                  | 35                        | 40       | 20       | 0.3                                        |  | 37                                | 39   | TAF 405020 RNAF 405520 |
|                  | —                     | LRTZ 354020 | 46                  | 35                        | 40       | 20.5     | 0.6                                        |  | 39                                | 39.5 | NAX 4032 NBX 4032      |
|                  | LRT 354030            | —           | 67                  | 35                        | 40       | 30       | 0.3                                        |  | 37                                | 39   | GTR 405520             |
|                  | LRT 354034            | —           | 78                  | 35                        | 40       | 34       | 0.3                                        |  | 37                                | 39   | TAF 405030             |
|                  | LRT 354040            | —           | 95                  | 35                        | 40       | 40       | 0.3                                        |  | 37                                | 39   | RNAFW 405034           |
|                  | LRT 354220            | —           | 65                  | 35                        | 42       | 20       | 0.6                                        |  | 39                                | 41   | RNAFW 405540           |
|                  | —                     | LRTZ 354221 | 67                  | 35                        | 42       | 21       | 0.6                                        |  | 39                                | 41   | RNA 4907               |
|                  | LRT 354230            | —           | 97                  | 35                        | 42       | 30.5     | 0.6                                        |  | 39                                | 41   | RNA 4907 UU            |
|                  | —                     | LRTZ 354230 | 100                 | 35                        | 42       | 30.5     | 0.6                                        |  | 39                                | 41   | TR 425630              |
| 38               | LRT 384320            | —           | 47.5                | 38                        | 43       | 20       | 0.3                                        |  | 40                                | 42   | GTR 425630             |
|                  | LRT 384330            | —           | 72                  | 38                        | 43       | 30       | 0.3                                        |  | 40                                | 42   | RNA 6907               |
|                  | LRT 404517            | —           | 44.5                | 40                        | 45       | 17       | 0.3                                        |  | 42                                | 44   | RNA 6907 UU            |
|                  | LRT 404520            | —           | 51                  | 40                        | 45       | 20       | 0.3                                        |  | 42                                | 44   | RNAF 455517            |
|                  | LRT 404530            | —           | 77                  | 40                        | 45       | 30       | 0.3                                        |  | 42                                | 44   | TAF 455520 RNAF 456220 |
|                  | LRT 404530-1          | —           | 77                  | 40                        | 45       | 30.5     | 0.6                                        |  | 44                                | 44.5 | NAX 4532 NBX 4532      |
|                  | —                     | LRTZ 404530 | 77                  | 40                        | 45       | 30.5     | 0.6                                        |  | 44                                | 44.5 | TAF 455530             |
|                  | LRT 404534            | —           | 88                  | 40                        | 45       | 34       | 0.3                                        |  | 42                                | 44   | TR 455930              |
|                  | LRT 404540            | —           | 105                 | 40                        | 45       | 40       | 0.3                                        |  | 42                                | 44   | GTR 455930             |
|                  | LRT 404822            | —           | 93                  | 40                        | 48       | 22       | 0.6                                        |  | 44                                | 47   | RNAFW 455534           |
| 40               | —                     | LRTZ 404823 | 95                  | 40                        | 48       | 23       | 0.6                                        |  | 44                                | 47   | RNAFW 456240           |
|                  | LRT 404840            | —           | 165                 | 40                        | 48       | 40       | 0.6                                        |  | 44                                | 47   | RNA 4908               |
|                  | —                     | LRTZ 404841 | 170                 | 40                        | 48       | 41       | 0.6                                        |  | 44                                | 47   | RNA 4908 UU            |
|                  | LRT 40517             | —           | 39                  | 35                        | 40       | 17       | 0.3                                        |  | 37                                | 39   | RNA 6908               |
|                  | LRT 40520             | —           | 46                  | 35                        | 40       | 20       | 0.3                                        |  | 37                                | 39   | RNA 6908 UU            |
|                  | —                     | LRTZ 40520  | 46                  | 35                        | 40       | 20.5     | 0.6                                        |  | 39                                | 39.5 |                        |
|                  | LRT 40530             | —           | 67                  | 35                        | 40       | 30       | 0.3                                        |  | 37                                | 39   |                        |
|                  | LRT 40534             | —           | 78                  | 35                        | 40       | 34       | 0.3                                        |  | 37                                | 39   |                        |
|                  | LRT 40540             | —           | 95                  | 35                        | 40       | 40       | 0.3                                        |  | 37                                | 39   |                        |
|                  | LRT 405220            | —           | 65                  | 35                        | 42       | 20       | 0.6                                        |  | 39                                | 41   |                        |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

LRTZ

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                            |  | Standard mounting<br>dimension mm |      | Assembled bearings     |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|--------------------------------------------|--|-----------------------------------|------|------------------------|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r<sub>s</sub> min</i> |  | Min.                              | Max. |                        |
| 42               | LRT 424720            | —           | 54                  | 42                        | 47       | 20       | 0.3                                        |  | 44                                | 46   | TAF 475720             |
|                  | LRT 424730            | —           | 81                  | 42                        | 47       | 30       | 0.3                                        |  | 44                                | 46   | TAF 475730             |
|                  | LRT 424830            | —           | 100                 | 42                        | 48       | 30.5     | 0.6                                        |  | 46                                | 47   | TR 486230              |
|                  | —                     | LRTZ 424830 | 100                 | 42                        | 48       | 30.5     | 0.6                                        |  | 46                                | 47   | GTR 486230             |
| 45               | LRT 455020            | —           | 58                  | 45                        | 50       | 20       | 0.3                                        |  | 47                                | 49   | RNAF 506220            |
|                  | LRT 455025            | —           | 71                  | 45                        | 50       | 25       | 0.3                                        |  | 47                                | 49   | TAF 506225 RNAF 506235 |
|                  | LRT 455030            | —           | 90                  | 45                        | 50       | 30.5     | 0.6                                        |  | 49                                | 49.5 | NAX 5035               |
|                  | —                     | LRTZ 455030 | 90                  | 45                        | 50       | 30.5     | 0.6                                        |  | 49                                | 49.5 | NBX 5035               |
|                  | LRT 455035            | —           | 95                  | 45                        | 50       | 35       | 0.3                                        |  | 47                                | 49   | TR 506430              |
|                  | LRT 455040            | —           | 115                 | 45                        | 50       | 40       | 0.3                                        |  | 47                                | 49   | GTR 506430             |
|                  | LRT 455222            | —           | 88                  | 45                        | 52       | 22       | 0.6                                        |  | 49                                | 51   | TAF 506235             |
|                  | —                     | LRTZ 455223 | 93                  | 45                        | 52       | 23       | 0.6                                        |  | 49                                | 51   | RNAFW 506240           |
|                  | LRT 455240            | —           | 165                 | 45                        | 52       | 40       | 0.6                                        |  | 49                                | 51   | RNA 4909               |
|                  | —                     | LRTZ 455241 | 170                 | 45                        | 52       | 41       | 0.6                                        |  | 49                                | 51   | RNA 4909 UU            |
| 50               | LRT 455520            | —           | 120                 | 45                        | 55       | 20       | 1                                          |  | 50                                | 54   | RNA 6909               |
|                  | LRT 455540            | —           | 245                 | 45                        | 55       | 40       | 1                                          |  | 50                                | 54   | RNA 6909 UU            |
|                  | LRT 505520            | —           | 63                  | 50                        | 55       | 20       | 0.3                                        |  | 52                                | 54   | RNAF 556820            |
|                  | LRT 505525            | —           | 77                  | 50                        | 55       | 25       | 0.3                                        |  | 52                                | 54   | TAF 556825             |
|                  | LRT 505535            | —           | 110                 | 50                        | 55       | 35       | 0.3                                        |  | 52                                | 54   | TAF 556835             |
|                  | LRT 505540            | —           | 130                 | 50                        | 55       | 40       | 0.3                                        |  | 52                                | 54   | RNAFW 556840           |
|                  | LRT 505822            | —           | 116                 | 50                        | 58       | 22       | 0.6                                        |  | 54                                | 57   | RNA 4910               |
|                  | —                     | LRTZ 505823 | 118                 | 50                        | 58       | 23       | 0.6                                        |  | 54                                | 57   | RNA 4910 UU            |
|                  | LRT 505840            | —           | 210                 | 50                        | 58       | 40       | 0.6                                        |  | 54                                | 57   | RNA 6910               |
|                  | —                     | LRTZ 505841 | 215                 | 50                        | 58       | 41       | 0.6                                        |  | 54                                | 57   | RNA 6910 UU            |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

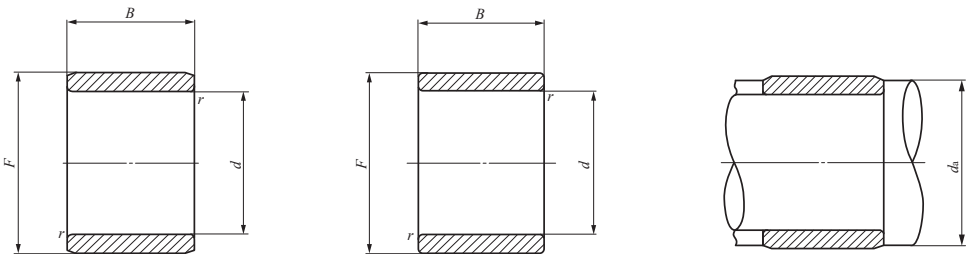
Inner Rings for General Usage



Shaft dia. 50 — 80mm

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             |  | Standard mounting<br>dimension mm |      | Assembled bearings |          |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|--|-----------------------------------|------|--------------------|----------|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> |  | Min.                              | Max. |                    |          |
| 50               | LRT 506025            | —           | 165                 | 50                        | 60       | 25.5     | 1                                           |  | 55                                | 59   | NAX 6040           | NBX 6040 |
|                  | LRT 506040            | —           | 265                 | 50                        | 60       | 40       | 1                                           |  | 55                                | 59   | RNAFW 607840       |          |
| 55               | LRT 556025            | —           | 88                  | 55                        | 60       | 25       | 0.3                                         |  | 57                                | 59   | TAF 607225         |          |
|                  | LRT 556035            | —           | 120                 | 55                        | 60       | 35       | 0.3                                         |  | 57                                | 59   | TAF 607235         |          |
|                  | LRT 556238            | —           | 190                 | 55                        | 62       | 38.5     | 1                                           |  | 60                                | 60.5 | TR 628138          |          |
|                  | —                     | LRTZ 556238 | 190                 | 55                        | 62       | 38.5     | 1                                           |  | 60                                | 60.5 | GTR 628138         |          |
|                  | LRT 556325            | —           | 145                 | 55                        | 63       | 25       | 1                                           |  | 60                                | 61   | RNA 4911           |          |
|                  | —                     | LRTZ 556326 | 150                 | 55                        | 63       | 26       | 1                                           |  | 60                                | 61   | RNA 4911 UU        |          |
|                  | LRT 556345            | —           | 255                 | 55                        | 63       | 45       | 1                                           |  | 60                                | 61   | RNA 6911           |          |
|                  | —                     | LRTZ 556346 | 260                 | 55                        | 63       | 46       | 1                                           |  | 60                                | 61   | RNA 6911 UU        |          |
| 60               | LRT 556530            | —           | 220                 | 55                        | 65       | 30       | 1.5                                         |  | 63                                | 63.5 | RNAF 658530        |          |
|                  | LRT 556560            | —           | 435                 | 55                        | 65       | 60       | 1.5                                         |  | 63                                | 63.5 | RNAFW 658560       |          |
|                  | LRT 606825            | —           | 150                 | 60                        | 68       | 25       | 0.6                                         |  | 64                                | 66   | TAF 688225         |          |
|                  | LRT 606825-1          | —           | 150                 | 60                        | 68       | 25       | 1                                           |  | 65                                | 66   | RNA 4912           |          |
|                  | —                     | LRTZ 606826 | 160                 | 60                        | 68       | 26       | 1                                           |  | 65                                | 66   | RNA 4912 UU        |          |
|                  | LRT 606835            | —           | 210                 | 60                        | 68       | 35       | 0.6                                         |  | 64                                | 66   | TAF 688235         |          |
|                  | LRT 606845            | —           | 275                 | 60                        | 68       | 45       | 1                                           |  | 65                                | 66   | RNA 6912           |          |
|                  | —                     | LRTZ 606846 | 280                 | 60                        | 68       | 46       | 1                                           |  | 65                                | 66   | RNA 6912 UU        |          |
| 65               | LRT 607025            | —           | 195                 | 60                        | 70       | 25.5     | 1                                           |  | 65                                | 68   | NAX 7040           |          |
|                  | LRT 607030            | —           | 240                 | 60                        | 70       | 30       | 1.5                                         |  | 68                                | 68.5 | RNAF 709030        |          |
|                  | LRT 607045            | —           | 355                 | 60                        | 70       | 45.5     | 1                                           |  | 65                                | 68   | TR 708945          |          |
|                  | —                     | LRTZ 607045 | 360                 | 60                        | 70       | 45.5     | 1                                           |  | 65                                | 68   | GTR 708945         |          |
|                  | LRT 607060            | —           | 480                 | 60                        | 70       | 60       | 1.5                                         |  | 68                                | 68.5 | RNAFW 709060       |          |
|                  | LRT 657225            | —           | 145                 | 65                        | 72       | 25       | 1                                           |  | 70                                | 70.5 | RNA 4913           |          |
|                  | —                     | LRTZ 657226 | 150                 | 65                        | 72       | 26       | 1                                           |  | 70                                | 70.5 | RNA 4913 UU        |          |
|                  | LRT 657245            | —           | 255                 | 65                        | 72       | 45       | 1                                           |  | 70                                | 70.5 | RNA 6913           |          |
| 65               | —                     | LRTZ 657246 | 265                 | 65                        | 72       | 46       | 1                                           |  | 70                                | 70.5 | RNA 6913 UU        |          |
|                  | LRT 657335            | —           | 235                 | 65                        | 73       | 35       | 1                                           |  | 70                                | 71   | TAF 739035         |          |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

LRTZ

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             |  | Standard mounting<br>dimension mm |      | Assembled bearings |  |
|------------------|-----------------------|-------------|---------------------|---------------------------|----------|----------|---------------------------------------------|--|-----------------------------------|------|--------------------|--|
|                  |                       |             |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> |  | Min.                              | Max. |                    |  |
| 65               | LRT 657530            | —           | 260                 | 65                        | 75       | 30       | 1.5                                         |  | 73                                | 73.5 | RNAF 759530        |  |
|                  | LRT 657560            | —           | 520                 | 65                        | 75       | 60       | 1.5                                         |  | 73                                | 73.5 | RNAFW 759560       |  |
| 70               | LRT 708025            | —           | 225                 | 70                        | 80       | 25       | 1                                           |  | 75                                | 78   | TAF 809525         |  |
|                  | LRT 708030            | —           | 275                 | 70                        | 80       | 30       | 1                                           |  | 75                                | 78   | RNA 4914           |  |
|                  | LRT 708030-1          | —           | 275                 | 70                        | 80       | 30       | 1.5                                         |  | 78                                | 78.5 | RNAF 8010030       |  |
|                  | —                     | LRTZ 708031 | 275                 | 70                        | 80       | 31       | 1                                           |  | 75                                | 78   | RNA 4914 UU        |  |
|                  | LRT 708035            | —           | 310                 | 70                        | 80       | 35       | 1                                           |  | 75                                | 78   | TAF 809535         |  |
|                  | LRT 708054            | —           | 490                 | 70                        | 80       | 54       | 1                                           |  | 75                                | 78   | RNA 6914           |  |
|                  | —                     | LRTZ 708055 | 500                 | 70                        | 80       | 55       | 1                                           |  | 75                                | 78   | RNA 6914 UU        |  |
|                  | LRT 708060            | —           | 560                 | 70                        | 80       | 60       | 1.5                                         |  | 78                                | 78.5 | RNAFW 8010060      |  |
| 75               | LRT 758345            | —           | 350                 | 75                        | 83       | 45.5     | 1                                           |  | 80                                | 81   | TR 8310845         |  |
|                  | —                     | LRTZ 758345 | 350                 | 75                        | 83       | 45.5     | 1                                           |  | 80                                | 81   | GTR 8310845        |  |
|                  | LRT 758525            | —           | 240                 | 75                        | 85       | 25       | 1                                           |  | 80                                | 83   | TAF 8510525        |  |
|                  | LRT 758530            | —           | 290                 | 75                        | 85       | 30       | 1                                           |  | 80                                | 83   | RNA 4915           |  |
|                  | LRT 758530-1          | —           | 290                 | 75                        | 85       | 30       | 1.5                                         |  | 83                                | 83.5 | RNAF 8510530       |  |
|                  | —                     | LRTZ 758531 | 300                 | 75                        | 85       | 31       | 1                                           |  | 80                                | 83   | RNA 4915 UU        |  |
|                  | LRT 758535            | —           | 335                 | 75                        | 85       | 35       | 1                                           |  | 80                                | 83   | TAF 8510535        |  |
|                  | LRT 758554            | —           | 520                 | 75                        | 85       | 54       | 1                                           |  | 80                                | 83   | RNA 6915           |  |
| 80               | —                     | LRTZ 758555 | 530                 | 75                        | 85       | 55       | 1                                           |  | 80                                | 83   | RNA 6915 UU        |  |
|                  | LRT 809025            | —           | 255                 | 80                        | 90       | 25       | 1                                           |  | 85                                | 88   | TAF 9011025        |  |
|                  | LRT 809030            | —           | 310                 | 80                        | 90       | 30       | 1                                           |  | 85                                | 88   | RNA 4916           |  |
|                  | LRT 809030-1          | —           | 310                 | 80                        | 90       | 30       | 1.5                                         |  | 88                                | 88.5 | RNAF 9011030       |  |
|                  | —                     | LRTZ 809031 | 315                 | 80                        | 90       | 31       | 1                                           |  | 85                                | 88   | RNA 4916 UU        |  |
|                  | LRT 809035            | —           | 355                 | 80                        | 90       | 35       | 1                                           |  | 85                                | 88   | TAF 9011035        |  |
|                  | LRT 809054            | —           | 550                 | 80                        | 90       | 54       | 1                                           |  | 85                                | 88   | RNA 6916           |  |
|                  | —                     | LRTZ 809055 | 560                 | 80                        | 90       | 55       | 1                                           |  | 85                                | 88   | RNA 6916 UU        |  |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

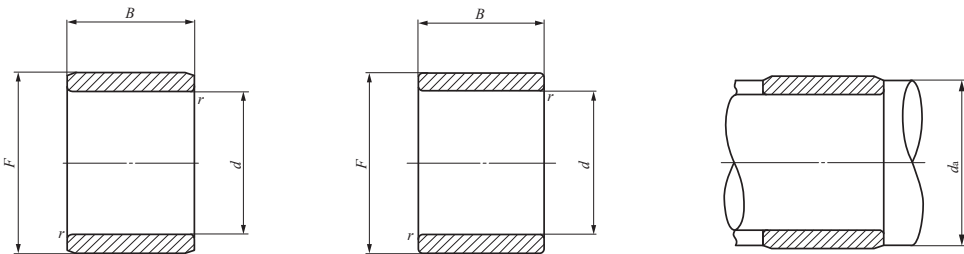
Inner Rings for General Usage



Shaft dia. 85 – 140mm

| Shaft<br>dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |
|---------------------|-----------------------|--------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|
|                     |                       |              |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                    |
| 85                  | LRT 859350            | —            | 440                 | 85                        | 93       | 50.5     | 1                                           | 90                                | 91   | TR 9311850         |
|                     | —                     | LRTZ 859350  | 440                 | 85                        | 93       | 50.5     | 1                                           | 90                                | 91   | GTR 9311850        |
|                     | LRT 859526            | —            | 280                 | 85                        | 95       | 26       | 1                                           | 90                                | 93   | TAF 9511526        |
|                     | LRT 859530            | —            | 330                 | 85                        | 95       | 30       | 1.5                                         | 93                                | 93.5 | RNAF 9511530       |
|                     | LRT 859536            | —            | 390                 | 85                        | 95       | 36       | 1                                           | 90                                | 93   | TAF 9511536        |
|                     | LRT 859545            | —            | 490                 | 85                        | 95       | 45.5     | 1.5                                         | 93                                | 93.5 | TR 9512045         |
|                     | —                     | LRTZ 859545  | 490                 | 85                        | 95       | 45.5     | 1.5                                         | 93                                | 93.5 | GTR 9512045        |
|                     | LRT 8510035           | —            | 575                 | 85                        | 100      | 35       | 1.1                                         | 91.5                              | 98   | RNA 4917           |
|                     | —                     | LRTZ 8510036 | 605                 | 85                        | 100      | 36       | 1.1                                         | 91.5                              | 98   | RNA 4917 UU        |
|                     | LRT 8510063           | —            | 1 040               | 85                        | 100      | 63       | 1.1                                         | 91.5                              | 98   | RNA 6917           |
| 90                  | —                     | LRTZ 8510064 | 1 060               | 85                        | 100      | 64       | 1.1                                         | 91.5                              | 98   | RNA 6917 UU        |
|                     | LRT 9010026           | —            | 295                 | 90                        | 100      | 26       | 1                                           | 95                                | 98   | TAF 10012026       |
|                     | LRT 9010030           | —            | 355                 | 90                        | 100      | 30       | 1.5                                         | 98                                | 98.5 | RNAF 10012030      |
|                     | LRT 9010036           | —            | 415                 | 90                        | 100      | 36       | 1                                           | 95                                | 98   | TAF 10012036       |
|                     | LRT 9010050           | —            | 580                 | 90                        | 100      | 50.5     | 1.5                                         | 98                                | 98.5 | TR 10012550        |
|                     | —                     | LRTZ 9010050 | 580                 | 90                        | 100      | 50.5     | 1.5                                         | 98                                | 98.5 | GTR 10012550       |
|                     | LRT 9010535           | —            | 610                 | 90                        | 105      | 35       | 1.1                                         | 96.5                              | 103  | RNA 4918           |
|                     | —                     | LRTZ 9010536 | 630                 | 90                        | 105      | 36       | 1.1                                         | 96.5                              | 103  | RNA 4918 UU        |
|                     | LRT 9010563           | —            | 1 100               | 90                        | 105      | 63       | 1.1                                         | 96.5                              | 103  | RNA 6918           |
|                     | —                     | LRTZ 9010564 | 1 120               | 90                        | 105      | 64       | 1.1                                         | 96.5                              | 103  | RNA 6918 UU        |
| 95                  | LRT 9510526           | —            | 315                 | 95                        | 105      | 26       | 1                                           | 100                               | 103  | TAF 10512526       |
|                     | LRT 9510536           | —            | 430                 | 95                        | 105      | 36       | 1                                           | 100                               | 103  | TAF 10512536       |
|                     | LRT 9511035           | —            | 650                 | 95                        | 110      | 35       | 1.1                                         | 101.5                             | 108  | RNA 4919           |
|                     | —                     | LRTZ 9511036 | 660                 | 95                        | 110      | 36       | 1.1                                         | 101.5                             | 108  | RNA 4919 UU        |
|                     | LRT 9511063           | —            | 1 160               | 95                        | 110      | 63       | 1.1                                         | 101.5                             | 108  | RNA 6919           |
|                     | —                     | LRTZ 9511064 | 1 180               | 95                        | 110      | 64       | 1.1                                         | 101.5                             | 108  | RNA 6919 UU        |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

LRTZ

| Shaft<br>dia.<br>mm | Identification number |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |       | Assembled bearings |
|---------------------|-----------------------|---------------|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|-------|--------------------|
|                     |                       |               |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max.  |                    |
| 100                 | LRT 10011030          | —             | 380                 | 100                       | 110      | 30       | 1                                           | 105                               | 108   | TAF 11013030       |
|                     | LRT 10011040          | —             | 500                 | 100                       | 110      | 40       | 1                                           | 105                               | 108   | TAF 11013040       |
|                     | LRT 10011050          | —             | 640                 | 100                       | 110      | 50.5     | 1.5                                         | 108                               | 108.5 | TR 11013550        |
|                     | —                     | LRTZ 10011050 | 640                 | 100                       | 110      | 50.5     | 1.5                                         | 108                               | 108.5 | GTR 11013550       |
|                     | LRT 10011540          | —             | 770                 | 100                       | 115      | 40       | 1.1                                         | 106.5                             | 113   | RNA 4920           |
|                     | —                     | LRTZ 10011541 | 780                 | 100                       | 115      | 41       | 1.1                                         | 106.5                             | 113   | RNA 4920 UU        |
| 105                 | LRT 10511550          | —             | 670                 | 105                       | 115      | 50.5     | 1.5                                         | 113                               | 113.5 | TR 11515350        |
|                     | —                     | LRTZ 10511550 | 670                 | 105                       | 115      | 50.5     | 1.5                                         | 113                               | 113.5 | GTR 11515350       |
| 110                 | LRT 11012030          | —             | 410                 | 110                       | 120      | 30       | 1                                           | 115                               | 118   | RNA 4822           |
|                     | LRT 11012540          | —             | 840                 | 110                       | 125      | 40       | 1.1                                         | 116.5                             | 123   | RNA 4922           |
|                     | —                     | LRTZ 11012541 | 870                 | 110                       | 125      | 41       | 1.1                                         | 116.5                             | 123   | RNA 4922 UU        |
| 120                 | LRT 12013030          | —             | 450                 | 120                       | 130      | 30       | 1                                           | 125                               | 128   | RNA 4824           |
|                     | LRT 12013545          | —             | 1 030               | 120                       | 135      | 45       | 1.1                                         | 126.5                             | 133   | RNA 4924           |
|                     | —                     | LRTZ 12013546 | 1 050               | 120                       | 135      | 46       | 1.1                                         | 126.5                             | 133   | RNA 4924 UU        |
| 125                 | LRT 12514060          | —             | 1 460               | 125                       | 140      | 60.5     | 1.5                                         | 133                               | 138   | TR 14017860        |
|                     | —                     | LRTZ 12514060 | 1 460               | 125                       | 140      | 60.5     | 1.5                                         | 133                               | 138   | GTR 14017860       |
| 130                 | LRT 13014535          | —             | 860                 | 130                       | 145      | 35       | 1.1                                         | 136.5                             | 143   | RNA 4826           |
|                     | LRT 13015050          | —             | 1 670               | 130                       | 150      | 50       | 1.5                                         | 138                               | 148   | RNA 4926           |
|                     | —                     | LRTZ 13015051 | 1 720               | 130                       | 150      | 51       | 1.5                                         | 138                               | 148   | RNA 4926 UU        |
| 135                 | LRT 13515060          | —             | 1 560               | 135                       | 150      | 60.5     | 1.5                                         | 143                               | 148   | TR 15018860        |
|                     | —                     | LRTZ 13515060 | 1 560               | 135                       | 150      | 60.5     | 1.5                                         | 143                               | 148   | GTR 15018860       |
| 140                 | LRT 14015535          | —             | 930                 | 140                       | 155      | 35       | 1.1                                         | 146.5                             | 153   | RNA 4828           |
|                     | LRT 14016050          | —             | 1 790               | 140                       | 160      | 50       | 1.5                                         | 148                               | 158   | RNA 4928           |
|                     | —                     | LRTZ 14016051 | 1 830               | 140                       | 160      | 51       | 1.5                                         | 148                               | 158   | RNA 4928 UU        |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

INNER RINGS

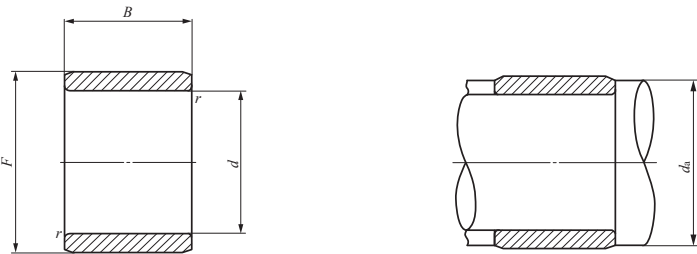
Inner Rings for General Usage



Shaft dia. 150 – 440mm

| Shaft dia.<br>mm | Identification number |   | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |
|------------------|-----------------------|---|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|
|                  |                       |   |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                    |
| 150              | LRT 15016540          | — | 1 130               | 150                       | 165      | 40       | 1.1                                         | 156.5                             | 163  | RNA 4830           |
|                  | LRT 15017060          | — | 2 290               | 150                       | 170      | 60       | 2                                           | 159                               | 168  | RNA 4930           |
| 160              | LRT 16017540          | — | 1 200               | 160                       | 175      | 40       | 1.1                                         | 166.5                             | 173  | RNA 4832           |
|                  | LRT 16018060          | — | 2 440               | 160                       | 180      | 60       | 2                                           | 169                               | 178  | RNA 4932           |
| 170              | LRT 17018545          | — | 1 420               | 170                       | 185      | 45       | 1.1                                         | 176.5                             | 183  | RNA 4834           |
|                  | LRT 17019060          | — | 2 580               | 170                       | 190      | 60       | 2                                           | 179                               | 188  | RNA 4934           |
| 180              | LRT 18019545          | — | 1 500               | 180                       | 195      | 45       | 1.1                                         | 186.5                             | 193  | RNA 4836           |
|                  | LRT 18020569          | — | 3 950               | 180                       | 205      | 69       | 2                                           | 189                               | 203  | RNA 4936           |
| 190              | LRT 19021050          | — | 2 380               | 190                       | 210      | 50       | 1.5                                         | 198                               | 208  | RNA 4838           |
|                  | LRT 19021569          | — | 4 200               | 190                       | 215      | 69       | 2                                           | 199                               | 213  | RNA 4938           |
| 200              | LRT 20022050          | — | 2 520               | 200                       | 220      | 50       | 1.5                                         | 208                               | 218  | RNA 4840           |
|                  | LRT 20022580          | — | 5 000               | 200                       | 225      | 80       | 2.1                                         | 211                               | 223  | RNA 4940           |
| 220              | LRT 22024050          | — | 2 750               | 220                       | 240      | 50       | 1.5                                         | 228                               | 238  | RNA 4844           |
|                  | LRT 22024580          | — | 5 500               | 220                       | 245      | 80       | 2.1                                         | 231                               | 243  | RNA 4944           |
| 240              | LRT 24026560          | — | 4 530               | 240                       | 265      | 60       | 2                                           | 249                               | 262  | RNA 4848           |
|                  | LRT 24026580          | — | 6 000               | 240                       | 265      | 80       | 2.1                                         | 251                               | 262  | RNA 4948           |
| 260              | LRT 26028560          | — | 4 930               | 260                       | 285      | 60       | 2                                           | 269                               | 282  | RNA 4852           |
|                  | LRT 260290100         | — | 9 900               | 260                       | 290      | 100      | 2.1                                         | 271                               | 287  | RNA 4952           |
| 280              | LRT 28030569          | — | 6 050               | 280                       | 305      | 69       | 2                                           | 289                               | 302  | RNA 4856           |
|                  | LRT 280310100         | — | 10 600              | 280                       | 310      | 100      | 2.1                                         | 291                               | 307  | RNA 4956           |
| 300              | LRT 30033080          | — | 9 100               | 300                       | 330      | 80       | 2.1                                         | 311                               | 327  | RNA 4860           |
|                  | LRT 300340118         | — | 18 000              | 300                       | 340      | 118      | 3                                           | 313                               | 337  | RNA 4960           |
| 320              | LRT 32035080          | — | 9 600               | 320                       | 350      | 80       | 2.1                                         | 331                               | 347  | RNA 4864           |
|                  | LRT 320360118         | — | 19 200              | 320                       | 360      | 118      | 3                                           | 333                               | 357  | RNA 4964           |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.



LRT

| Shaft dia.<br>mm | Identification number |   | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |                                             | Standard mounting<br>dimension mm |      | Assembled bearings |
|------------------|-----------------------|---|---------------------|---------------------------|----------|----------|---------------------------------------------|-----------------------------------|------|--------------------|
|                  |                       |   |                     | <i>d</i>                  | <i>F</i> | <i>B</i> | <sup>(1)</sup><br><i>r</i> <sub>s min</sub> | Min.                              | Max. |                    |
| 340              | LRT 34037080          | — | 10 200              | 340                       | 370      | 80       | 2.1                                         | 351                               | 367  | RNA 4868           |
|                  | LRT 340380118         | — | 20 300              | 340                       | 380      | 118      | 3                                           | 353                               | 377  | RNA 4968           |
| 360              | LRT 36039080          | — | 10 800              | 360                       | 390      | 80       | 2.1                                         | 371                               | 387  | RNA 4872           |
|                  | LRT 360400118         | — | 21 500              | 360                       | 400      | 118      | 3                                           | 373                               | 397  | RNA 4972           |
| 380              | LRT 380415100         | — | 16 700              | 380                       | 415      | 100      | 2.1                                         | 391                               | 412  | RNA 4876           |
|                  | LRT 380430140         | — | 33 900              | 380                       | 430      | 140      | 4                                           | 396                               | 427  | RNA 4976           |
| 400              | LRT 400450140         | — | 35 600              | 400                       | 450      | 140      | 4                                           | 416                               | 447  | RNA 4980           |
| 420              | LRT 420470140         | — | 37 300              | 420                       | 470      | 140      | 4                                           | 436                               | 467  | RNA 4984           |
| 440              | LRT 440490160         | — | 44 100              | 440                       | 490      | 160      | 4                                           | 456                               | 487  | RNA 4988           |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remark No oil hole is provided.

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INNER RINGS

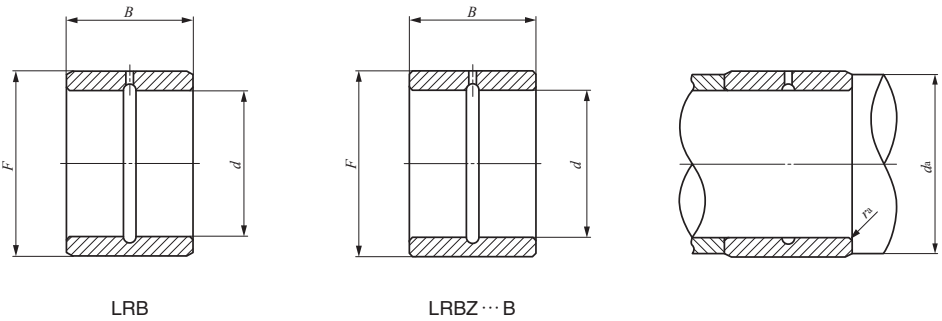
Inner Rings for General Usage **Inch Series**



Shaft dia. 9.525 — 22.225mm

| Shaft dia.<br>mm<br>(inch)                       | Identification number |                      | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm(inch)        |                                          |          | Standard mounting<br>dimensions mm <sup>(1)</sup> |      |                                    |
|--------------------------------------------------|-----------------------|----------------------|---------------------|----------------------------------------|------------------------------------------|----------|---------------------------------------------------|------|------------------------------------|
|                                                  |                       |                      |                     | <i>d</i>                               | <i>F</i>                                 | <i>B</i> | <i>d</i> <sub>a</sub><br>Min.                     | Max. | <i>r</i> <sub>as max</sub><br>Max. |
| <b>9.525</b><br>( <sup>3</sup> / <sub>8</sub> )  | <b>LRB 61012</b>      | —                    | 18.5                | 9.525 ( <sup>3</sup> / <sub>8</sub> )  | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 19.300   | 14                                                | 14.5 | 0.6                                |
|                                                  | —                     | <b>LRBZ 61016 B</b>  | 25                  | 9.525 ( <sup>3</sup> / <sub>8</sub> )  | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 25.650   | 14                                                | 14.5 | 0.6                                |
| <b>12.700</b><br>( <sup>1</sup> / <sub>2</sub> ) | <b>LRB 81212</b>      | —                    | 23.5                | 12.700 ( <sup>1</sup> / <sub>2</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 19.300   | 17.5                                              | 18   | 1                                  |
|                                                  | <b>LRB 81216</b>      | —                    | 31                  | 12.700 ( <sup>1</sup> / <sub>2</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.650   | 17.5                                              | 18   | 1                                  |
|                                                  | —                     | <b>LRBZ 81216 B</b>  | 31                  | 12.700 ( <sup>1</sup> / <sub>2</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 25.650   | 17.5                                              | 18   | 0.6                                |
| <b>15.875</b><br>( <sup>5</sup> / <sub>8</sub> ) | <b>LRB 101412</b>     | —                    | 28                  | 15.875 ( <sup>5</sup> / <sub>8</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 19.300   | 21                                                | 21.2 | 1                                  |
|                                                  | <b>LRB 101416</b>     | —                    | 37.5                | 15.875 ( <sup>5</sup> / <sub>8</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 25.650   | 21                                                | 21.2 | 1                                  |
|                                                  | —                     | <b>LRBZ 101416 B</b> | 37.5                | 15.875 ( <sup>5</sup> / <sub>8</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 25.650   | 21                                                | 21.2 | 0.6                                |
| <b>19.050</b><br>( <sup>3</sup> / <sub>4</sub> ) | <b>LRB 121612</b>     | —                    | 33                  | 19.050 ( <sup>3</sup> / <sub>4</sub> ) | 25.400 ( 1 )                             | 19.300   | 24                                                | 24.4 | 1                                  |
|                                                  | <b>LRB 121616</b>     | —                    | 44                  | 19.050 ( <sup>3</sup> / <sub>4</sub> ) | 25.400 ( 1 )                             | 25.650   | 24                                                | 24.4 | 1                                  |
|                                                  | —                     | <b>LRBZ 121616 B</b> | 44                  | 19.050 ( <sup>3</sup> / <sub>4</sub> ) | 25.400 ( 1 )                             | 25.650   | 24                                                | 24.4 | 0.6                                |
| <b>22.225</b><br>( <sup>7</sup> / <sub>8</sub> ) | <b>LRB 141816</b>     | —                    | 50                  | 22.225 ( <sup>7</sup> / <sub>8</sub> ) | 28.575 ( 1 <sup>1</sup> / <sub>8</sub> ) | 25.650   | 27                                                | 27.5 | 1                                  |
|                                                  | <b>LRB 141820</b>     | —                    | 62                  | 22.225 ( <sup>7</sup> / <sub>8</sub> ) | 28.575 ( 1 <sup>1</sup> / <sub>8</sub> ) | 32.000   | 27                                                | 27.5 | 1                                  |
|                                                  | —                     | <b>LRBZ 141820 B</b> | 62                  | 22.225 ( <sup>7</sup> / <sub>8</sub> ) | 28.575 ( 1 <sup>1</sup> / <sub>8</sub> ) | 32.000   | 27                                                | 27.5 | 0.6                                |

Note(1) Maximum allowable fillet corner radius of shaft  
Remark LRB and LRBZ...B are provided with an oil groove and an oil hole.



| Assembled bearings |  |  |
|--------------------|--|--|
| <b>BR 101812</b>   |  |  |
| <b>BR 101816UU</b> |  |  |
| <b>BR 122012</b>   |  |  |
| <b>BR 122016</b>   |  |  |
| <b>BR 122016UU</b> |  |  |
| <b>BR 142212</b>   |  |  |
| <b>BR 142216</b>   |  |  |
| <b>BR 142216UU</b> |  |  |
| <b>BR 162412</b>   |  |  |
| <b>BR 162416</b>   |  |  |
| <b>BR 162416UU</b> |  |  |
| <b>BR 182616</b>   |  |  |
| <b>BR 182620</b>   |  |  |
| <b>BR 182620UU</b> |  |  |

H  
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INNER RINGS

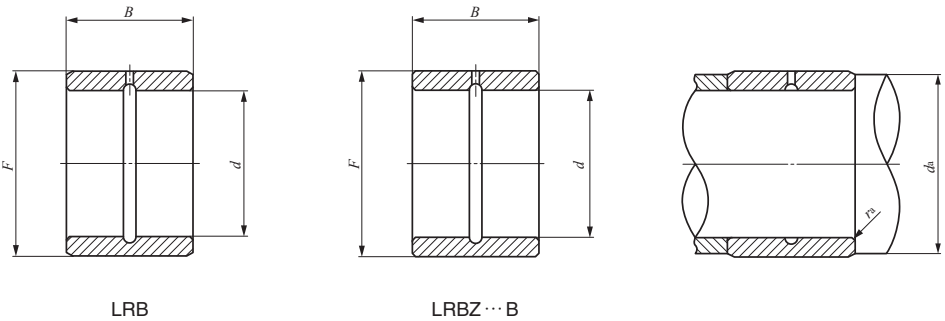
Inner Rings for General Usage **Inch Series**



Shaft dia. 25.400 — 38.100mm

| Shaft dia.<br>mm<br>(inch) | Identification number |               | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm(inch) |                |          | Standard mounting<br>dimensions mm <sup>(1)</sup> |      |                                    |
|----------------------------|-----------------------|---------------|---------------------|---------------------------------|----------------|----------|---------------------------------------------------|------|------------------------------------|
|                            |                       |               |                     | <i>d</i>                        | <i>F</i>       | <i>B</i> | <i>d</i> <sub>a</sub><br>Min.                     | Max. | <i>r</i> <sub>as max</sub><br>Max. |
| 25.400<br>(1)              | LRB 162016            | —             | 56                  | 25.400 (1 )                     | 31.750 (1 1/4) | 25.650   | 30.5                                              | 30.7 | 1                                  |
|                            | LRB 162020            | —             | 72                  | 25.400 (1 )                     | 31.750 (1 1/4) | 32.000   | 30.5                                              | 30.7 | 1                                  |
|                            | —                     | LRBZ 162020 B | 72                  | 25.400 (1 )                     | 31.750 (1 1/4) | 32.000   | 30.5                                              | 30.7 | 0.6                                |
| 28.575<br>(1 1/8)          | LRB 182216            | —             | 63                  | 28.575 (1 1/8)                  | 34.925 (1 3/8) | 25.650   | 33.5                                              | 33.9 | 1                                  |
|                            | LRB 182220            | —             | 77                  | 28.575 (1 1/8)                  | 34.925 (1 3/8) | 32.000   | 33.5                                              | 33.9 | 1                                  |
|                            | —                     | LRBZ 182220 B | 77                  | 28.575 (1 1/8)                  | 34.925 (1 3/8) | 32.000   | 33.5                                              | 33.9 | 0.6                                |
| 31.750<br>(1 1/4)          | LRB 202416            | —             | 71                  | 31.750 (1 1/4)                  | 38.100 (1 1/2) | 25.650   | 37                                                | 37.1 | 1.5                                |
|                            | LRB 202420            | —             | 86                  | 31.750 (1 1/4)                  | 38.100 (1 1/2) | 32.000   | 37                                                | 37.1 | 1.5                                |
|                            | —                     | LRBZ 202420 B | 86                  | 31.750 (1 1/4)                  | 38.100 (1 1/2) | 32.000   | 37                                                | 37.1 | 0.6                                |
| 34.925<br>(1 3/8)          | LRB 222616            | —             | 77                  | 34.925 (1 3/8)                  | 41.275 (1 5/8) | 25.650   | 40.2                                              | 40.2 | 1.5                                |
|                            | LRB 222620            | —             | 96                  | 34.925 (1 3/8)                  | 41.275 (1 5/8) | 32.000   | 40.2                                              | 40.2 | 1.5                                |
|                            | —                     | LRBZ 222620 B | 96                  | 34.925 (1 3/8)                  | 41.275 (1 5/8) | 32.000   | 40.2                                              | 40.2 | 0.6                                |
| 38.100<br>(1 1/2)          | LRB 242816            | —             | 80                  | 38.100 (1 1/2)                  | 44.450 (1 3/4) | 25.650   | 43.3                                              | 43.4 | 1.5                                |
|                            | LRB 242820            | —             | 100                 | 38.100 (1 1/2)                  | 44.450 (1 3/4) | 32.000   | 43.3                                              | 43.4 | 1.5                                |
|                            | LRB 243020            | —             | 155                 | 38.100 (1 1/2)                  | 47.625 (1 7/8) | 32.000   | 43.3                                              | 45   | 1.5                                |
|                            | —                     | LRBZ 242820 B | 100                 | 38.100 (1 1/2)                  | 44.450 (1 3/4) | 32.000   | 43.3                                              | 43.4 | 0.6                                |
|                            | —                     | LRBZ 243020 B | 160                 | 38.100 (1 1/2)                  | 47.625 (1 7/8) | 32.000   | 43.3                                              | 45   | 1                                  |

Note(1) Maximum allowable fillet corner radius of shaft  
Remark LRB and LRBZ...B are provided with an oil groove and an oil hole.



| Assembled bearings |           |  |
|--------------------|-----------|--|
| BR 202816          |           |  |
| BR 202820          |           |  |
| BR 202820UU        |           |  |
| BR 223016          |           |  |
| BR 223020          |           |  |
| BR 223020UU        |           |  |
| BR 243316          |           |  |
| BR 243320          |           |  |
| BR 243320UU        |           |  |
| BR 263516          |           |  |
| BR 263520          |           |  |
| BR 263520UU        |           |  |
| BR 283716          |           |  |
| BR 283720          | BR 283820 |  |
| BR 303920          |           |  |
| BR 283720UU        |           |  |
| BR 303920UU        |           |  |

INNER RINGS

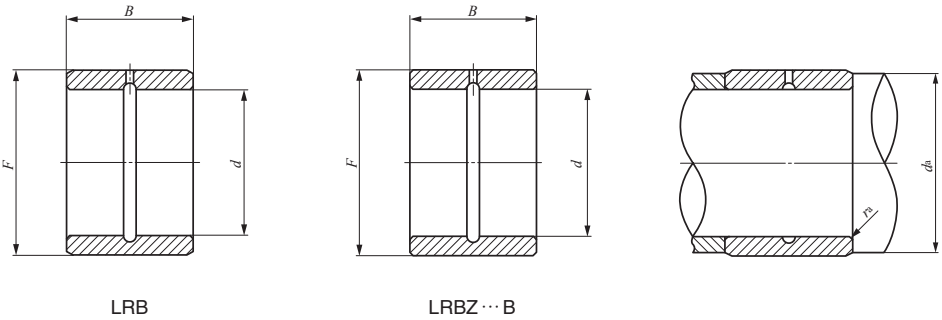
Inner Rings for General Usage **Inch Series**



Shaft dia. 41.275 — 63.500mm

| Shaft dia.<br>mm<br>(inch) | Identification number |               | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm(inch) |                |          | Standard mounting<br>dimensions mm <sup>(1)</sup> |      |                                    |
|----------------------------|-----------------------|---------------|-------------------------|---------------------------------|----------------|----------|---------------------------------------------------|------|------------------------------------|
|                            |                       |               |                         | <i>d</i>                        | <i>F</i>       | <i>B</i> | <i>d</i> <sub>a</sub><br>Min.                     | Max. | <i>r</i> <sub>as max</sub><br>Max. |
| 41.275<br>(1 5/8)          | LRB 263216            | —             | 135                     | 41.275 (1 5/8)                  | 50.800 (2 )    | 25.650   | 48                                                | 49   | 1.5                                |
|                            | LRB 263220            | —             | 170                     | 41.275 (1 5/8)                  | 50.800 (2 )    | 32.000   | 48                                                | 49   | 1.5                                |
|                            | —                     | LRBZ 263220 B | 170                     | 41.275 (1 5/8)                  | 50.800 (2 )    | 32.000   | 48                                                | 49   | 1                                  |
| 44.450<br>(1 3/4)          | LRB 283624            | —             | 300                     | 44.450 (1 3/4)                  | 57.150 (2 1/4) | 38.350   | 52.5                                              | 55   | 1.5                                |
|                            | LRB 283628            | —             | 345                     | 44.450 (1 3/4)                  | 57.150 (2 1/4) | 44.700   | 52.5                                              | 55   | 1.5                                |
|                            | —                     | LRBZ 283628 B | 345                     | 44.450 (1 3/4)                  | 57.150 (2 1/4) | 44.700   | 52.5                                              | 55   | 1.5                                |
| 50.800<br>(2)              | LRB 324024            | —             | 335                     | 50.800 (2 )                     | 63.500 (2 1/2) | 38.350   | 58                                                | 61   | 2                                  |
|                            | LRB 324028            | —             | 390                     | 50.800 (2 )                     | 63.500 (2 1/2) | 44.700   | 58                                                | 61   | 2                                  |
|                            | —                     | LRBZ 324028 B | 390                     | 50.800 (2 )                     | 63.500 (2 1/2) | 44.700   | 58                                                | 61   | 1.5                                |
| 57.150<br>(2 1/4)          | LRB 364424            | —             | 375                     | 57.150 (2 1/4)                  | 69.850 (2 3/4) | 38.350   | 65                                                | 67   | 2                                  |
|                            | LRB 364428            | —             | 440                     | 57.150 (2 1/4)                  | 69.850 (2 3/4) | 44.700   | 65                                                | 67   | 2                                  |
|                            | —                     | LRBZ 364428 B | 440                     | 57.150 (2 1/4)                  | 69.850 (2 3/4) | 44.700   | 65                                                | 67   | 1.5                                |
| 63.500<br>(2 1/2)          | LRB 404824            | —             | 410                     | 63.500 (2 1/2)                  | 76.200 (3 )    | 38.350   | 71                                                | 73   | 2                                  |
|                            | LRB 404828            | —             | 480                     | 63.500 (2 1/2)                  | 76.200 (3 )    | 44.700   | 71                                                | 73   | 2                                  |
|                            | —                     | LRBZ 404828 B | 480                     | 63.500 (2 1/2)                  | 76.200 (3 )    | 44.700   | 71                                                | 73   | 1.5                                |

Note<sup>(1)</sup> Maximum allowable fillet corner radius of shaft  
Remark LRB and LRBZ...B are provided with an oil groove and an oil hole.



| Assembled bearings |  |
|--------------------|--|
| BR 324116          |  |
| BR 324120          |  |
| BR 324120UU        |  |
| BR 364824          |  |
| BR 364828          |  |
| BR 364828UU        |  |
| BR 405224          |  |
| BR 405228          |  |
| BR 405228UU        |  |
| BR 445624          |  |
| BR 445628          |  |
| BR 445628UU        |  |
| BR 486024          |  |
| BR 486028          |  |
| BR 486028UU        |  |

INNER RINGS

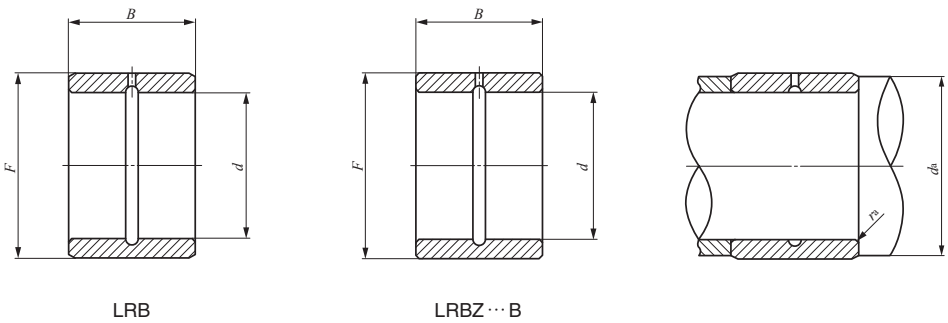
Inner Rings for General Usage **Inch Series**



Shaft dia. 69.850 — 88.900mm

| Shaft dia.<br>mm<br>(inch) | Identification number |               | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm(inch) |             |          | Standard mounting<br>dimensions mm <sup>(1)</sup> |      |                                    |
|----------------------------|-----------------------|---------------|-------------------------|---------------------------------|-------------|----------|---------------------------------------------------|------|------------------------------------|
|                            |                       |               |                         | <i>d</i>                        | <i>F</i>    | <i>B</i> | <i>d</i> <sub>a</sub><br>Min.                     | Max. | <i>r</i> <sub>as max</sub><br>Max. |
| 69.850<br>(2¾)             | LRB 445228            | —             | 530                     | 69.850 (2¾)                     | 82.550 (3¼) | 44.700   | 77                                                | 79   | 2                                  |
|                            | LRB 445232            | —             | 600                     | 69.850 (2¾)                     | 82.550 (3¼) | 51.050   | 77                                                | 79   | 2                                  |
|                            | —                     | LRBZ 445228 B | 530                     | 69.850 (2¾)                     | 82.550 (3¼) | 44.700   | 77                                                | 79   | 1.5                                |
| 76.200<br>(3)              | LRB 485632            | —             | 640                     | 76.200 (3)                      | 88.900 (3½) | 51.050   | 83.5                                              | 86   | 2                                  |
|                            | —                     | LRBZ 485632 B | 640                     | 76.200 (3)                      | 88.900 (3½) | 51.050   | 83.5                                              | 86   | 1.5                                |
| 82.550<br>(3¼)             | LRB 526032            | —             | 690                     | 82.550 (3¼)                     | 95.250 (3¾) | 51.050   | 91                                                | 93   | 2.5                                |
|                            | —                     | LRBZ 526032 B | 690                     | 82.550 (3¼)                     | 95.250 (3¾) | 51.050   | 91                                                | 93   | 1.5                                |
| 88.900<br>(3½)             | LRB 566432            | —             | 750                     | 88.900 (3½)                     | 101.600 (4) | 51.050   | 97                                                | 99   | 2.5                                |

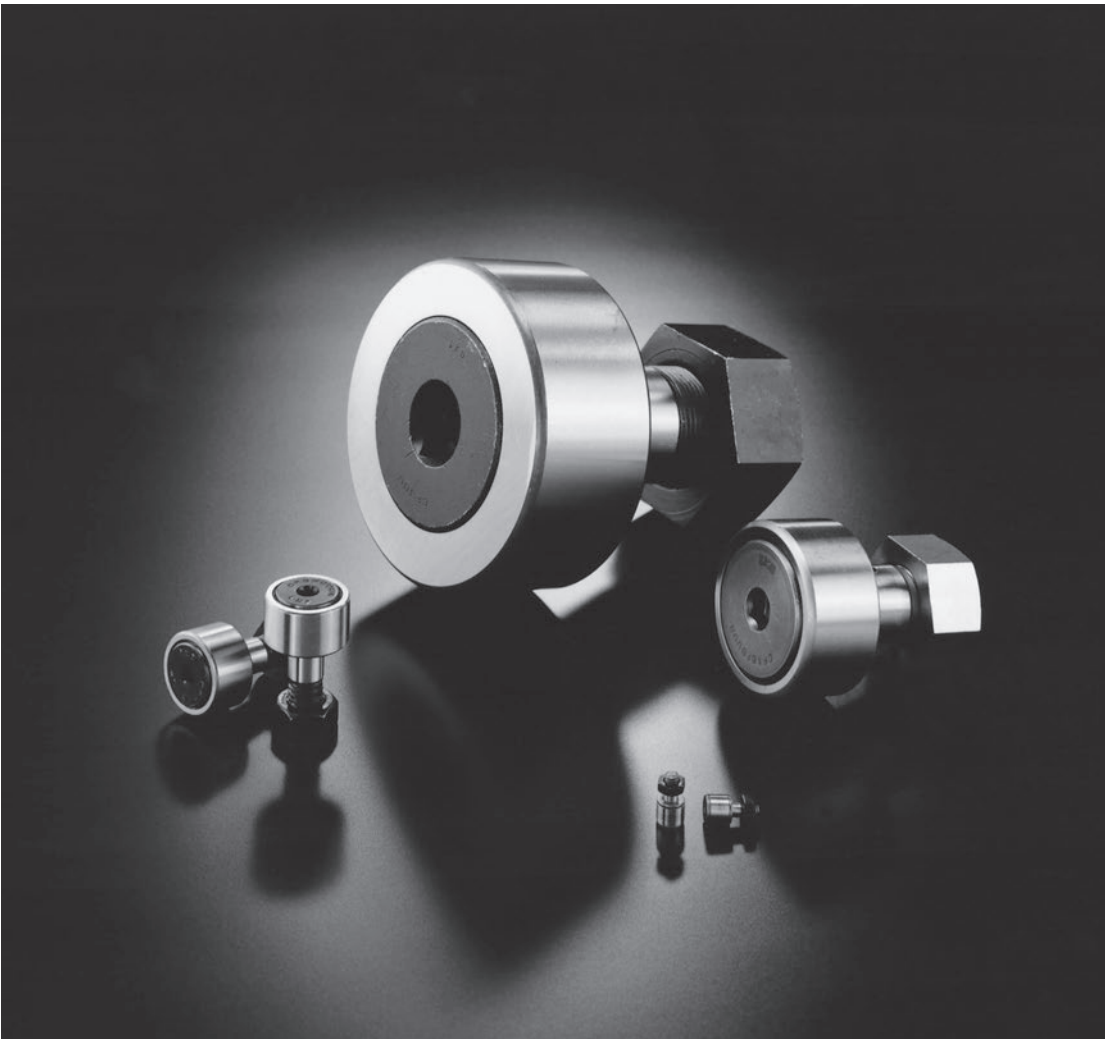
Note<sup>(1)</sup> Maximum allowable fillet corner radius of shaft  
Remark LRB with inner ring bore diameter *d* of 76.200 mm or less and LRBZ···B are provided with an oil groove and an oil hole.  
Other models are provided with an oil groove and two oil holes.



| Assembled bearings |  |
|--------------------|--|
| BR 526828          |  |
| BR 526832          |  |
| BR 526828UU        |  |
| BR 567232          |  |
| BR 567232UU        |  |
| BR 607632          |  |
| BR 607632UU        |  |
| BR 648032          |  |

# CAM FOLLOWERS

- Standard Type Cam Followers
  - Stainless Steel Made Cam Followers
  - Eccentric Type Cam Followers
  - Solid Eccentric Stud Type Cam Followers
  - Thrust Disk Type Cam Followers
  - Centralized Lubrication Type Cam Followers
  - Easy Mounting Type Cam Followers
- Cam Follower G
  - C-Lube Cam Followers
  - Miniature Type Cam Followers
  - Stainless Steel Made Miniature Cam Followers
  - Thrust Disk Type Miniature Cam Followers
  - Cylindrical Roller Cam Followers
  - Inch series Cam Followers

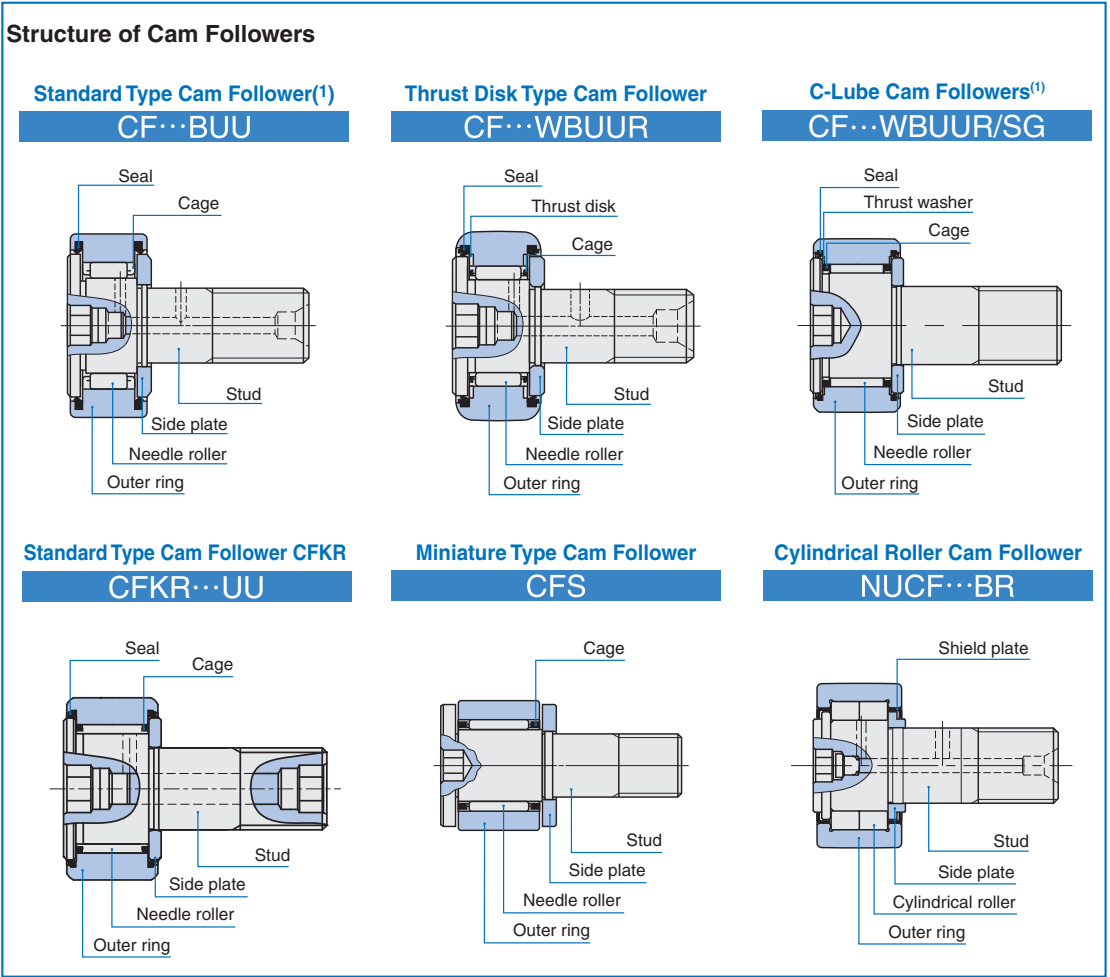


## Structure and Features

IKO Cam Followers are bearings with a stud incorporating needle rollers in a thick walled outer ring. These bearings are designed for outer ring rotation, and have superior rotational performance with a small coefficient of friction and high load capacity. As studs already have threads or steps, they are easy to mount. Cam Followers are follower bearings for cam mechanisms and linear motions and have high rigidity and

high accuracy. They are, therefore, used widely for machine tools, industrial robots, electronic devices, and OA equipment. Stainless steel made Cam Followers are superior in corrosion resistance and suitable for applications in environments where oil cannot be used or water splashed, and in clean rooms.

### Structure of Cam Followers



Note<sup>(1)</sup> Thermosetting solid-type lubricant C-Lube fills inner space of the bearing.

I  
CF  
CFKR  
CFS  
NUCF  
CR

For Cam Followers, the types shown in Table 1 are available.

Table 1 Type of Cam Followers

| Bearing Model                                                      |                        |                        |                                           | Item               | With cage              |                    | Full complement        |           |
|--------------------------------------------------------------------|------------------------|------------------------|-------------------------------------------|--------------------|------------------------|--------------------|------------------------|-----------|
|                                                                    |                        |                        |                                           | Crowned outer ring | Cylindrical outer ring | Crowned outer ring | Cylindrical outer ring |           |
| Standard Type<br>Cam Follower<br>CF...B<br>CFKR                    | High carbon steel made | Stud Head Hex Hole     | Shield type                               | CF ... B R         | CF ... B               | CF ...V B R        | CF ... V B             |           |
|                                                                    | Stainless steel made   |                        | Sealed type                               | CF ... B UUR       | CF ... B UU            | CF ...V B UUR      | CF ... V B UU          |           |
|                                                                    |                        |                        | Shield type                               | CF ...F B R        | CF ...F B              | —                  | —                      |           |
|                                                                    |                        |                        | Sealed type                               | CF ...F B UUR      | CF ...F B UU           | —                  | —                      |           |
|                                                                    |                        | High carbon steel made | Double Hex Hole                           | Shield type        | CFKR... R              | CFKR               | CFKR...V R             | CFKR... V |
|                                                                    | Sealed type            | CFKR... UUR            |                                           | CFKR ... UU        | CFKR...V UUR           | CFKR... V UU       |                        |           |
| Eccentric Type<br>Cam Followers<br>CFE...B<br>CFKRE                | High carbon steel made | Stud Head Hex Hole     | Shield type                               | CFE ... B R        | CFE ... B              | CFE ...V B R       | CFE ... V B            |           |
|                                                                    |                        |                        | Sealed type                               | CFE ... B UUR      | CFE ... B UU           | CFE ...V B UUR     | CFE ... V B UU         |           |
|                                                                    |                        | Double Hex Hole        | Shield type                               | CFKRE ... R        | CFKRE                  | CFKRE...V R        | CFKRE... V             |           |
|                                                                    |                        |                        | Sealed type                               | CFKRE ... UUR      | CFKRE ... UU           | CFKRE...V UUR      | CFKRE... V UU          |           |
| Solid Eccentric<br>Stud Type Cam<br>Followers<br>CFES...B          | High carbon steel made | With hexagon hole      | Shield type                               | CFES... B R        | CFES... B              | —                  | —                      |           |
|                                                                    |                        |                        | Sealed type                               | CFES... B UUR      | CFES... B UU           | —                  | —                      |           |
| Thrust Disk Type<br>Cam Followers<br>CF...WB                       | High carbon steel made | With hexagon hole      | Shield type                               | CF ... WB R        | —                      | —                  | —                      |           |
|                                                                    | Stainless steel made   |                        | Sealed type                               | CF ... WB UUR      | —                      | —                  | —                      |           |
|                                                                    |                        |                        | Shield type                               | CF ...F WB R       | —                      | —                  | —                      |           |
|                                                                    |                        |                        | Sealed type                               | CF ...F WB UUR     | —                      | —                  | —                      |           |
| Centralized<br>Lubrication Type<br>Cam Followers<br>CF-RU1, CF-FU1 | High carbon steel made | With screwdriver slot  | Sealed type                               | CF-RU1             | CF-FU1                 | —                  | —                      |           |
| Easy Mounting<br>Type Cam<br>Followers<br>CF-SFU...B               | High carbon steel made | With hexagon hole      | Sealed type                               | —                  | CF-SFU... B            | —                  | —                      |           |
| Cam Follower G<br>CF...G                                           | High carbon steel made | With hexagon hole      | Shield type                               | —                  | CF ...G                | —                  | —                      |           |
| C-Lube Cam<br>Followers<br>CF...WB.../SG                           | High carbon steel made | With hexagon hole      | Sealed type                               | CF ...WB.../SG     | —                      | —                  | —                      |           |
| Miniature Type<br>Cam Followers<br>CFS                             | High carbon steel made | With hexagon hole      | Shield type                               | —                  | CFS                    | —                  | CFS ... V              |           |
|                                                                    | Stainless steel made   |                        |                                           | —                  | CFS ...F               | —                  | CFS ...F V             |           |
| Thrust Disk Type<br>Miniature Cam<br>Followers<br>CFS...W          | High carbon steel made | With hexagon hole      | Shield type                               | —                  | CFS ... W              | —                  | CFS ...WV              |           |
|                                                                    | Stainless steel made   |                        |                                           | —                  | CFS ...F W             | —                  | —                      |           |
| Cylindrical Roller<br>Cam Followers<br>NUCF...B                    | High carbon steel made | With hexagon hole      | Shield type                               | —                  | —                      | NUCF... B R        | —                      |           |
| Inch series Cam<br>Followers<br>CR                                 | High carbon steel made | With hexagon hole      | Shield type                               | CR ... B R         | CR ...B                | CR ...V B R        | CR ... V B             |           |
|                                                                    |                        |                        | Sealed type                               | CR ... B UUR       | CR ...B UU             | CR ...V B UUR      | CR ... V B UU          |           |
|                                                                    |                        |                        | Sealed type with integrated thrust washer | —                  | —                      | CR ...V B S R      | CR ... V B S           |           |
|                                                                    |                        | With screwdriver slot  | Shield type                               | CR ... R           | CR                     | CR ...V R          | CR ... V               |           |
| Sealed type                                                        | CR ... UUR             |                        | CR ... UU                                 | CR ...V UUR        | CR ... V UU            |                    |                        |           |
| Inch series Cam<br>Followers<br>CRH...B                            | High carbon steel made | With hexagon hole      | Shield type                               | —                  | —                      | CRH...V B R        | CRH... V B             |           |
|                                                                    |                        |                        | Sealed type                               | —                  | —                      | CRH...V B UUR      | CRH... V B UU          |           |

Standard Type Cam Followers

These are the basic type bearings in IKO Cam Follower series. Standard Type Cam Followers CF...B with stud diameters ranging from 3 mm to 30 mm are available, and are suitable for a wide range of applications. Standard Type Cam Followers CFKR have sockets with hexagon holes on both stud ends, which allow mounting with a hexagon wrench from either side.

Eccentric Type Cam Followers

The eccentric stud can be rotated to create a uniform line, enabling easy adjustment for even load distribution across the outer ring outer surface. Eccentricity is 0.4 (CFE) ~ 1.5 mm.

Solid Eccentric Stud Type Cam Followers

The eccentric stud can be rotated to create a uniform line, enabling easy adjustment for even load distribution across the outer ring outer surface. These are eccentric cam followers with an integrated stud that can be mounted in the same mounting holes as those for Standard Type Cam Followers. Eccentricity is from 0.25 mm to 0.6 mm.

Thrust Disk Type Cam Followers

The thrust disk seal, made of special synthetic resin with excellent abrasion and heat resistance, is incorporated in the sliding contact area between the shoulders of the outer ring and the stud head and side plate. This prevents friction and abrasion inside the bearing due to axial loads caused by mounting errors.

Centralized Lubrication Type Cam Followers

These bearings have one or two pipe-threaded holes in the stud. Thus, this series is suitable when centralized lubrication is required.

Easy Mounting Type Cam Followers

These bearings have a stepped tapered portion on the stud. When mounting the Cam Follower, it is easy to fix its location by tightening a set screw to the stepped portion. Thus, this type is suitable when a large number of Cam Followers are used in a machine such as a pallet changer.

C-Lube Cam Followers

These bearings are lubricated with a newly developed thermosetting solid-type lubricant which fills the inner space of the bearing. This lubricant provides long-term maintenance free.

Miniature Type Cam Followers

These are compactly designed bearings, incorporating very thin needle rollers in an outer ring with a small outside diameter. They are used in electronic devices, OA equipment, small index devices, etc.

Cylindrical Roller Cam Followers

These bearings are full complement type bearings incorporating double rows of full complement cylindrical rollers in the outer ring, and can withstand large radial loads. Additionally, the outer ring is guided by the outer ring shoulder and the end face of cylindrical rollers to the axial direction.

Inch series Cam Followers

Two types, CR and CRH, are available in the Inch series Cam Followers. Black oxide film treatment is made on CRH models. CR with ThrustDisk Seals™ prevents the ingress of foreign substances as well as friction and abrasion on the interior of the bearing caused by axial load generated due to mounting errors.

### Lubrication method of Hex Head Cam Followers

(Types) Standard Type, Eccentric Type, Solid Eccentric Stud Type, Thrust Disk Type, Easy Mounting Type, Cylindrical Roller Type.

#### 1 Way

Stud dia. 5~10mm<sup>(1)</sup>

Re-greasing fitting is incorporated in the stud head.

#### 3 Ways

Stud dia. 12~30mm

Grease nipple is incorporated in the stud head.

Remark : All Easy Mounting Type have a 1way port.  
Note <sup>(1)</sup> CFKR and CFKRE can be lubricated from both head part and thread side.  
Also, a grease nipple is built into the stud head.

1N=0.102kgf=0.2248lbs.  
1mm=0.03937inch

14

I3

Internal Structures and Shapes

The Cam Follower series has various types, such as high carbon steel type, stainless steel type, caged type, full complement type, shield type, sealed type,

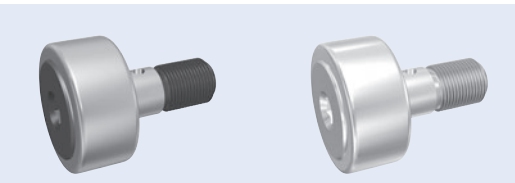
type with crowned outer ring, type with cylindrical outer ring, etc.

Type of material

In addition to high carbon steel products, stainless steel products are also available. Stainless steel products are suited for applications where oil cannot be used or where water splashes, and in cleanrooms.

«High carbon steel made»

«Stainless steel made»

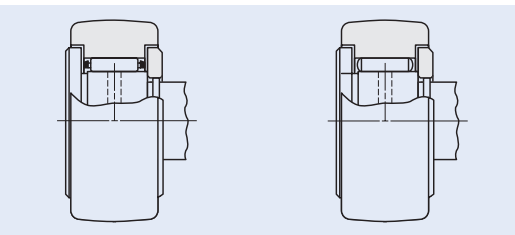


Roller guide method

Cam Followers include the caged type and the full complement type. The caged type has a small coefficient of friction and is suitable for high speed rotations, while the full complement type is suitable for heavy loads at low speed rotations.

«With cage»

«Full complement»

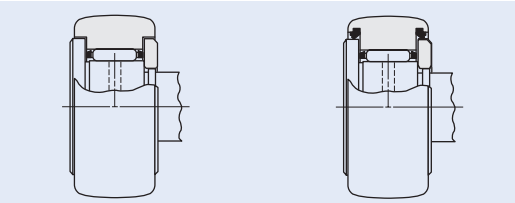


Seal structure

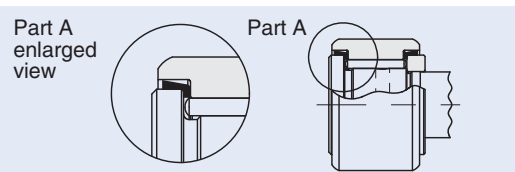
Available Cam Followers include the shield type, the sealed type, and type with ThrustDisk Seals™. In the shield type, labyrinths are formed by the narrow clearances between the outer ring and the stud flange, and between the outer ring and the side plate. The sealed type incorporates seals in the narrow clearances (the shield type labyrinths) to prevent the ingress of foreign substances. The sealed type with ThrustDisk Seals™ prevents grease leakage and the ingress of foreign substances into the bearing interior. It also prevents friction and abrasion on the interior of the bearing caused by axial load generated due to mounting errors.

«Shield type»

«Sealed type»



«Sealed type with integrated thrust washer» (1)



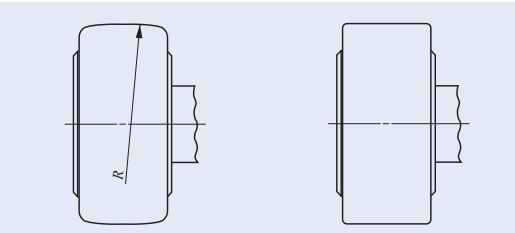
Notes(1) Applicable only to Inch Series Cam Followers CR (Stud Head Hex Hole)

Shape of outer ring outside surface

The outside surface of the outer ring of Cam Followers, which makes direct contact with the mating cam guide surface, is either crowned or cylindrical. The crowned outer rings are effective in moderating the edge load due to mounting errors. The cylindrical outer rings have a large contact area with the mating cam guide surface, and are suitable for applications in which the applied load is large or the cam guide surface hardness is low.

«Crowned outer ring»

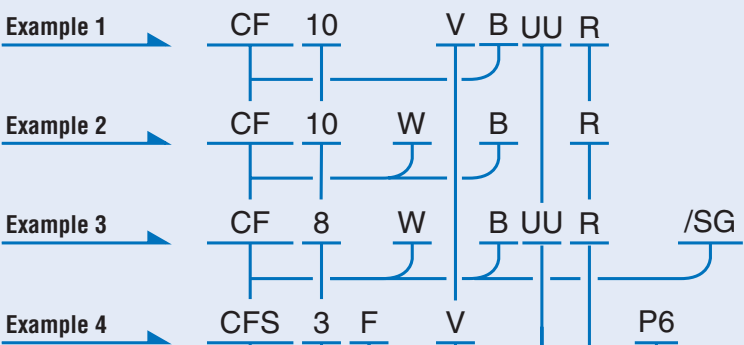
«Cylindrical outer ring»



Identification number

Some examples of the identification number of Cam Followers are shown below. For applicable material symbol, roller guide method, seal structure and shape of outer ring outside surface, refer dimension table of each series.

Examples of identification number



| Model code    |                                                                    |
|---------------|--------------------------------------------------------------------|
| CF...B        | Standard Type Cam Follower(Stud Head Hex Hole)                     |
| CFKR          | Standard Type Cam Follower(Double Hex Hole )                       |
| CFE...B       | Eccentric Type Cam Followers(Stud Head Hex Hole)                   |
| CFKRE         | Eccentric Type Cam Followers(Double Hex Hole )                     |
| CFES...B      | Solid Eccentric Stud Type Cam Followers                            |
| CF...WB       | Thrust Disk Type Cam Followers                                     |
| CF-RU1        | Centralized Lubrication Type Cam Followers(Crowned outer ring)     |
| CF-FU1        | Centralized Lubrication Type Cam Followers(Cylindrical outer ring) |
| CF-SFU...B    | Easy Mounting Type Cam Followers                                   |
| CF...G        | Cam Follower G                                                     |
| CF...WB.../SG | C-Lube Cam Followers                                               |
| CFS           | Miniature Type Cam Followers                                       |
| CFS...W       | Thrust Disk Type Miniature Cam Followers                           |
| NUCF...B      | Cylindrical Roller Cam Followers                                   |
| CR            | Inch series Cam Followers(With screwdriver slot)                   |
| CR...B        | Inch series Cam Followers(Stud Head Hex Hole)                      |
| CRH...B       | Inch series Cam Followers(Stud Head Hex Hole)                      |

| Size                                                                                           |  |
|------------------------------------------------------------------------------------------------|--|
| The value indicates a stud diameter. (unit: mm)                                                |  |
| For Double Hex Hole Cam Followers, the outside diameter of the outer ring is indicated.        |  |
| In the inch series, the outside diameter of the outrerring in units of 1/16 inch is indicated. |  |

| Material  |                        |
|-----------|------------------------|
| No symbol | High carbon steel made |
| F         | Stainless steel made   |

| Roller guide method |                      |
|---------------------|----------------------|
| No symbol           | With cage type       |
| V                   | Full complement type |

| Seal structure |                                           |
|----------------|-------------------------------------------|
| No symbol      | Shield type                               |
| UU             | Sealed type                               |
| S(1)           | Sealed type with integrated thrust washer |

Notes(1) Applicable only to Inch Series Cam Followers CR (Stud Head Hex Hole)

| Shape of outer ring outside surface |                             |
|-------------------------------------|-----------------------------|
| R                                   | With crowned outer ring     |
| No symbol                           | With cylindrical outer ring |

| Classification symbol |         |                                    |
|-----------------------|---------|------------------------------------|
| No symbol             | Class 0 | Applicable to Miniature CFS series |
| P6                    | Class 6 |                                    |
| P5                    | Class 5 |                                    |
| P4                    | Class 4 |                                    |

I  
CF  
CFKR  
CFS  
NUCF  
CR

Accuracy

The accuracy of Cam Followers is shown in Table 2, Table 3.1, Table 3.2 and Table 3.3. Cam Followers with special accuracy are also available. When they are required, please contact IKO.

Table 2 Tolerances

unit:  $\mu$  m

| Series                         | Metric CF <sup>(1)</sup> |                        | Miniature series CF | Inch series CF     |                        |
|--------------------------------|--------------------------|------------------------|---------------------|--------------------|------------------------|
|                                | Crowned outer ring       | Cylindrical outer ring |                     | Crowned outer ring | Cylindrical outer ring |
| Dimensions and symbols         |                          |                        |                     |                    |                        |
| Outside dia. of outer ring $D$ | 0<br>-50                 | See Table 3.1          | See Table 3.2       | 0<br>-50           | See Table 3.3          |
| Stud dia. $d_1$                | h7                       |                        | h6                  | +25<br>0           |                        |
| Width of outer ring $C$        | 0<br>-120                |                        | 0<br>-120           | 0<br>-130          |                        |

Note<sup>(1)</sup> Applicable to Cam Followers other than Miniature Type Cam Followers and Inch Series Cam Followers.

Table 3.1 Tolerances and allowable values of outer rings (Metric CF cylindrical outer rings<sup>(1)</sup>)

unit:  $\mu$  m

| $D$<br>Nominal outside dia. of outer ring<br>mm |       | $\Delta_{Dmp}$<br>Single plane mean outside dia. deviation |     | $V_{Dsp}$<br>Outside dia.<br>variation in a single<br>radial plane (Max.) | $V_{Dmp}$<br>Mean outside dia.<br>variation<br>(Max.) | $K_{ea}$<br>Radial runout of<br>assembled bearing<br>outer ring (Max.) |
|-------------------------------------------------|-------|------------------------------------------------------------|-----|---------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------|
| Over                                            | Incl. | High                                                       | Low |                                                                           |                                                       |                                                                        |
| 6                                               | 18    | 0                                                          | - 8 | 10                                                                        | 6                                                     | 15                                                                     |
| 18                                              | 30    | 0                                                          | - 9 | 12                                                                        | 7                                                     | 15                                                                     |
| 30                                              | 50    | 0                                                          | -11 | 14                                                                        | 8                                                     | 20                                                                     |
| 50                                              | 80    | 0                                                          | -13 | 16                                                                        | 10                                                    | 25                                                                     |
| 80                                              | 120   | 0                                                          | -15 | 19                                                                        | 11                                                    | 35                                                                     |

Note<sup>(1)</sup> Applicable to Cam Followers other than Miniature Type Cam Followers and Inch Series Cam Followers.

Table 3.2 Tolerances and allowable values of outer rings (Miniature series CF)

unit:  $\mu$  m

| $\Delta_{Dmp}$<br>Single plane mean outside dia. deviation |     |         |     |         |     |         |     | $K_{ea}$<br>Radial runout of assembled bearing outer ring<br>(Max.) |         |         |         |
|------------------------------------------------------------|-----|---------|-----|---------|-----|---------|-----|---------------------------------------------------------------------|---------|---------|---------|
| Class 0                                                    |     | Class 6 |     | Class 5 |     | Class 4 |     | Class 0                                                             | Class 6 | Class 5 | Class 4 |
| High                                                       | Low | High    | Low | High    | Low | High    | Low |                                                                     |         |         |         |
| 0                                                          | -8  | 0       | -7  | 0       | -5  | 0       | -4  | 15                                                                  | 8       | 5       | 4       |

Table 3.3 Tolerances and allowable values of outer rings (Inch series CF cylindrical outer ring)

unit:  $\mu$  m

| $D$<br>Nominal outside dia. of outer ring<br>mm |       | $\Delta_{Dmp}$<br>Single plane mean outside dia.<br>deviation |     | $V_{Dsp}$<br>Outside dia.<br>variation in a single<br>radial plane (Max.) | $V_{Dmp}$<br>Mean outside dia.<br>variation<br>(Max.) | $K_{ea}$<br>Radial runout of<br>assembled bearing<br>outer ring (Max.) |
|-------------------------------------------------|-------|---------------------------------------------------------------|-----|---------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------|
| Over                                            | Incl. | High                                                          | Low |                                                                           |                                                       |                                                                        |
| 6                                               | 18    | 0                                                             | -25 | 10                                                                        | 6                                                     | 15                                                                     |
| 18                                              | 30    |                                                               |     | 12                                                                        | 7                                                     | 15                                                                     |
| 30                                              | 50    |                                                               |     | 14                                                                        | 8                                                     | 20                                                                     |
| 50                                              | 80    |                                                               |     | 16                                                                        | 10                                                    | 25                                                                     |
| 80                                              | 120   |                                                               |     | 19                                                                        | 11                                                    | 35                                                                     |

Clearance

The radial internal clearances of Cam Followers are shown in Table 4.

Table 4 Radial internal clearance

unit:  $\mu$  m

| Identification number <sup>(1)</sup> |                                        |                                              |                              | Radial internal clearance |      |
|--------------------------------------|----------------------------------------|----------------------------------------------|------------------------------|---------------------------|------|
| Metric CF series <sup>(2)</sup>      | Miniature CFS series CF <sup>(3)</sup> | Cylindrical Roller Cam Followers<br>NUCF...B | Inch series CF               | Min.                      | Max. |
| CF 3~CF 5                            | CFS1.4 ~CFS5                           | —                                            | CR 8, CR 8-1, CRH 8-1, CRH 9 | 3                         | 17   |
| CF 6                                 | CFS6                                   | —                                            | CR10, CR10-1, CRH10-1, CRH11 | 5                         | 20   |
| CF 8~CF12-1<br>CFKR22~CFKR32         | —                                      | —                                            | CR12~CR22, CRH12~CRH22       | 5                         | 25   |
| CF16~CF20-1<br>CFKR35~CFKR52         | —                                      | —                                            | CR24~CR36, CRH24~CRH36       | 10                        | 30   |
| CF24~CF30-2<br>CFKR62~CFKR90         | —                                      | —                                            | CR48, CRH40~CRH56            | 10                        | 40   |
| —                                    | —                                      | —                                            | CRH64                        | 15                        | 50   |
| —                                    | —                                      | NUCF10 R~NUCF24 R                            | —                            | 20                        | 45   |
| —                                    | —                                      | NUCF24-1R~NUCF30-2R                          | —                            | 25                        | 50   |

Note<sup>(1)</sup> Also applicable to full complement type, type with crowned outer ring, sealed type, and type with hexagon hole.

<sup>(2)</sup> Applicable to all Cam Followers other than Miniature Type Cam Followers, Cylindrical Roller Cam Followers and Inch Series Cam Followers.

<sup>(3)</sup> Applicable to all Miniature Type Cam Followers.

Fit

Tables 5 and 6 show recommended tolerances of mounting holes for Cam Follower studs. Since the Cam Follower is supported in a cantilever position, the mounting hole diameter should be prepared without play between the stud and the hole especially when heavy shock loads are applied.

Table 5 Recommended fit

| Type                             | Tolerance class of mounting hole for stud |
|----------------------------------|-------------------------------------------|
| Metric CF                        | H7                                        |
| Miniature series CF              | H6                                        |
| Cylindrical Roller Cam Followers | H7                                        |
| Inch series CF                   | F7                                        |

Table 6 Dimensional tolerances of mounting hole

unit:  $\mu$  m

| Nominal outside dia. of stud<br>mm |       | F7   |       | H6   |       | H7   |       |
|------------------------------------|-------|------|-------|------|-------|------|-------|
| Over                               | Incl. | Over | Incl. | Over | Incl. | Over | Incl. |
| —                                  | 3     | +16  | + 6   | + 6  | 0     | +10  | 0     |
| 3                                  | 6     | +22  | +10   | + 8  | 0     | +12  | 0     |
| 6                                  | 10    | +28  | +13   | + 9  | 0     | +15  | 0     |
| 10                                 | 18    | +34  | +16   | +11  | 0     | +18  | 0     |
| 18                                 | 30    | +41  | +20   | +13  | 0     | +21  | 0     |
| 30                                 | 50    | +50  | +25   | +16  | 0     | +25  | 0     |

Maximum Allowable Static Load

The applicable load on Cam Followers is, in some cases, limited by the bending strength and shear strength of the stud and the strength of the outer ring instead of the load rating of the needle roller bearing. Therefore, the maximum allowable static load that is limited by these strengths is specified.

Track Capacity

Track capacity is defined as the load which can be continuously applied on a Cam Follower placed on a steel cam guide surface without causing deformation or indentation on the cam guide surface when the outer ring of the Cam Follower makes contact with the mating cam guide surface (plane). The track capacities shown in Tables 7.1 and 7.2 are applicable when the hardness of the mating cam guide surface is 40HRC (Tensile strength 1250N/mm²). When the hardness of the mating cam guide surface differs from 40HRC, the track capacity is obtained by multiplying the value by the track capacity factor shown in Table 8.

If lubrication between the outer ring and the mating cam guide surface is insufficient, seizure and/or wear may occur depending on the application. Therefore, attention must be paid to lubrication and surface roughness of the mating cam guide especially for high-speed rotations such as cam mechanisms.

For lubrication between the outer ring and the mating cam guide surface, C-Lube Unit for Cam Followers is recommended. (See page I20.)

Table 7.1 Track load capacity

unit: N

| Type of bearing                    | Identification number with crowned outer ring | Track capacity | Identification number with cylindrical outer ring | Track capacity |
|------------------------------------|-----------------------------------------------|----------------|---------------------------------------------------|----------------|
| Metric CF <sup>(1)</sup>           | CF 3 R                                        | 542            | CF 3                                              | 1 360          |
|                                    | CF 4 R                                        | 712            | CF 4                                              | 1 790          |
|                                    | CF 5 R                                        | 794            | CF 5                                              | 2 210          |
|                                    | CF 6 R                                        | 1 040          | CF 6                                              | 3 400          |
|                                    | CF 8 R                                        | 1 330          | CF 8                                              | 4 040          |
|                                    | CF10 R • CFKR22R                              | 1 610          | CF10 • CFKR22                                     | 4 680          |
|                                    | CF10-1R • CFKR26R                             | 2 030          | CF10-1 • CFKR26                                   | 5 530          |
|                                    | CF12 R • CFKR30R                              | 2 470          | CF12 • CFKR30                                     | 7 010          |
|                                    | CF12-1R • CFKR32R                             | 2 710          | CF12-1 • CFKR32                                   | 7 480          |
|                                    | CF16 R • CFKR35R                              | 3 060          | CF16 • CFKR35                                     | 11 200         |
|                                    | CF18 R • CFKR40R                              | 3 660          | CF18 • CFKR40                                     | 14 500         |
|                                    | CF20 R • CFKR52R                              | 5 190          | CF20 • CFKR52                                     | 23 200         |
|                                    | CF20-1R • CFKR47R                             | 4 530          | CF20-1 • CFKR47                                   | 21 000         |
|                                    | CF24 R • CFKR62R                              | 6 580          | CF24 • CFKR62                                     | 34 300         |
|                                    | CF24-1R • CFKR72R                             | 8 020          | CF24-1 • CFKR72                                   | 39 800         |
|                                    | CF30 R • CFKR80R                              | 9 220          | CF30 • CFKR80                                     | 52 700         |
|                                    | CF30-1R • CFKR85R                             | 9 990          | CF30-1 • CFKR85                                   | 56 000         |
|                                    | CF30-2R • CFKR90R                             | 10 800         | CF30-2 • CFKR90                                   | 59 300         |
| Miniature series CF <sup>(2)</sup> | —                                             | —              | CFS1.4                                            | 128            |
|                                    | —                                             | —              | CFS2                                              | 220            |
|                                    | —                                             | —              | CFS2.5                                            | 298            |
|                                    | —                                             | —              | CFS3                                              | 485            |
|                                    | —                                             | —              | CFS4                                              | 799            |
|                                    | —                                             | —              | CFS5                                              | 1 210          |
|                                    | —                                             | —              | CFS6                                              | 1 680          |

Notes<sup>(1)</sup> Applicable to Cam Followers other than Miniature Type Cam Followers and Inch Series Cam Followers.  
<sup>(2)</sup> This table is applicable to all Miniature Type Cam Followers.

Table 7.2 Track capacity

unit: N

| Type of bearing               | Identification number with crowned outer ring | Track capacity | Identification number with cylindrical outer ring | Track capacity | Identification number with crowned outer ring | Track capacity | Identification number with cylindrical outer ring | Track capacity |
|-------------------------------|-----------------------------------------------|----------------|---------------------------------------------------|----------------|-----------------------------------------------|----------------|---------------------------------------------------|----------------|
| Inch series CF <sup>(1)</sup> | CR 8 R                                        | 770            | CR 8                                              | 2 140          | —                                             | —              | —                                                 | —              |
|                               | CR 8-1R                                       | 770            | CR 8-1                                            | 2 360          | CRH 8-1R                                      | 401            | CRH 8-1                                           | 2 360          |
|                               | —                                             | —              | —                                                 | —              | CRH 9 R                                       | 469            | CRH 9                                             | 2 650          |
|                               | CR10 R                                        | 1 030          | CR10                                              | 3 210          | —                                             | —              | —                                                 | —              |
|                               | CR10-1R                                       | 1 030          | CR10-1                                            | 3 480          | CRH10-1R                                      | 579            | CRH10-1                                           | 3 480          |
|                               | —                                             | —              | —                                                 | —              | CRH11 R                                       | 658            | CRH11                                             | 3 830          |
|                               | CR12 R                                        | 1 340          | CR12                                              | 4 500          | CRH12 R                                       | 853            | CRH12                                             | 4 500          |
|                               | CR14 R                                        | 1 630          | CR14                                              | 5 250          | CRH14 R                                       | 1 050          | CRH14                                             | 5 250          |
|                               | CR16 R                                        | 1 970          | CR16                                              | 7 280          | CRH16 R                                       | 1 420          | CRH16                                             | 7 280          |
|                               | CR18 R                                        | 2 300          | CR18                                              | 7 710          | CRH18 R                                       | 1 660          | CRH18                                             | 7 710          |
|                               | CR20 R                                        | 2 680          | CR20                                              | 10 700         | CRH20 R                                       | 2 160          | CRH20                                             | 10 700         |
|                               | CR22 R                                        | 3 050          | CR22                                              | 11 800         | CRH22 R                                       | 2 450          | CRH22                                             | 11 800         |
|                               | CR24 R                                        | 3 410          | CR24                                              | 15 400         | CRH24 R                                       | 3 410          | CRH24                                             | 15 400         |
|                               | CR26 R                                        | 3 820          | CR26                                              | 16 700         | CRH26 R                                       | 3 820          | CRH26                                             | 16 700         |
|                               | CR28 R                                        | 4 210          | CR28                                              | 21 000         | CRH28 R                                       | 4 210          | CRH28                                             | 21 000         |
|                               | CR30 R                                        | 4 610          | CR30                                              | 22 500         | CRH30 R                                       | 4 610          | CRH30                                             | 22 500         |
|                               | CR32 R                                        | 5 050          | CR32                                              | 30 900         | CRH32 R                                       | 5 690          | CRH32                                             | 30 900         |
|                               | CR36 R                                        | 5 900          | CR36                                              | 34 700         | CRH36 R                                       | 6 640          | CRH36                                             | 34 700         |
|                               | —                                             | —              | —                                                 | —              | CRH40 R                                       | 8 970          | CRH40                                             | 45 000         |
|                               | —                                             | —              | —                                                 | —              | CRH44 R                                       | 10 200         | CRH44                                             | 49 500         |
|                               | —                                             | —              | CR48                                              | 64 300         | CRH48 R                                       | 11 400         | CRH48                                             | 64 300         |
|                               | —                                             | —              | —                                                 | —              | CRH52 R                                       | 12 700         | CRH52                                             | 69 600         |
|                               | —                                             | —              | —                                                 | —              | CRH56 R                                       | 14 100         | CRH56                                             | 87 000         |
|                               | —                                             | —              | —                                                 | —              | CRH64 R                                       | 16 800         | CRH64                                             | 113 000        |

Notes<sup>(1)</sup> This table is applicable to all Inch series CF.

Table 8 Track capacity factor

| Hardness HRC | Tensile strength N/mm² | Track capacity factor   |                             |
|--------------|------------------------|-------------------------|-----------------------------|
|              |                        | With crowned outer ring | With cylindrical outer ring |
| 20           | 760                    | 0.22                    | 0.37                        |
| 25           | 840                    | 0.31                    | 0.46                        |
| 30           | 950                    | 0.45                    | 0.58                        |
| 35           | 1 080                  | 0.65                    | 0.75                        |
| 38           | 1 180                  | 0.85                    | 0.89                        |
| 40           | 1 250                  | 1.00                    | 1.00                        |
| 42           | 1 340                  | 1.23                    | 1.15                        |
| 44           | 1 435                  | 1.52                    | 1.32                        |
| 46           | 1 530                  | 1.85                    | 1.51                        |
| 48           | 1 635                  | 2.27                    | 1.73                        |
| 50           | 1 760                  | 2.80                    | 1.99                        |
| 52           | 1 880                  | 3.46                    | 2.29                        |
| 54           | 2 015                  | 4.21                    | 2.61                        |
| 56           | 2 150                  | 5.13                    | 2.97                        |
| 58           | 2 290                  | 6.26                    | 3.39                        |

Allowable Rotational Speed

The allowable rotational speed of Cam Followers is affected by mounting and operating conditions. For  $d_1n$  values with only pure radial load applied, use the maximum values in Table 9 or lower as a guideline. Under actual operating conditions, use the recommended  $d_1n$  values in Table 9 as a guideline in consideration of the effect of axial loads. For C-Lube Cam Followers, use a  $d_1n$  value of 10,000 or less as a guideline.

Table 9  $d_1n$  values of Cam Followers<sup>(1)</sup>

| Type                            | Grease  |             | Oil     |             |
|---------------------------------|---------|-------------|---------|-------------|
|                                 | Maximum | Recommended | Maximum | Recommended |
| Caged type                      | 84 000  | 8 400       | 140 000 | 14 000      |
| Full complement type            | 42 000  | 4 200       | 70 000  | 7 000       |
| Cylindrical Roller Cam Follower | 66 000  | 6 600       | 110 000 | 11 000      |
| C-Lube Cam Followers            | 10 000  |             | 10 000  |             |

Note<sup>(1)</sup>  $d_1n$  value =  $d_1 \times n$   
where,  $d_1$ <sup>(2)</sup>: Stud diameter mm  
 $n$ : Rotational speed min<sup>-1</sup>  
<sup>(2)</sup> For Eccentric Type Cam Followers, thread diameter  $G$  as shown in the dimension table is applicable.

Table 10 Bearings with prepacked grease

○ : Prepacked    × : Not prepacked

| Item<br>Series<br>Size of stud diameter $d_1$ <sup>(1)</sup> mm |                              |        | With cage         |                       |                   |                       | Full complement |
|-----------------------------------------------------------------|------------------------------|--------|-------------------|-----------------------|-------------------|-----------------------|-----------------|
|                                                                 |                              |        | Shield type       |                       | Sealed type       |                       |                 |
|                                                                 |                              |        | With hexagon hole | With screwdriver slot | With hexagon hole | With screwdriver slot |                 |
| Standard Type Cam Follower                                      | CF···B<br>CFKR               | 3~ 5   | ○                 | —                     | ○                 | —                     | —               |
| Eccentric Type Cam Followers                                    | CFE···B<br>CFKRE             | 6~ 10  |                   |                       |                   |                       | ○               |
| Solid Eccentric Stud Type Cam Followers                         | CFES···B                     | 12~ 30 | ×                 | —                     | —                 | —                     |                 |
| Thrust Disk Type Cam Followers                                  | CF···WB                      |        |                   |                       |                   |                       |                 |
| Centralized Lubrication Type Cam Followers                      | CF-RU1, CF-FU1               |        | —                 | —                     | —                 | ○                     | —               |
| Easy Mounting Type Cam Followers                                | CF-SFU···B                   |        | —                 | —                     | ○                 | —                     | —               |
| Cam Follower G                                                  | CF···G                       |        | ○                 | —                     | —                 | —                     | —               |
| C-Lube Cam Followers                                            | CF···WB···/SG <sup>(2)</sup> |        | —                 | —                     | ×                 | —                     | —               |
| Miniature Type Cam Followers                                    | CFS<br>CFS···W               |        | ○                 | —                     | —                 | —                     | ○               |
| Cylindrical Roller Cam Followers                                | NUCF···B                     |        | —                 | —                     | —                 | —                     | ○               |
| Inch series Cam Followers                                       | CR, CR···B                   |        | ○                 | ○                     | ○                 | ○                     | ○               |
|                                                                 | CRH···B                      |        | —                 | —                     | —                 | —                     | ○               |

Notes<sup>(1)</sup> For Eccentric Type Cam Followers, thread diameter  $G$  as shown in the dimension table is applicable.  
<sup>(2)</sup> C-Lube, a thermosetting solid-type lubricant, fills the inner space of the bearing.

Lubrication

Grease-prepacked Cam Followers are shown in Table 10. The lubricating grease prepacked in these bearings is ALVANIA GREASE S2 (Shell Lubricants Japan K.K.). For Cam Followers without prepacked grease, grease should be packed through the oil hole in the stud for use. If they are used without grease, wear of rolling contact surfaces may take place, leading to a short bearing life.

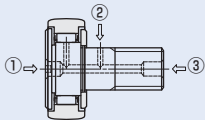
Oil Hole

The position of oil hole is shown in Table 11. Perform greasing quietly by fitting a lubrication nozzle indicated in Table 12 to a straight type grease gun in JIS B 9808 and pressing the nozzle against the grease nipple or re-greasing fitting. Due to their structures, lubrication is not possible for sizes 3 and 4 Standard Type Cam Followers CF···B, C-Lube Cam Followers, Cam Followers G and Miniature CFS series.

Table 11 Position of oil hole

○ : Oil hole is prepared.

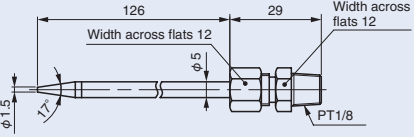
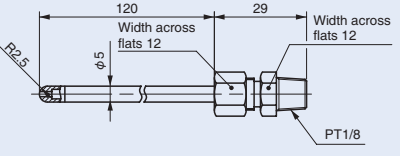
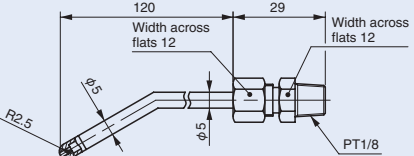
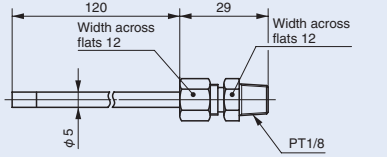
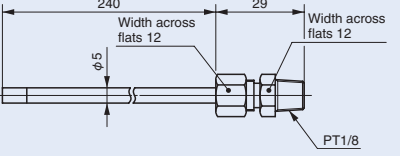
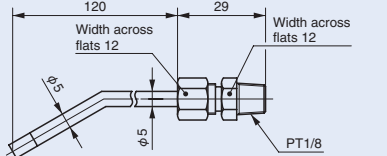
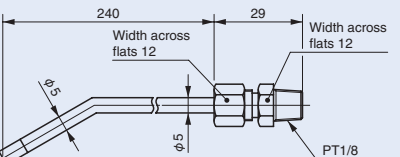
| Oil hole position                          |                                               |                       | ① Head           | ② Stud outside surface | ③ Stud end |
|--------------------------------------------|-----------------------------------------------|-----------------------|------------------|------------------------|------------|
| Series                                     | Size of stud diameter $d_1$ <sup>(1)</sup> mm |                       |                  |                        |            |
| Standard Type Cam Follower                 | CF···B                                        | $d_1 < 5$             | —                | —                      | —          |
| Eccentric Type Cam Followers               | CFE···B                                       | $5 \leq d_1 \leq 10$  | ○ <sup>(3)</sup> | —                      | —          |
| Solid Eccentric Stud Type Cam Followers    | CFES···B                                      | $10 < d_1$            | ○ <sup>(2)</sup> | ○                      | ○          |
| Thrust Disk Type Cam Followers             | CF···WB                                       | $d_1 \leq 10$         | ○ <sup>(2)</sup> | —                      | ○          |
| Standard Type Cam Follower                 | CFKR                                          | $10 < d_1$            | ○ <sup>(2)</sup> | ○                      | ○          |
| Eccentric Type Cam Followers               | CFKRE                                         | $d_1 \leq 12$         | ○                | —                      | —          |
| Centralized Lubrication Type Cam Followers | CF-RU1, CF-FU1 <sup>(4)</sup>                 | $12 < d_1$            | ○                | ○                      | ○          |
| Easy Mounting Type Cam Followers           | CF-SFU···B                                    | $d_1 \leq 10$         | ○ <sup>(3)</sup> | —                      | —          |
| Cam Follower G                             | CF···G                                        | $10 < d_1$            | ○ <sup>(5)</sup> | —                      | —          |
| C-Lube Cam Followers                       | CF···WB···/SG                                 |                       | —                | —                      | —          |
| Miniature Type Cam Followers               | CFS                                           |                       | —                | —                      | —          |
|                                            | CFS···W                                       |                       | —                | —                      | —          |
| Cylindrical Roller Cam Followers           | NUCF···B                                      | $d_1 \leq 10$         | ○ <sup>(3)</sup> | —                      | —          |
|                                            |                                               | $10 < d_1$            | ○ <sup>(2)</sup> | ○                      | ○          |
| Inch series Cam Followers                  | CR···B                                        | With hexagon hole     | $d_1 \leq 6.35$  | —                      | —          |
|                                            |                                               |                       | $6.35 < d_1$     | —                      | ○          |
|                                            | CR                                            | With screwdriver slot | $d_1 \leq 6.35$  | ○                      | —          |
|                                            |                                               |                       | $6.35 < d_1$     | ○                      | ○          |
|                                            | CRH···B                                       | With hexagon hole     | $d_1 \leq 7.938$ | —                      | —          |
|                                            |                                               |                       | $7.938 < d_1$    | —                      | ○          |



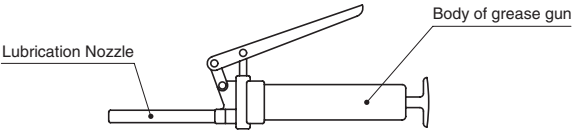
Notes<sup>(1)</sup> In case of Eccentric Type Cam Followers, thread diameter  $G$  shown in the table of dimensions is applicable in place of stud dia. and the oil hole on the outer surface of the stud cannot be used for lubrication.  
<sup>(2)</sup> Grease nipple is incorporated in the hexagon hole. Re-greasing can be made from the stud head and the stud end by press fitting a supplied grease nipple into the stud end. See page 14.  
<sup>(3)</sup> Re-lubrication can be made from the re-greasing fitting that is inserted into the hexagon hole. See page 14.  
<sup>(4)</sup> Tapped holes for oil connectors are provided at the stud end and hole of the head.  
<sup>(5)</sup> Re-greasing can be made from the grease nipple in the hexagon hole.

I  
CF  
CFKR  
CFS  
NUCF  
CR

Table 12 Type and Dimension of Lubrication Nozzles

| Type    | Dimension                                                                           | Applicable grease nipple and re-grease fitting                                   |
|---------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| A-5126T |    | NPF3 <sup>(1)</sup><br>NPF6-1 <sup>(1)</sup><br>Re-grease fitting <sup>(1)</sup> |
| A-5120R |    | NPF4-1 <sup>(1)</sup><br>NPF6-1 <sup>(1)</sup>                                   |
| B-5120R |    |                                                                                  |
| A-5120V |    | NPT4-1<br>NPT6-1<br>NPB2<br>NPB3<br>NPB3-1<br>NPB4                               |
| A-5240V |   |                                                                                  |
| B-5120V |  |                                                                                  |
| B-5240V |  |                                                                                  |

Note<sup>(1)</sup> HSP-3(Yamada Corporation)can be used for them.  
Remark The above nozzles can be attached on the standard grease gun shown below.  
If required, please consult to IKO with type of lubrication nozzle.



Accessories

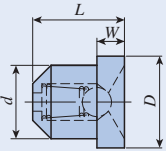
Cam Follower accessories are shown in Table 13.  
Grease nipple dimensions are shown in Table 14 and Table 15. Dimensions of plug for unused oil hole and dimensions of plug inserter are shown in Table 16.  
Nut dimensions are shown in Table 17 and Table 18.

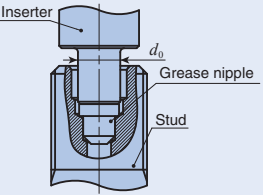
Table 13 Accessories

| Accessories                                |                            |                       | ○ : Attached  |      |     |                  |
|--------------------------------------------|----------------------------|-----------------------|---------------|------|-----|------------------|
| Series                                     | Size of stud dia. $d_1$ mm |                       | Grease nipple | Plug | Nut | Spring washer    |
| Standard Type Cam Follower                 | CF...B                     | $d_1 \leq 10$         | —             | —    | ○   | — <sup>(2)</sup> |
| Eccentric Type Cam Followers               | CFE...B                    |                       | —             | —    | ○   | — <sup>(2)</sup> |
| Solid Eccentric Stud Type Cam Followers    | CFES...B                   | $10 < d_1$            | ○             | —    | ○   | — <sup>(2)</sup> |
| Thrust Disk Type Cam Followers             | CF...WB                    |                       | ○             | —    | ○   | — <sup>(2)</sup> |
| Standard Type Cam Follower                 | CFKR                       | $d_1 \leq 10$         | ○             | —    | ○   | — <sup>(2)</sup> |
| Eccentric Type Cam Followers               | CFKRE                      |                       | ○             | —    | ○   | — <sup>(2)</sup> |
| Centralized Lubrication Type Cam Followers | CF-RU1, CF-FU1             | $d_1 \leq 10$         | —             | —    | ○   | —                |
| Easy Mounting Type Cam Followers           | CF-SFU...B                 |                       | —             | —    | —   | —                |
| Cam Follower G                             | CF...G                     | $d_1 \leq 6.35$       | —             | —    | ○   | —                |
| C-Lube Cam Followers                       | CF...WB.../SG              |                       | —             | —    | ○   | —                |
| Miniature Type Cam Followers               | CFS, CFS...W               | $6.35 < d_1$          | —             | —    | ○   | —                |
| Cylindrical Roller Cam Followers           | NUCF...B                   |                       | —             | —    | ○   | —                |
| Inch series Cam Followers                  | CR...B                     | With hexagon hole     | —             | —    | ○   | —                |
|                                            | CR                         | With screwdriver slot | ○             | ○    | ○   | —                |
|                                            | CRH...B                    | With hexagon hole     | —             | —    | ○   | —                |
|                                            | CRH...B                    | With hexagon hole     | ○             | ○    | ○   | —                |

Notes <sup>(1)</sup> For Eccentric Type Cam Follower, thread diameter G is applied.  
<sup>(2)</sup> Eccentric Type Cam Followers are supplied with spring washers.  
Remark: The standard grease nipple (brass) is included in the Stainless Steel Made Cam Follower.  
When a stainless steel grease nipple is required, please contact IKO.

Table 14 Dimensions of grease nipple for Standard Type Cam Followers <sup>(1)</sup>

|  |                                |     |     |     |                                       |                          |
|---------------------------------------------------------------------------------------|--------------------------------|-----|-----|-----|---------------------------------------|--------------------------|
| Identification number                                                                 | Dimensions of grease nipple mm |     |     |     | Stud diameter $d_1$ <sup>(2)</sup> mm | Dimension of inserter mm |
|                                                                                       | $d$                            | $D$ | $L$ | $W$ |                                       | $d_0^{+0.05/-0.05}$      |
| NPF3 <sup>(3)</sup>                                                                   | 3                              | 4   | 4.5 | 1.3 | 10                                    | 4.1                      |
| NPF4-1                                                                                | 4                              | 5   | 5   | 1.5 | 12~16                                 | 5.3                      |
| NPF6-1                                                                                | 6                              | 7   | 8   | 2   | 18~30                                 | 7.3                      |



Notes <sup>(1)</sup> Applicable to Cam Followers other than Inch series Cam Followers.  
<sup>(2)</sup> For Eccentric Type Cam Followers, thread diameter G as shown in the dimension table is applicable.  
<sup>(3)</sup> Only applicable to Standard Type Cam Follower CFKR, and Eccentric Type Cam Follower CFKRE sizes 22 and 26.  
Remark The same grease nipple as the accessory is integrated in the hexagon hole on the head.

Table 15 Dimensions of grease nipple for Inch series Cam Followers

| Identification number | Dimensions mm |          |                       |          |                       |          | Applicable Cam Followers     |
|-----------------------|---------------|----------|-----------------------|----------|-----------------------|----------|------------------------------|
|                       | <i>d</i>      | <i>D</i> | <i>D</i> <sub>1</sub> | <i>L</i> | <i>L</i> <sub>1</sub> | <i>W</i> |                              |
| NPB2                  | 3.18          | 7.5      | 6                     | 9        | 5.5                   | 1.5      | CR8 ~ CR10-1, CRH8-1 ~ CRH11 |
| NPB3                  | 4.76          | 7.5      | 6                     | 10       | 5.5                   | 1.5      | CR12 ~ CR22, CRH12 ~ CRH22   |
| NPB3-1                | 4.76          | 7.5      | 6                     | 12.5     | 5.5                   | 1.55     | CR24 ~ CR36, CRH24 ~ CRH44   |
| NPB4                  | 6.35          | 8        | 6                     | 13       | 6                     | 2        | CR48, CRH48 ~ CRH64          |

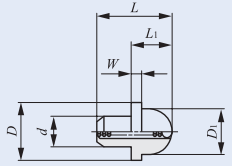
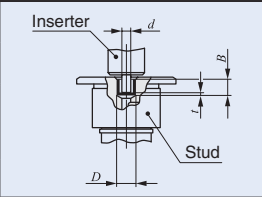


Table 16 Dimensions of plug for Inch series Cam Followers

| Identification number | Dimensions of plug mm |          |          | Dimension of inserter mm  | Applicable bearings (1)    |
|-----------------------|-----------------------|----------|----------|---------------------------|----------------------------|
|                       | <i>D</i>              | <i>t</i> | <i>B</i> | <i>d</i> <sub>0-0.1</sub> |                            |
| USB2F                 | 3.18                  | 0.3      | 3.3      | 2.3                       | CR 8 ~ CR10-1              |
| USB3F                 | 4.76                  | 0.4      | 4.3      | 3.7                       | CR12 ~ CR36, CRH12 ~ CRH44 |
| USB4F                 | 6.35                  | 0.5      | 4.8      | 5.2                       | CR48, CRH48 ~ CRH64        |



Note(1) Shows representative types.

Table 18 Inch series nut dimensions

| Model of bearing | Stud diameter <i>d</i> <sub>1</sub> (inch) | Nut dimensions mm |          |          |          |
|------------------|--------------------------------------------|-------------------|----------|----------|----------|
|                  |                                            | <i>G</i> UNF      | <i>m</i> | <i>s</i> | <i>e</i> |
| CR<br>CRH        | 4.826                                      | No.10-32          | 4        | 8        | 9.2      |
|                  | 6.35 ( 1/4 )                               | 1/4-28            | 5.5      | 10       | 11.5     |
|                  | 7.938 ( 5/16 )                             | 5/16-24           | 6.5      | 12       | 13.8     |
|                  | 9.525 ( 3/8 )                              | 3/8-24            | 8        | 14       | 16.2     |
|                  | 11.112 ( 7/16 )                            | 7/16-20           | 10       | 17       | 19.5     |
|                  | 12.7 ( 1/2 )                               | 1/2-20            | 11       | 19       | 21.9     |
|                  | 15.875 ( 5/8 )                             | 5/8-18            | 14       | 23       | 26.5     |
|                  | 19.05 ( 3/4 )                              | 3/4-16            | 16       | 26       | 30       |
|                  | 22.225 ( 7/8 )                             | 7/8-14            | 19       | 32       | 37       |
|                  | 25.4 ( 1 )                                 | 1 -14UNS          | 22       | 36       | 41.4     |
|                  | 28.575 ( 1 1/8 )                           | 1 1/8-12          | 24       | 41       | 47.1     |
|                  | 31.75 ( 1 1/4 )                            | 1 1/4-12          | 27       | 46       | 53.5     |
|                  | 38.1 ( 1 1/2 )                             | 1 1/2-12          | 33       | 55       | 63.5     |
|                  | 44.45 ( 1 3/4 )                            | 1 3/4-12UN        | 38       | 65       | 75.1     |
|                  | 50.8 ( 2 )                                 | 2 -12UN           | 44       | 75       | 86.6     |

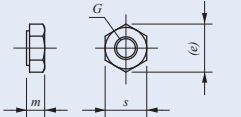
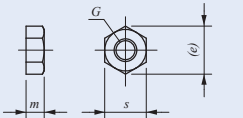


Table 17 Metric series nut dimensions

| Model of bearing                                                                                                          | Stud diameter <i>d</i> <sub>1</sub> (1) | Nut dimensions mm        |          |          |          |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------|----------|----------|----------|
|                                                                                                                           |                                         | <i>G</i>                 | <i>m</i> | <i>s</i> | <i>e</i> |
| CF<br>CFKR<br>CFES<br>CFE<br>CFKRE<br>CF...W<br>CF-RU1<br>CF-FU1<br>CF...G<br>CF...WB.../SG<br>CFS<br>CFS...W<br>NUCF...B | 1.4                                     | M 1.4×0.3                | 1.1      | 3        | 3.25     |
|                                                                                                                           | 2                                       | M 2 ×0.4                 | 1.6      | 4        | 4.6      |
|                                                                                                                           | 2.5                                     | M 2.5×0.45               | 2        | 5        | 5.8      |
|                                                                                                                           | 3                                       | M 3 ×0.5                 | 2.4      | 5.5      | 6.4      |
|                                                                                                                           | 4                                       | M 4 ×0.7                 | 3.2      | 7        | 8.1      |
|                                                                                                                           | 5                                       | M 5 ×0.8                 | 4        | 8        | 9.2      |
|                                                                                                                           | 6                                       | M 6 ×1                   | 5        | 10       | 11.5     |
|                                                                                                                           | 8                                       | M 8 ×1.25                | 6.5      | 13       | 15       |
|                                                                                                                           | 10                                      | M10 ×1.0(2)<br>M10 ×1.25 | 8        | 17       | 19.6     |
|                                                                                                                           | 12                                      | M12 ×1.5                 | 10       | 19       | 21.9     |
|                                                                                                                           | 16                                      | M16 ×1.5                 | 13       | 24       | 27.7     |
|                                                                                                                           | 18                                      | M18 ×1.5                 | 15       | 27       | 31.2     |
|                                                                                                                           | 20                                      | M20 ×1.5                 | 16       | 30       | 34.6     |
|                                                                                                                           | 24                                      | M24 ×1.5                 | 19       | 36       | 41.6     |
|                                                                                                                           | 30                                      | M30 ×1.5                 | 24       | 46       | 53.1     |



Note(1) For Eccentric Type Cam Followers, thread diameter *G* as shown in the dimension table is applicable.

Note(2) Applicable to Standard Type Cam Follower CFKR, and Eccentric Type Cam Follower CFKRE.

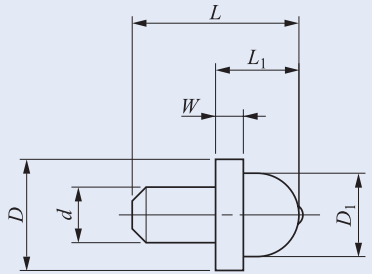
Special Specification

The grease nipple supplied with Metric series Cam Follower with hexagon socket as an accessory may be replaced with the NPT type grease nipple indicated in Table 19 upon your request. If required, please order with supplemental code, "/NP" at the end of identification number.

Example of Identification Number  
CF 12 BUU / NP

Table 19 Dimension of NPT type grease nipple

| Code number | Dimension of grease nipple mm |          |                       |          |                       |          | Size of stud dia. <i>d</i> <sub>1</sub> (1)<br>mm |
|-------------|-------------------------------|----------|-----------------------|----------|-----------------------|----------|---------------------------------------------------|
|             | <i>d</i>                      | <i>D</i> | <i>D</i> <sub>1</sub> | <i>L</i> | <i>L</i> <sub>1</sub> | <i>W</i> |                                                   |
| NPT4-1      | 4                             | 8        | 6                     | 12       | 6                     | 2        | 12 ~ 16                                           |
| NPT6-1      | 6                             | 8        | 6                     | 14       | 8                     | 4        | 18 ~ 30                                           |

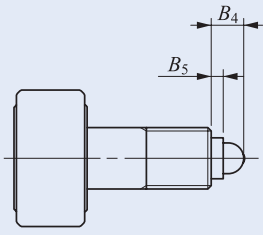


Note(1) For Eccentric Type Cam Follower CFE, thread diameter *G* is applied.

Remark Not applicable to Standard Type Cam Follower CFKR, and Eccentric Type Cam Follower CFKRE.

Table 20 Dimension of assembled NPT type grease nipple

| Code number | Dimension mm          |                       | Size of stud dia. <i>d</i> <sub>1</sub> (1)<br>mm |
|-------------|-----------------------|-----------------------|---------------------------------------------------|
|             | <i>B</i> <sub>4</sub> | <i>B</i> <sub>5</sub> |                                                   |
| NPT4-1      | 6                     | 2                     | 12 ~ 16                                           |
| NPT6-1      | 8                     | 4                     | 18 ~ 30                                           |

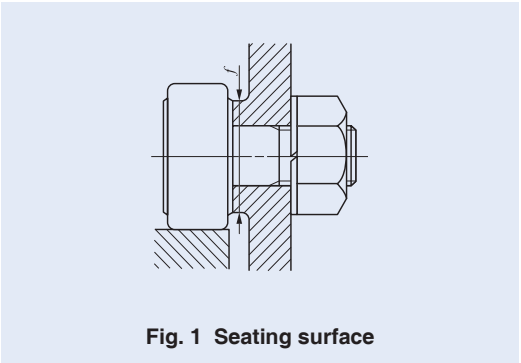


Note(1) For Eccentric Type Cam Follower CFE, thread diameter *G* is applied.

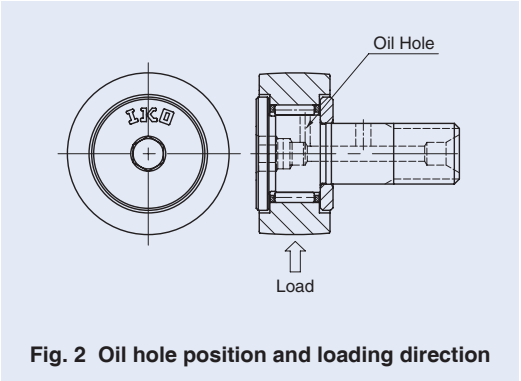
I  
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CFS  
NUCF  
CR

Mounting

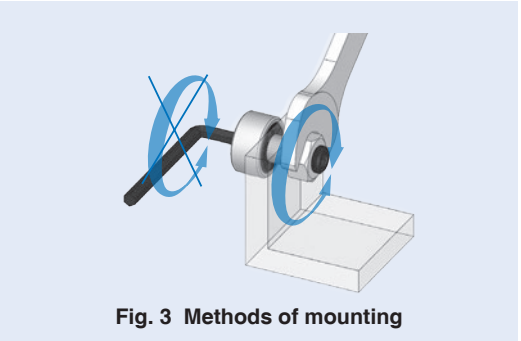
①Make the center axis of the mounting hole perpendicular to the moving direction of the Cam Follower and match the side shoulder accurately with the seating surface indicated by dimension *f* in the table of dimensions. (See Fig. 1)  
The chamfered mounting hole should be as small as possible (C0.5 or so).  
When mounting Cam Followers, do not hit the flange head of the Cam Follower directly with a hammer, etc. This may lead to a bearing failure such as irregular rotation or cracking.  
If the Cam Follower outer ring is not in good contact with the mating running surface then we recommend use of a crowned outer ring type.



②The **IKO** mark on the flange head of the stud indicates the position of the oil hole on the raceway. Avoid locating the oil hole within the loading zone. This may lead to a short bearing life. (See Fig. 2.) The hole located in the middle part of the stud perpendicular to the stud center axis is used for greasing or locking.

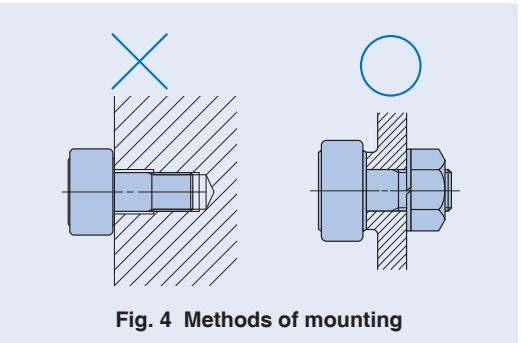


③When mounting Cam Followers, fix in place by holding the hexagon hole or screwdriver slot with a hex wrench or slotted screwdriver and use a wrench to tighten on a nut. (See Fig. 3)  
If mounting by turning the hexagon hole or screwdriver slot itself, the hexagon hole or screwdriver slot of the Cam Follower may become damaged.



④When tightening the nut, the tightening torque should not exceed the values shown in the table of dimensions. If the tightening torque is too large, it is possible that the threaded portion of the stud will be broken. When there is a possibility of loosening, a special nut such as a lock nut, spring washer, or self-locking nut should be used.

⑤When direct-fixing the Cam Follower without nuts for mounting as shown in Fig. 4, it may be difficult to achieve sufficient tightening torque. If the screw then loosens, stress may concentrate on the thread, causing the stud to break. Such a method is not recommended.



⑥Solid Eccentric Stud Type Cam Followers and Eccentric Type Cam Followers, are mounted in reference position where **IKO** mark on the head of stud is located as Fig.5. The outer ring position can be adjusted appropriately by turning the stud with a screwdriver or hexagon bar wrench using the screwdriver slot or hexagon hole of the stud head. The stud is fixed with a nut and a spring washer, etc. The tightening torque should not exceed the values of maximum tightening torque shown in the table of dimensions.

When shock loads are applied and the adjusted eccentricity has to be ensured, it is recommended to make holes in the housing, stud and eccentric collar, and fix the stud with a dowel pin as shown in Fig. 6. However, when the stud diameter is less than 8 mm (Eccentric collar diameter 11 mm), it is difficult to make a hole in the stud because the stud is through-hardened.

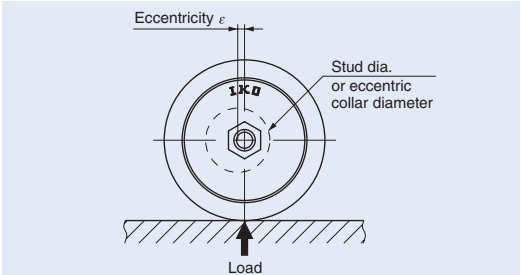


Fig. 5 Reference position for adjusting of Solid Eccentric Stud Type Cam Followers and Eccentric Type Cam Followers

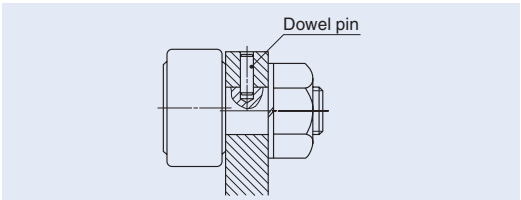


Fig. 6 Mounting example of Solid Eccentric Stud Type Cam Follower

Operating Temperature Range

Operating temperature range of Cam Followers is -20°C ~ +120°C. However, note that the maximum allowable temperature varies in models shown in Table 21.

Table 21 Limitation of operating temperature range

| Model<br>Stud diameter <i>d</i> <sub>1</sub> mm                                              |                                        | Item                         |                             | With cage         | Full complement |
|----------------------------------------------------------------------------------------------|----------------------------------------|------------------------------|-----------------------------|-------------------|-----------------|
|                                                                                              |                                        | Shield type                  | Sealed type                 | ThrustDisk Seals™ |                 |
| Miniature Type<br>Cam Followers CFS<br>Thrust Disk Type<br>Miniature Cam Followers CFS ... W | <i>d</i> <sub>1</sub> = 2              | -20°C ~ 110°C <sup>(1)</sup> | —                           | —                 | —               |
| Standard Type<br>Cam Followers CF ... B                                                      | <i>d</i> <sub>1</sub> = 3,4            | -20°C ~ 110°C <sup>(1)</sup> | -20°C ~ 80°C                | —                 | —               |
| Thrust Disk Type<br>Cam Followers CF ... WB                                                  | <i>d</i> <sub>1</sub> = 5              | -20°C ~ 120°C                | —                           | —                 | —               |
| Standard Type Cam Followers /<br>Stainless Steel Made CF ... FB                              | 3 ≤ <i>d</i> <sub>1</sub> ≤ 5          | -20°C ~ 110°C <sup>(1)</sup> | -20°C ~ 80°C                | —                 | —               |
| Thrust Disk Type Cam Followers /<br>Stainless Steel Made CF ... FWB                          |                                        | —                            | —                           | —                 | —               |
| C-Lube Cam Followers<br>CF ... WB ... /SG                                                    | 5 ≤ <i>d</i> <sub>1</sub> ≤ 20         | —                            | -15°C ~ 80°C <sup>(2)</sup> | —                 | —               |
| Inch Series Cam Followers<br>ThrustDisk Seals™<br>CR ... VBS                                 | 4.826 ≤ <i>d</i> <sub>1</sub> ≤ 22.225 | —                            | —                           | -20°C ~ 80°C      | —               |

Notes<sup>(1)</sup> 100°C when used continuously.  
<sup>(2)</sup> Below 60°C is recommended for long use.

⑦The length of a mounting hole for Eccentric Type Cam Followers must be at least that of the *S* dimension in Fig. 7.

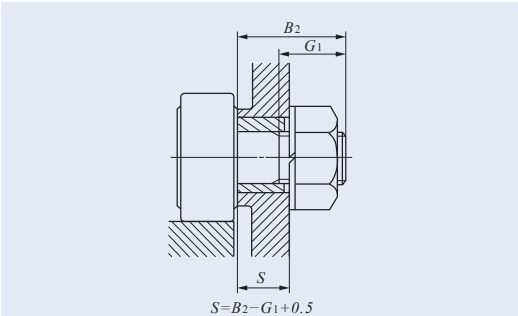
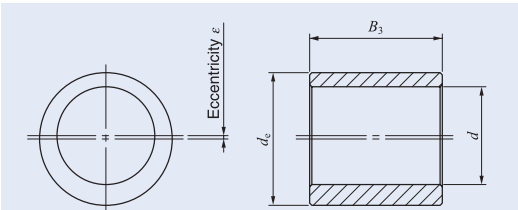


Fig. 7 Length of the mounting hole of Eccentric Type Cam Follower

⑧Eccentric collar is available for Inch series Cam Followers.  
Cam Followers with Eccentric collars, CRE are also available. If required, please consult with IKO.

Table 20 Eccentric collars for Inch series Cam Followers



unit: mm

| Identifica-<br>number<br>of collar | Outer diameter<br>of collar<br><i>d<sub>ε</sub></i> | Length<br>of collar<br><i>B<sub>3</sub></i> | Eccentri-<br>city<br><i>ε</i> | Stud dia.<br><i>d</i> | Applicable<br>Cam Followers  |
|------------------------------------|-----------------------------------------------------|---------------------------------------------|-------------------------------|-----------------------|------------------------------|
| EB 8                               | 6.350 ( 1/4 )                                       | 6.350 ( 1/4 )                               | 0.250                         | 4.826                 | CR 8<br>CR 8-1 (V)(B)(UU)(R) |
| EB10                               | 9.525 ( 3/8 )                                       | 9.525 ( 3/8 )                               | 0.380                         | 6.350 ( 1/4 )         | CR10<br>CR10-1 (V)(B)(UU)(R) |
| EB12                               | 12.700 ( 1/2 )                                      | 12.700 ( 1/2 )                              | 0.380                         | 9.525 ( 3/8 )         | CR12<br>CR14 (V)(B)(UU)(R)   |
| EB16                               | 15.875 ( 5/8 )                                      | 15.875 ( 5/8 )                              | 0.760                         | 11.112 ( 7/16 )       | CR16<br>CR18 (V)(B)(UU)(R)   |
| EB20                               | 17.450                                              | 17.450                                      | 0.760                         | 12.700 ( 1/2 )        | CR20<br>CR22 (V)(B)(UU)(R)   |
| EB24                               | 22.225 ( 7/8 )                                      | 22.225 ( 7/8 )                              | 0.760                         | 15.875 ( 5/8 )        | CR24<br>CR26 (V)(B)(UU)(R)   |
| EB28                               | 25.400 ( 1 )                                        | 25.400 ( 1 )                                | 0.760                         | 19.050 ( 3/4 )        | CR28<br>CR30 (V)(B)(UU)(R)   |
| EB32                               | 30.150                                              | 30.150                                      | 0.760                         | 22.225 ( 7/8 )        | CR32<br>CR36 (V)(B)(UU)(R)   |
| EB48                               | 44.450 ( 1 3/4 )                                    | 44.450 ( 1 3/4 )                            | 1.520                         | 31.750 ( 1 1/4 )      | CR48 VUU                     |

⑨For mounting Easy Mounting Type Cam Followers, it is recommended to fix the fixing screw from the upper side to the stepped portion of the stud. (See Fig. 8.)  
While M5 - M6 screws are generally used as fixing screws, adjust the size used depending on the usage criteria.

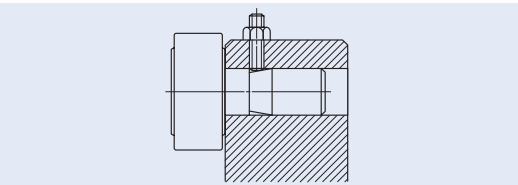


Fig. 8 Mounting example of Easy Mounting Type Cam Follower

■ Precaution For Use

- ①Do not wash C-Lube Cam Follower with organic solvent and/or white kerosene, which have the ability of removing fat nor leave them in contact with the above agents.
- ②To ensure normal rotation of the C-Lube Cam Follower, apply a load of 1% or over of the dynamic load rating at use.

Option Parts

C-Lube Unit for Cam Followers

■ Structure and features

IKO C-Lube unit for Cam Follower is a lubrication part to be mounted on the Cam Follower and its integral capillary lubricating element has a lot of lubrication oil impregnated in it.  
The capillary lubricating element is consecutive porous resin formed by sinter molding of fine resin powder and a lot of lubrication oil is impregnated in it by using the capillary action that occurs within the internal space.

Regular lubrication is not needed as lubrication oil is supplied onto the outside diameter surface of the outer ring and mating guide surface (cam guide surface). The grease is not scattered and contamination of the surrounding environment is prevented.  
The combination with IKO C-Lube cam follower (See Page I55) realizes maintenance-free cam follower inside and cam guide surface.

Structure of C-Lube Unit for Cam Followers

C-Lube unit

C-Lube

IKO C-Lube Cam Follower

Magnified photos of C-Lube

Before impregnating oil

Fusion- bonded

Resin particles are strongly fusion bonded.

After impregnating oil

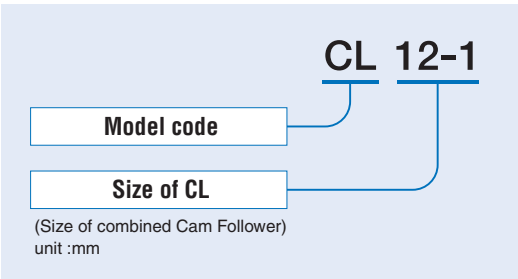
Resin part

Lubricant part

Lubricant is retained in cavities amongst resin particles.

■ Identification number

The identification number example of IKO C-Lube Unit is shown below.



■ Allowable Rotational speed

The Rotational speed of IKO Cam Follower with C-Lube Unit should not exceeded  $d_1n=10,000$  for reference.

$d_1n=d_1 \times n$   
 $d_1$  : Stud diameter of Cam Follower, mm  
 $n$  : Rotational speed, min<sup>-1</sup>

■ Minimum rotational angle

Lubricating oil is supplied to the whole external diameter surface of the outer ring. Accordingly, use the product in a condition in which the outer ring makes one or more turns.

■ Operating temperature

Allowable operating temperature range of IKO Cam Follower with C-Lube Unit is -15 to 80°C.

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Mounting

1Set the C-Lube Unit perpendicularly to the center axis of Cam Follower and fix together with Cam Follower by tightening nut. (See Fig. 9.)

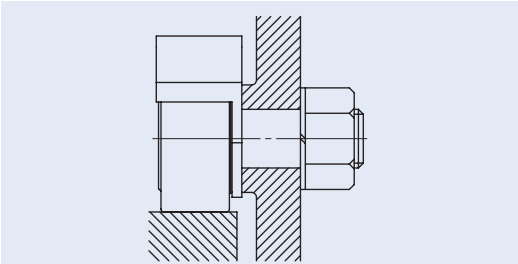


Fig. 9 Mounting of C-Lube Unit

2Position of C-Lube Unit is adjustable. C-Lube Unit must be positioned avoiding loading direction. (See Fig. 10.)

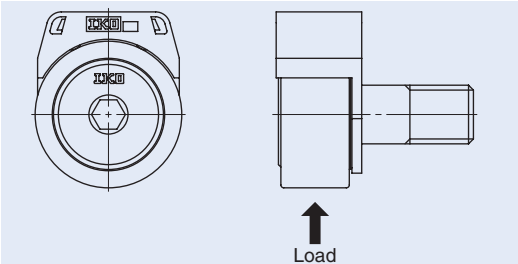


Fig. 10 Load direction of Cam Follower

3When tightening the nut, the tightening torque should not be exceeded the value maximum tightening torque on dimension table. In case loosening of the nut is predicted due to vibration, using lock nut, spring washer and other special washer are recommended.

Precaution for use

1Do not wash with organic solvent and/or white kerosene, which have the ability of removing fat nor leave them in contact with the above agents.

2Do not apply a load onto the C-Lube Unit directly.

3To ensure normal rotation of the Cam Follower, apply a load of 1% or over of the dynamic load rating at use. Also, the outer ring needs to be rotate over a revolution to supply lubricant on entire outer diameter surface.

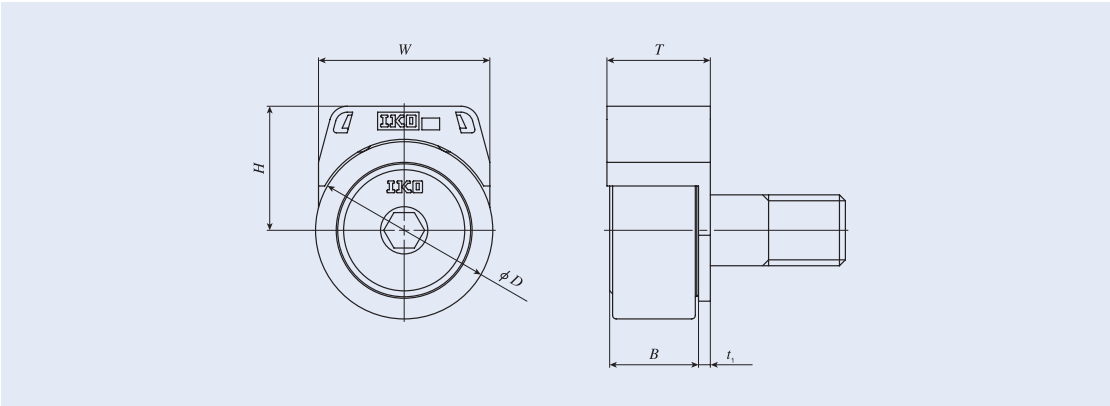
4The maximum allowable load on IKO Cam Follower with C-Lube Unit is, 80% of the maximum allowable load of the needle bearing. C-Lube Unit may be damaged and influenced to the smooth rotation and lubricating performance by excessive load.

5After assembling C-Lube Unit and Cam Followers in the machine, please confirm that C-Lube unit provides oil correctly to the cam guide surface before actual operation.

6Do not use in the environment which contamination of liquid and/or harmful foreign matter are expected.

7Replace with new C-Lube Unit when inside oil finishes completely. Re-lubrication is not possible.

Table 21 Dimensions of C-Lube Unit for Cam Followers



| Model number | Boundary Dimensions mm |      |      |                | Applicable Cam Followers |                        |          |
|--------------|------------------------|------|------|----------------|--------------------------|------------------------|----------|
|              | W                      | H    | T    | t <sub>1</sub> | Model number (1)         | Boundary Dimensions mm |          |
|              |                        |      |      |                |                          | D                      | B        |
| CL 5         | 12.4                   | 10.7 | 12.1 | 1.5            | CF 5 B                   | 13                     | 10       |
| CL 6         | 15.4                   | 12.6 | 14   | 1.5            | CF 6 B                   | 16                     | 12.2 max |
| CL 8         | 18.4                   | 14.2 | 14   | 1.5            | CF 8 B                   | 19                     | 12.2 max |
| CL 10        | 21                     | 17   | 15.5 | 2              | CF 10 B<br>CFKR 22       | 22                     | 13.2 max |
| CL 10-1      | 21                     | 19.2 | 15.5 | 2              | CF 10-1 B<br>CFKR 26     | 26                     | 13.2 max |
| CL 12        | 29                     | 21   | 17.5 | 2              | CF 12 B<br>CFKR 30       | 30                     | 15.2 max |
| CL 12-1      | 29                     | 22   | 17.5 | 2              | CF 12-1 B<br>CFKR 32     | 32                     | 15.2 max |
| CL 16        | 33.8                   | 27.4 | 23.4 | 2.5            | CF 16 B<br>CFKR 35       | 35                     | 19.6 max |
| CL 18        | 38.8                   | 30.4 | 25.4 | 2.5            | CF 18 B<br>CFKR 40       | 40                     | 21.6 max |
| CL 20        | 45.8                   | 38.4 | 29.9 | 3              | CF 20 B<br>CFKR 52       | 52                     | 25.6 max |
| CL 20-1      | 45.8                   | 35.4 | 29.9 | 3              | CF 20-1 B<br>CFKR 47     | 47                     | 25.6 max |

Note(1) Only representative identification numbers are shown in the table, but applicable to all Cam Followers other than Miniature Type Cam Followers, Cylindrical Roller Cam Followers and Inch Series Cam Followers.  
It is recommended to use together with C-Lube Cam Followers in order to make maintenance-free more effective.  
Remark Load on the Cam Follower with the C-Lube unit equipped must be up to 80% of the maximum allowable static load of the Cam Follower to be combined. For the maximum allowed static load of each Cam Follower, please see the dimension tables of respective models.

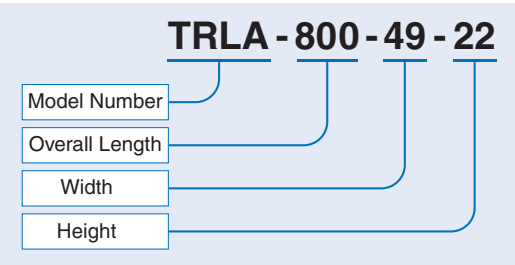
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Option Parts

Way for Cam Follower

The accuracy of the mating cam guide that comes in contact with the outer ring of Cam Followers has a large influence on the guide performance of Cam Followers and machinery.  
A specially designed high-precision Way for Cam Follower should be used in order to achieve sufficient performance from the Cam Followers. Fixed with bolts for simple assembly and available in 2 models - A type or B type - depending on the mounting direction.

Identification number



Model Types

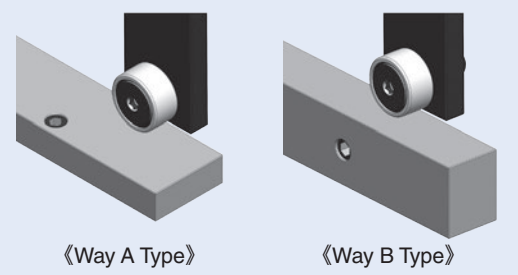
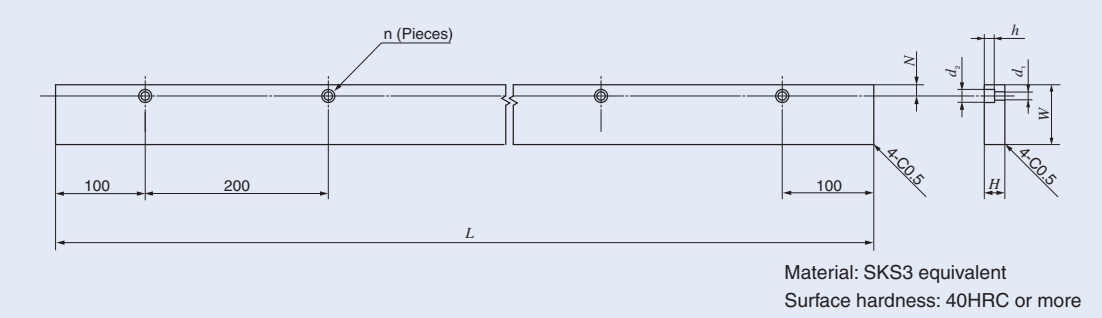


Table of Dimensions

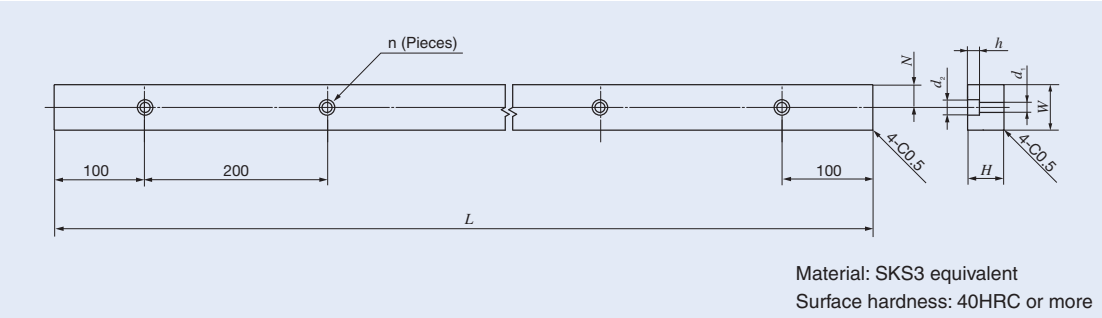
Way A Type



| Identification number | Boundary Dimensions   mm |     |     |     |       |       |     | Applicable Cam Followers |    |   |    |    |                  |    |   |    |    |                  |
|-----------------------|--------------------------|-----|-----|-----|-------|-------|-----|--------------------------|----|---|----|----|------------------|----|---|----|----|------------------|
|                       | $L_{(n)}$                | $W$ | $H$ | $N$ | $d_1$ | $d_2$ | $h$ |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA- 600-40-22       | 600(3)                   | 40  | 22  | 12  | 9     | 14    | 11  | Stud dia. 3~ 8mm         |    |   |    |    |                  |    |   |    |    |                  |
| TRLA- 800-40-22       | 800(4)                   |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA-1000-40-22       | 1000(5)                  |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA- 600-49-22       | 600(3)                   | 49  |     |     |       |       |     | 22                       | 12 | 9 | 14 | 11 | Stud dia.10~18mm |    |   |    |    |                  |
| TRLA- 800-49-22       | 800(4)                   |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA-1000-49-22       | 1000(5)                  |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA- 600-64-22       | 600(3)                   | 64  |     |     |       |       |     |                          |    |   |    |    | 22               | 12 | 9 | 14 | 11 | Stud dia.20~30mm |
| TRLA- 800-64-22       | 800(4)                   |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |
| TRLA-1000-64-22       | 1000(5)                  |     |     |     |       |       |     |                          |    |   |    |    |                  |    |   |    |    |                  |

Remark For other dimensions, please contact IKO.

Way B Type

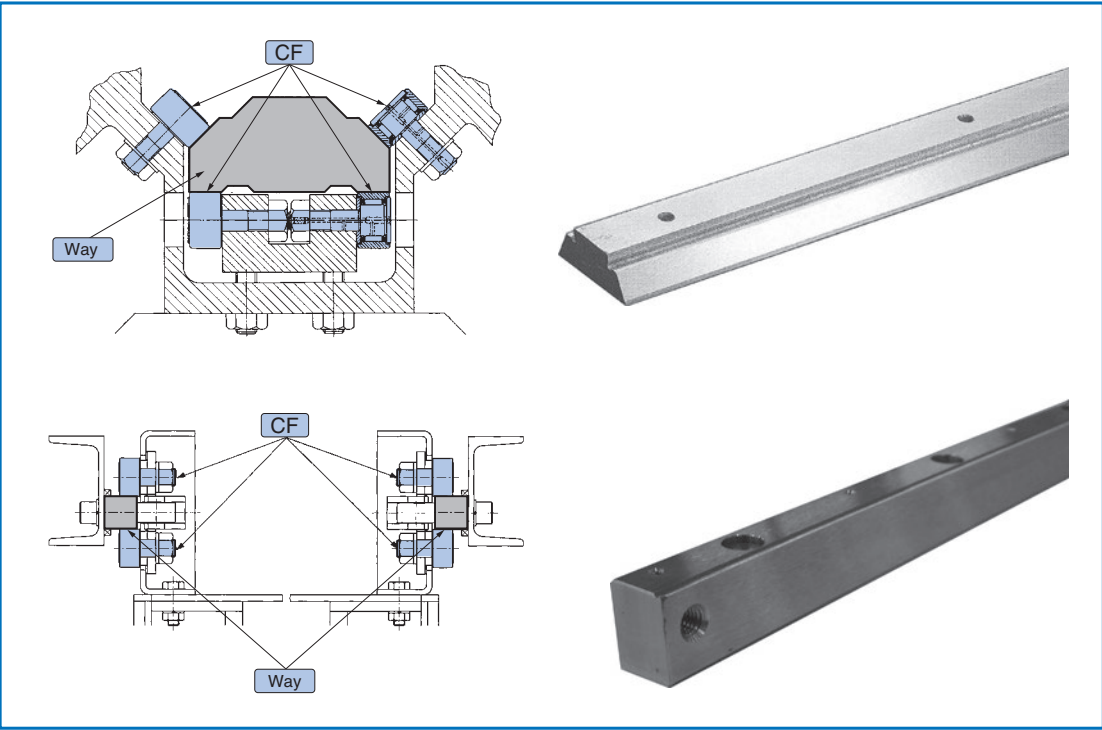


| Identification number | Boundary Dimensions   mm |     |     |     |       |       |     | Applicable Cam Followers |
|-----------------------|--------------------------|-----|-----|-----|-------|-------|-----|--------------------------|
|                       | $L_{(n)}$                | $W$ | $H$ | $N$ | $d_1$ | $d_2$ | $h$ |                          |
| TRLB- 600-34-22       | 600(3)                   | 34  | 22  | 17  | 9     | 14    | 11  | Stud dia. 3~12mm         |
| TRLB- 800-34-22       | 800(4)                   |     |     |     |       |       |     |                          |
| TRLB-1000-34-22       | 1000(5)                  |     |     |     |       |       |     |                          |
| TRLB- 600-50-40       | 600(3)                   | 50  | 40  | 25  | 11    | 17    | 13  | Stud dia.16~30mm         |
| TRLB- 800-50-40       | 800(4)                   |     |     |     |       |       |     |                          |
| TRLB-1000-50-40       | 1000(5)                  |     |     |     |       |       |     |                          |

Remark For other dimensions, please contact IKO.

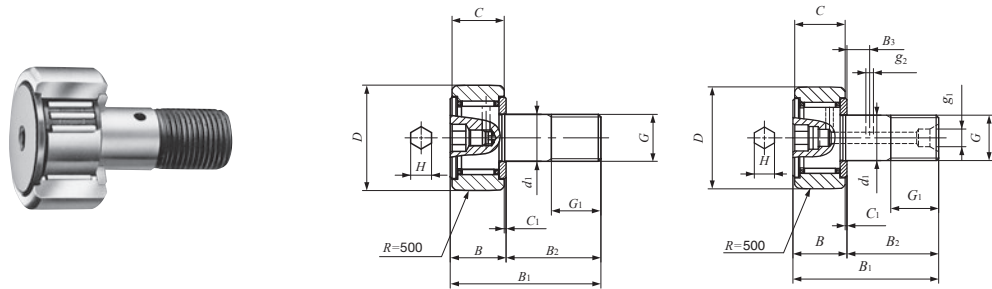
Introduction of Special Support Examples

Introducing special support examples for Ways for Cam Follower.  
A variety of shapes are supported in addition to the special support examples. For details, please contact IKO.



CAM FOLLOWERS

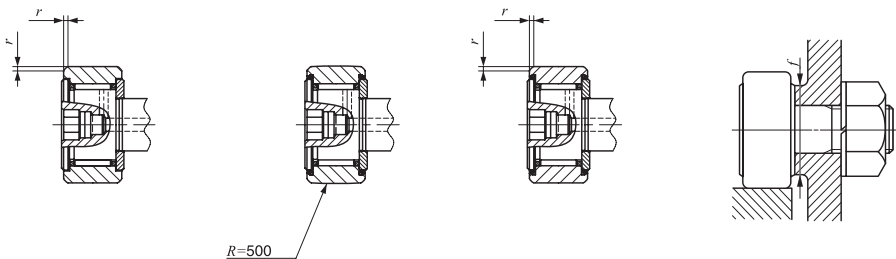
Standard Type Cam Followers CF...B With Cage/Stud Head Hex Hole



Stud dia. 3—30mm

| Stud dia.<br><br>mm | Identification number      |                                |                            |                                | Mass<br>(Ref.)<br><br>g |          |          |                       |          |
|---------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|-------------------------|----------|----------|-----------------------|----------|
|                     | Shield type                |                                | Sealed type                |                                |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> | <i>G</i> |
|                     | With crowned<br>outer ring | With cylindrical<br>outer ring | With crowned<br>outer ring | With cylindrical<br>outer ring |                         |          |          |                       |          |
| 3                   | CF 3 BR                    | CF 3 B                         | CF 3 BUUR                  | CF 3 BUU                       | 4.3                     | 10       | 7        | 3                     | M 3×0.5  |
| 4                   | CF 4 BR                    | CF 4 B                         | CF 4 BUUR                  | CF 4 BUU                       | 7.4                     | 12       | 8        | 4                     | M 4×0.7  |
| 5                   | CF 5 BR                    | CF 5 B                         | CF 5 BUUR                  | CF 5 BUU                       | 10.3                    | 13       | 9        | 5                     | M 5×0.8  |
| 6                   | CF 6 BR                    | CF 6 B                         | CF 6 BUUR                  | CF 6 BUU                       | 18.5                    | 16       | 11       | 6                     | M 6×1    |
| 8                   | CF 8 BR                    | CF 8 B                         | CF 8 BUUR                  | CF 8 BUU                       | 28.5                    | 19       | 11       | 8                     | M 8×1.25 |
|                     | CF 8 BRM                   | CF 8 BM                        | CF 8 BUURM                 | CF 8 BUUM                      | 28.5                    | 19       | 11       | 8                     | M 8×1    |
| 10                  | CF 10 BR                   | CF 10 B                        | CF 10 BUUR                 | CF 10 BUU                      | 45                      | 22       | 12       | 10                    | M10×1.25 |
|                     | CF 10 BRM                  | CF 10 BM                       | CF 10 BUURM                | CF 10 BUUM                     | 45                      | 22       | 12       | 10                    | M10×1    |
|                     | CF 10-1 BR                 | CF 10-1 B                      | CF 10-1 BUUR               | CF 10-1 BUU                    | 60                      | 26       | 12       | 10                    | M10×1.25 |
|                     | CF 10-1 BRM                | CF 10-1 BM                     | CF 10-1 BUURM              | CF 10-1 BUUM                   | 60                      | 26       | 12       | 10                    | M10×1    |
| 12                  | CF 12 BR                   | CF 12 B                        | CF 12 BUUR                 | CF 12 BUU                      | 95                      | 30       | 14       | 12                    | M12×1.5  |
|                     | CF 12-1 BR                 | CF 12-1 B                      | CF 12-1 BUUR               | CF 12-1 BUU                    | 105                     | 32       | 14       | 12                    | M12×1.5  |
| 16                  | CF 16 BR                   | CF 16 B                        | CF 16 BUUR                 | CF 16 BUU                      | 170                     | 35       | 18       | 16                    | M16×1.5  |
| 18                  | CF 18 BR                   | CF 18 B                        | CF 18 BUUR                 | CF 18 BUU                      | 250                     | 40       | 20       | 18                    | M18×1.5  |
| 20                  | CF 20 BR                   | CF 20 B                        | CF 20 BUUR                 | CF 20 BUU                      | 460                     | 52       | 24       | 20                    | M20×1.5  |
|                     | CF 20-1 BR                 | CF 20-1 B                      | CF 20-1 BUUR               | CF 20-1 BUU                    | 385                     | 47       | 24       | 20                    | M20×1.5  |
| 24                  | CF 24 BR                   | CF 24 B                        | CF 24 BUUR                 | CF 24 BUU                      | 815                     | 62       | 29       | 24                    | M24×1.5  |
|                     | CF 24-1 BR                 | CF 24-1 B                      | CF 24-1 BUUR               | CF 24-1 BUU                    | 1 140                   | 72       | 29       | 24                    | M24×1.5  |
| 30                  | CF 30 BR                   | CF 30 B                        | CF 30 BUUR                 | CF 30 BUU                      | 1 870                   | 80       | 35       | 30                    | M30×1.5  |
|                     | CF 30-1 BR                 | CF 30-1 B                      | CF 30-1 BUUR               | CF 30-1 BUU                    | 2 030                   | 85       | 35       | 30                    | M30×1.5  |
|                     | CF 30-2 BR                 | CF 30-2 B                      | CF 30-2 BUUR               | CF 30-2 BUU                    | 2 220                   | 90       | 35       | 30                    | M30×1.5  |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remarks1. Models with a stud diameter *d*<sub>1</sub> of 4 mm or less have no oil hole. For models with a stud dia. 5 to 10mm, oil hole (re-greasing fitting) is provided at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.  
2. Shield type models with a stud diameter *d*<sub>1</sub> of 10mm or less and the sealed type models are provided with prepacked grease. Other models are not provided with prepacked grease. Perform proper lubrication for use.

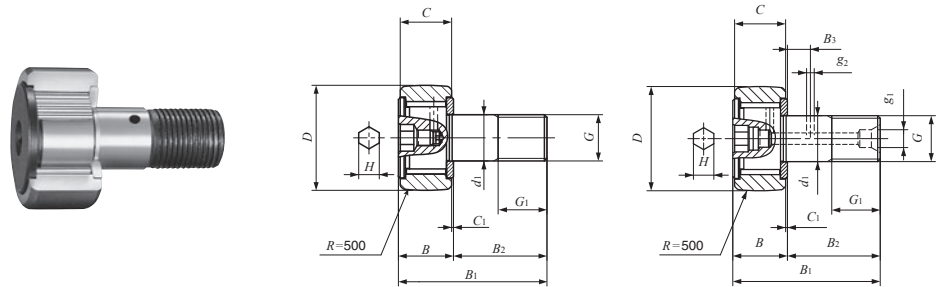


| Boundary dimensions mm |          |                       |                       |                       |                       |                       |                       |          |                                      | Mounting<br>dimension<br><i>f</i><br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|------------------------|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|--------------------------------------|-------------------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------------------|------------------------------------------|
| <i>G</i> <sub>1</sub>  | <i>B</i> | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>g</i> <sub>1</sub> | <i>g</i> <sub>2</sub> | <i>H</i> | <i>r</i> <sub>s</sub> <sup>(1)</sup> |                                                 |                                        |                                               |                                                           |                                          |
| 5                      | 8        | 17                    | 9                     | —                     | 0.5                   | —                     | —                     | 2        | 0.2                                  | 6.8                                             | 0.34                                   | 1 500                                         | 1 020                                                     | 384                                      |
| 6                      | 9        | 20                    | 11                    | —                     | 0.5                   | —                     | —                     | 2.5      | 0.3                                  | 8.3                                             | 0.78                                   | 2 070                                         | 1 590                                                     | 834                                      |
| 7.5                    | 10       | 23                    | 13                    | —                     | 0.5                   | —                     | —                     | 3        | 0.3                                  | 9.3                                             | 1.6                                    | 2 520                                         | 2 140                                                     | 1 260                                    |
| 8                      | 12.2max  | 28.2max               | 16                    | —                     | 0.6                   | —                     | —                     | 3        | 0.3                                  | 11                                              | 2.7                                    | 3 660                                         | 3 650                                                     | 1 950                                    |
| 10                     | 12.2max  | 32.2max               | 20                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 13                                              | 6.5                                    | 4 250                                         | 4 740                                                     | 4 620                                    |
| 10                     | 12.2max  | 32.2max               | 20                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 13                                              | 7.1                                    | 4 250                                         | 4 740                                                     | 4 620                                    |
| 12                     | 13.2max  | 36.2max               | 23                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 16                                              | 13.8                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 12                     | 13.2max  | 36.2max               | 23                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 16                                              | 14.7                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 12                     | 13.2max  | 36.2max               | 23                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 16                                              | 13.8                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 12                     | 13.2max  | 36.2max               | 23                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                  | 16                                              | 14.7                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 13                     | 15.2max  | 40.2max               | 25                    | 6                     | 0.6                   | 4                     | 3                     | 6        | 0.6                                  | 21                                              | 21.9                                   | 7 910                                         | 9 790                                                     | 9 790                                    |
| 13                     | 15.2max  | 40.2max               | 25                    | 6                     | 0.6                   | 4                     | 3                     | 6        | 0.6                                  | 21                                              | 21.9                                   | 7 910                                         | 9 790                                                     | 9 790                                    |
| 17                     | 19.6max  | 52.1max               | 32.5                  | 8                     | 0.8                   | 4                     | 3                     | 6        | 0.6                                  | 26                                              | 58.5                                   | 12 000                                        | 18 300                                                    | 18 300                                   |
| 19                     | 21.6max  | 58.1max               | 36.5                  | 8                     | 0.8                   | 6                     | 3                     | 8        | 1                                    | 29                                              | 86.2                                   | 14 800                                        | 25 200                                                    | 25 200                                   |
| 21                     | 25.6max  | 66.1max               | 40.5                  | 9                     | 0.8                   | 6                     | 4                     | 8        | 1                                    | 34                                              | 119                                    | 20 700                                        | 34 600                                                    | 34 600                                   |
| 21                     | 25.6max  | 66.1max               | 40.5                  | 9                     | 0.8                   | 6                     | 4                     | 8        | 1                                    | 34                                              | 119                                    | 20 700                                        | 34 600                                                    | 34 600                                   |
| 25                     | 30.6max  | 80.1max               | 49.5                  | 11                    | 0.8                   | 6                     | 4                     | 12       | 1                                    | 40                                              | 215                                    | 30 500                                        | 52 600                                                    | 52 000                                   |
| 25                     | 30.6max  | 80.1max               | 49.5                  | 11                    | 0.8                   | 6                     | 4                     | 12       | 1                                    | 40                                              | 215                                    | 30 500                                        | 52 600                                                    | 52 000                                   |
| 32                     | 37 max   | 100 max               | 63                    | 15                    | 1                     | 6                     | 4                     | 17       | 1                                    | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |
| 32                     | 37 max   | 100 max               | 63                    | 15                    | 1                     | 6                     | 4                     | 17       | 1                                    | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |
| 32                     | 37 max   | 100 max               | 63                    | 15                    | 1                     | 6                     | 4                     | 17       | 1                                    | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |

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CAM FOLLOWERS

Standard Type Cam Followers CF...B Full Complement Type/Stud Head Hex Hole



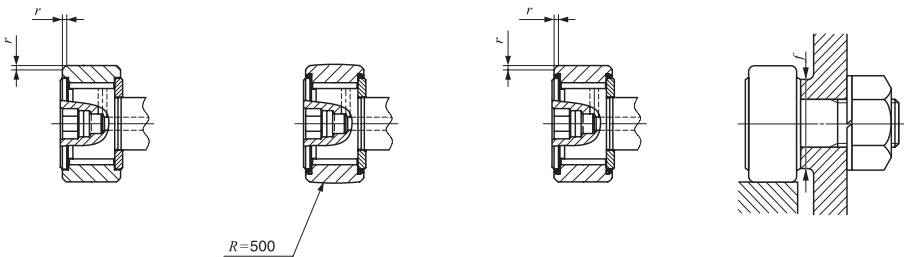
Stud dia. 6–30mm

CF...VBR  
Stud dia.  $d_1$  6-10mm

CF...VBR  
Stud dia.  $d_1$  12-30mm

| Stud<br>dia.<br><br>mm | Identification number      |                                |  |                            |                                |  | Mass<br>(Ref.)<br><br>g |          |          |                       |
|------------------------|----------------------------|--------------------------------|--|----------------------------|--------------------------------|--|-------------------------|----------|----------|-----------------------|
|                        | Shield type                |                                |  | Sealed type                |                                |  |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> |
|                        | With crowned<br>outer ring | With cylindrical<br>outer ring |  | With crowned<br>outer ring | With cylindrical<br>outer ring |  |                         |          |          |                       |
| 6                      | CF 6 VBR                   | CF 6 VB                        |  | CF 6 VBUUR                 | CF 6 VBUU                      |  | 19                      | 16       | 11       | 6                     |
| 8                      | CF 8 VBR                   | CF 8 VB                        |  | CF 8 VBUUR                 | CF 8 VBUU                      |  | 29                      | 19       | 11       | 8                     |
|                        | CF 8 VBRM                  | CF 8 VBM                       |  | CF 8 VBUURM                | CF 8 VBUUM                     |  | 29                      | 19       | 11       | 8                     |
| 10                     | CF 10 VBR                  | CF 10 VB                       |  | CF 10 VBUUR                | CF 10 VBUU                     |  | 46                      | 22       | 12       | 10                    |
|                        | CF 10 VBRM                 | CF 10 VBM                      |  | CF 10 VBUURM               | CF 10 VBUUM                    |  | 46                      | 22       | 12       | 10                    |
|                        | CF 10-1 VBR                | CF 10-1 VB                     |  | CF 10-1 VBUUR              | CF 10-1 VBUU                   |  | 61                      | 26       | 12       | 10                    |
|                        | CF 10-1 VBRM               | CF 10-1 VBM                    |  | CF 10-1 VBUURM             | CF 10-1 VBUUM                  |  | 61                      | 26       | 12       | 10                    |
| 12                     | CF 12 VBR                  | CF 12 VB                       |  | CF 12 VBUUR                | CF 12 VBUU                     |  | 97                      | 30       | 14       | 12                    |
|                        | CF 12-1 VBR                | CF 12-1 VB                     |  | CF 12-1 VBUUR              | CF 12-1 VBUU                   |  | 107                     | 32       | 14       | 12                    |
| 16                     | CF 16 VBR                  | CF 16 VB                       |  | CF 16 VBUUR                | CF 16 VBUU                     |  | 173                     | 35       | 18       | 16                    |
| 18                     | CF 18 VBR                  | CF 18 VB                       |  | CF 18 VBUUR                | CF 18 VBUU                     |  | 255                     | 40       | 20       | 18                    |
| 20                     | CF 20 VBR                  | CF 20 VB                       |  | CF 20 VBUUR                | CF 20 VBUU                     |  | 465                     | 52       | 24       | 20                    |
|                        | CF 20-1 VBR                | CF 20-1 VB                     |  | CF 20-1 VBUUR              | CF 20-1 VBUU                   |  | 390                     | 47       | 24       | 20                    |
| 24                     | CF 24 VBR                  | CF 24 VB                       |  | CF 24 VBUUR                | CF 24 VBUU                     |  | 820                     | 62       | 29       | 24                    |
|                        | CF 24-1 VBR                | CF 24-1 VB                     |  | CF 24-1 VBUUR              | CF 24-1 VBUU                   |  | 1 140                   | 72       | 29       | 24                    |
| 30                     | CF 30 VBR                  | CF 30 VB                       |  | CF 30 VBUUR                | CF 30 VBUU                     |  | 1 870                   | 80       | 35       | 30                    |
|                        | CF 30-1 VBR                | CF 30-1 VB                     |  | CF 30-1 VBUUR              | CF 30-1 VBUU                   |  | 2 030                   | 85       | 35       | 30                    |
|                        | CF 30-2 VBR                | CF 30-2 VB                     |  | CF 30-2 VBUUR              | CF 30-2 VBUU                   |  | 2 220                   | 90       | 35       | 30                    |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
Remarks1. Models with a stud diameter  $d_1$  of 10 mm or less have an oil hole (re-greasing fitting) at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.



CF...VB

CF...VBUUR

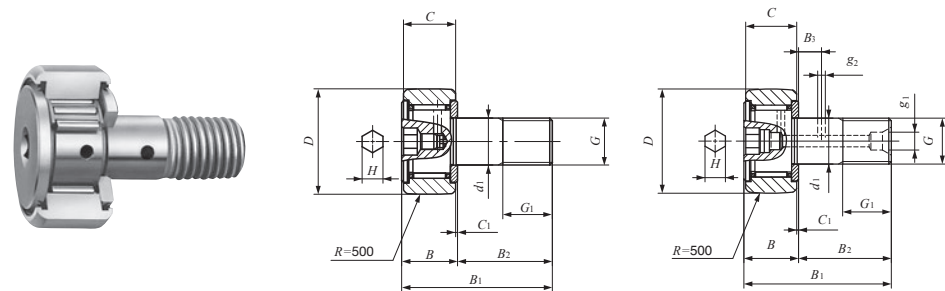
CF...VBUU

| Boundary dimensions mm |       |           |            |       |       |       |       |       |    |                  | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>$C_0$<br>N | Maximum<br>allowable<br>static load<br>N |
|------------------------|-------|-----------|------------|-------|-------|-------|-------|-------|----|------------------|--------------------------------------------|----------------------------------------|----------------------------------------|-------------------------------------------|------------------------------------------|
| G                      | $G_1$ | $B_{max}$ | $B_{1max}$ | $B_2$ | $B_3$ | $C_1$ | $g_1$ | $g_2$ | H  | $r_{smin}^{(1)}$ |                                            |                                        |                                        |                                           |                                          |
| M 6×1                  | 8     | 12.2      | 28.2       | 16    | —     | 0.6   | —     | —     | 3  | 0.3              | 11                                         | 2.7                                    | 6 980                                  | 8 500                                     | 1 950                                    |
| M 8×1.25               | 10    | 12.2      | 32.2       | 20    | —     | 0.6   | —     | —     | 4  | 0.3              | 13                                         | 6.5                                    | 8 170                                  | 11 200                                    | 4 620                                    |
| M 8×1                  | 10    | 12.2      | 32.2       | 20    | —     | 0.6   | —     | —     | 4  | 0.3              | 13                                         | 7.1                                    | 8 170                                  | 11 200                                    | 4 620                                    |
| M10×1.25               | 12    | 13.2      | 36.2       | 23    | —     | 0.6   | —     | —     | 4  | 0.3              | 16                                         | 13.8                                   | 9 570                                  | 14 500                                    | 8 650                                    |
| M10×1                  | 12    | 13.2      | 36.2       | 23    | —     | 0.6   | —     | —     | 4  | 0.3              | 16                                         | 14.7                                   | 9 570                                  | 14 500                                    | 8 650                                    |
| M10×1.25               | 12    | 13.2      | 36.2       | 23    | —     | 0.6   | —     | —     | 4  | 0.3              | 16                                         | 13.8                                   | 9 570                                  | 14 500                                    | 8 650                                    |
| M10×1                  | 12    | 13.2      | 36.2       | 23    | —     | 0.6   | —     | —     | 4  | 0.3              | 16                                         | 14.7                                   | 9 570                                  | 14 500                                    | 8 650                                    |
| M12×1.5                | 13    | 15.2      | 40.2       | 25    | 6     | 0.6   | 4     | 3     | 6  | 0.6              | 21                                         | 21.9                                   | 13 500                                 | 19 700                                    | 13 200                                   |
| M12×1.5                | 13    | 15.2      | 40.2       | 25    | 6     | 0.6   | 4     | 3     | 6  | 0.6              | 21                                         | 21.9                                   | 13 500                                 | 19 700                                    | 13 200                                   |
| M16×1.5                | 17    | 19.6      | 52.1       | 32.5  | 8     | 0.8   | 4     | 3     | 6  | 0.6              | 26                                         | 58.5                                   | 20 700                                 | 37 600                                    | 23 200                                   |
| M18×1.5                | 19    | 21.6      | 58.1       | 36.5  | 8     | 0.8   | 6     | 3     | 8  | 1                | 29                                         | 86.2                                   | 25 300                                 | 51 300                                    | 31 100                                   |
| M20×1.5                | 21    | 25.6      | 66.1       | 40.5  | 9     | 0.8   | 6     | 4     | 8  | 1                | 34                                         | 119                                    | 33 200                                 | 64 500                                    | 37 500                                   |
| M20×1.5                | 21    | 25.6      | 66.1       | 40.5  | 9     | 0.8   | 6     | 4     | 8  | 1                | 34                                         | 119                                    | 33 200                                 | 64 500                                    | 37 500                                   |
| M24×1.5                | 25    | 30.6      | 80.1       | 49.5  | 11    | 0.8   | 6     | 4     | 12 | 1                | 40                                         | 215                                    | 46 600                                 | 92 000                                    | 52 000                                   |
| M24×1.5                | 25    | 30.6      | 80.1       | 49.5  | 11    | 0.8   | 6     | 4     | 12 | 1                | 40                                         | 215                                    | 46 600                                 | 92 000                                    | 52 000                                   |
| M30×1.5                | 32    | 37        | 100        | 63    | 15    | 1     | 6     | 4     | 17 | 1                | 49                                         | 438                                    | 67 700                                 | 144 000                                   | 85 900                                   |
| M30×1.5                | 32    | 37        | 100        | 63    | 15    | 1     | 6     | 4     | 17 | 1                | 49                                         | 438                                    | 67 700                                 | 144 000                                   | 85 900                                   |
| M30×1.5                | 32    | 37        | 100        | 63    | 15    | 1     | 6     | 4     | 17 | 1                | 49                                         | 438                                    | 67 700                                 | 144 000                                   | 85 900                                   |

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CAM FOLLOWERS

Standard Type Cam Followers CF···B / Stainless Steel Made With Cage/Stud Head Hex Hole



Stud dia. 3–20mm

CF···FBR  
Stud dia. d<sub>1</sub> 3-10mm

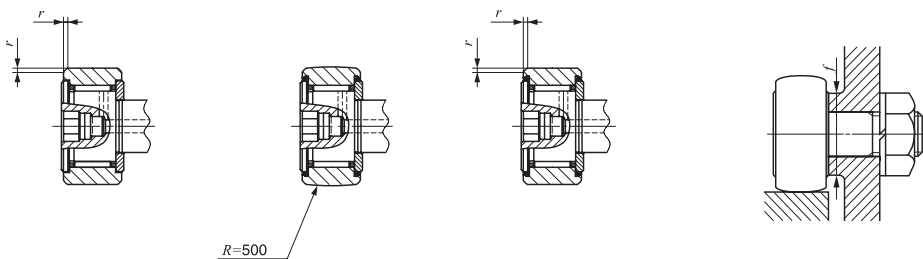
CF···FBR  
Stud dia. d<sub>1</sub> 12-20mm

| Stud dia.<br>mm | Identification number      |     |                                |    |                            |       |                                |      | Mass<br>(Ref.)<br><br>g |          |          |                       |          |                       |
|-----------------|----------------------------|-----|--------------------------------|----|----------------------------|-------|--------------------------------|------|-------------------------|----------|----------|-----------------------|----------|-----------------------|
|                 | Shield type                |     |                                |    | Sealed type                |       |                                |      |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> | <i>G</i> | <i>G</i> <sub>1</sub> |
|                 | With crowned<br>outer ring |     | With cylindrical<br>outer ring |    | With crowned<br>outer ring |       | With cylindrical<br>outer ring |      |                         |          |          |                       |          |                       |
| 3               | CF 3                       | FBR | CF 3                           | FB | CF 3                       | FBUUR | CF 3                           | FBUU | 4.3                     | 10       | 7        | 3                     | M 3×0.5  | 5                     |
| 4               | CF 4                       | FBR | CF 4                           | FB | CF 4                       | FBUUR | CF 4                           | FBUU | 7.4                     | 12       | 8        | 4                     | M 4×0.7  | 6                     |
| 5               | CF 5                       | FBR | CF 5                           | FB | CF 5                       | FBUUR | CF 5                           | FBUU | 10.3                    | 13       | 9        | 5                     | M 5×0.8  | 7.5                   |
| 6               | CF 6                       | FBR | CF 6                           | FB | CF 6                       | FBUUR | CF 6                           | FBUU | 18.5                    | 16       | 11       | 6                     | M 6×1    | 8                     |
| 8               | CF 8                       | FBR | CF 8                           | FB | CF 8                       | FBUUR | CF 8                           | FBUU | 28.5                    | 19       | 11       | 8                     | M 8×1.25 | 10                    |
| 10              | CF 10                      | FBR | CF 10                          | FB | CF 10                      | FBUUR | CF 10                          | FBUU | 45<br>60                | 22<br>26 | 12       | 10                    | M10×1.25 | 12                    |
| 12              | CF 12                      | FBR | CF 12                          | FB | CF 12                      | FBUUR | CF 12                          | FBUU | 95<br>105               | 30<br>32 | 14       | 12                    | M12×1.5  | 13                    |
| 16              | CF 16                      | FBR | CF 16                          | FB | CF 16                      | FBUUR | CF 16                          | FBUU | 170                     | 35       | 18       | 16                    | M16×1.5  | 17                    |
| 18              | CF 18                      | FBR | CF 18                          | FB | CF 18                      | FBUUR | CF 18                          | FBUU | 250                     | 40       | 20       | 18                    | M18×1.5  | 19                    |
| 20              | CF 20                      | FBR | CF 20                          | FB | CF 20                      | FBUUR | CF 20                          | FBUU | 460<br>385              | 52<br>47 | 24       | 20                    | M20×1.5  | 21                    |
|                 | CF 20-1                    | FBR | CF 20-1                        | FB | CF 20-1                    | FBUUR | CF 20-1                        | FBUU |                         |          |          |                       |          |                       |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*

Remarks1. Models with a stud diameter *d*<sub>1</sub> of 4 mm or less have no oil hole. For models with a stud dia. 5 to 10 mm, oil hole (re-greasing fitting) is provided at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.

2. Shield type models with a stud diameter *d*<sub>1</sub> of 10 mm or less and the sealed type models are provided with prepacked grease. Other models are not provided with prepacked grease. Perform proper lubrication for use.



CF···FB

CF···FBUUR

CF···FBUU

| Boundary dimensions mm |                       |                       |                       |                       |                       |                       |          |                                          | Mounting dimension<br><i>f</i><br>Min. mm | Maximum tightening torque<br>N·m | Basic dynamic load rating<br><i>C</i><br>N | Basic static load rating<br><i>C</i> <sub>0</sub><br>N | Maximum allowable static load<br>N |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|------------------------------------------|-------------------------------------------|----------------------------------|--------------------------------------------|--------------------------------------------------------|------------------------------------|
| <i>B</i>               | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>g</i> <sub>1</sub> | <i>g</i> <sub>2</sub> | <i>H</i> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> |                                           |                                  |                                            |                                                        |                                    |
| 8                      | 17                    | 9                     | —                     | 0.5                   | —                     | —                     | 2        | 0.2                                      | 6.8                                       | 0.34                             | 1 200                                      | 813                                                    | 384                                |
| 9                      | 20                    | 11                    | —                     | 0.5                   | —                     | —                     | 2.5      | 0.3                                      | 8.3                                       | 0.78                             | 1 650                                      | 1 270                                                  | 834                                |
| 10                     | 23                    | 13                    | —                     | 0.5                   | —                     | —                     | 3        | 0.3                                      | 9.3                                       | 1.6                              | 1 930                                      | 1 730                                                  | 1 260                              |
| 12.2 max               | 28.2 max              | 16                    | —                     | 0.6                   | —                     | —                     | 3        | 0.3                                      | 11                                        | 2.7                              | 2 930                                      | 2 920                                                  | 1 950                              |
| 12.2 max               | 32.2 max              | 20                    | —                     | 0.6                   | —                     | —                     | 4        | 0.3                                      | 13                                        | 6.5                              | 3 400                                      | 3 790                                                  | 3 790                              |
| 13.2 max               | 36.2 max              | 23                    | —                     | 0.6                   | —                     | —                     | 5        | 0.3                                      | 16                                        | 13.8                             | 4 340                                      | 5 510                                                  | 5 510                              |
| 15.2 max               | 40.2 max              | 25                    | 6                     | 0.6                   | 4                     | 3                     | 6        | 0.6                                      | 21                                        | 21.9                             | 6 330                                      | 7 830                                                  | 7 830                              |
| 19.6 max               | 52.1 max              | 32.5                  | 8                     | 0.8                   | 4                     | 3                     | 6        | 0.6                                      | 26                                        | 58.5                             | 9 620                                      | 14 700                                                 | 14 700                             |
| 21.6 max               | 58.1 max              | 36.5                  | 8                     | 0.8                   | 6                     | 3                     | 8        | 1                                        | 29                                        | 86.2                             | 11 800                                     | 20 200                                                 | 20 200                             |
| 25.6 max               | 66.1 max              | 40.5                  | 9                     | 0.8                   | 8                     | 4                     | 8        | 1                                        | 34                                        | 119                              | 16 500                                     | 27 700                                                 | 27 700                             |

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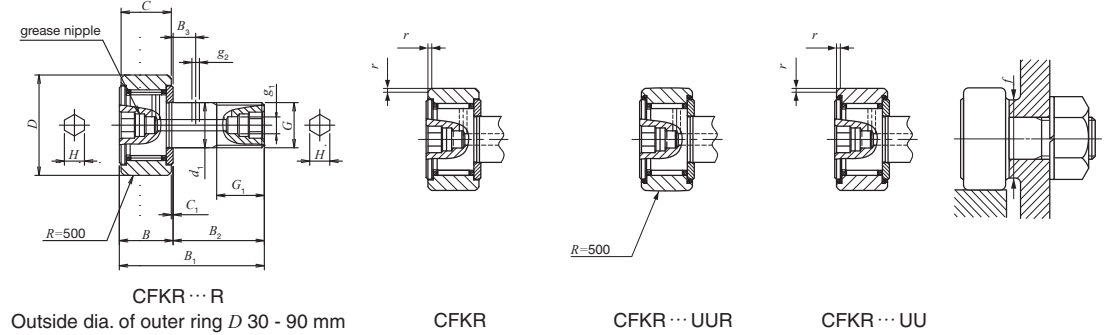
Standard Type Cam Followers CFKR With Cage/Stud Head Hex Hole



Stud dia. 10–30mm

| Stud<br>diameter<br><br>mm | Identification number <sup>(1)</sup> |                        |                    |                        | Mass<br>(Ref.)<br><br>g |          |          |                       |          |                       |
|----------------------------|--------------------------------------|------------------------|--------------------|------------------------|-------------------------|----------|----------|-----------------------|----------|-----------------------|
|                            | Shield type                          |                        | Sealed type        |                        |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> | <i>G</i> | <i>G</i> <sub>I</sub> |
|                            | Crowned outer ring                   | Cylindrical outer ring | Crowned outer ring | Cylindrical outer ring |                         |          |          |                       |          |                       |
| 10                         | CFKR 22 R                            | CFKR 22                | CFKR 22 UUR        | CFKR 22 UU             | 43                      | 22       | 12       | 10                    | M10×1.0  | 12                    |
|                            | CFKR 26 R                            | CFKR 26                | CFKR 26 UUR        | CFKR 26 UU             | 58                      | 26       |          |                       |          |                       |
| 12                         | CFKR 30 R                            | CFKR 30                | CFKR 30 UUR        | CFKR 30 UU             | 94                      | 30       | 14       | 12                    | M12×1.5  | 13                    |
|                            | CFKR 32 R                            | CFKR 32                | CFKR 32 UUR        | CFKR 32 UU             | 104                     | 32       |          |                       |          |                       |
| 16                         | CFKR 35 R                            | CFKR 35                | CFKR 35 UUR        | CFKR 35 UU             | 165                     | 35       | 18       | 16                    | M16×1.5  | 17                    |
| 18                         | CFKR 40 R                            | CFKR 40                | CFKR 40 UUR        | CFKR 40 UU             | 248                     | 40       | 20       | 18                    | M18×1.5  | 19                    |
| 20                         | CFKR 47 R                            | CFKR 47                | CFKR 47 UUR        | CFKR 47 UU             | 378                     | 47       | 24       | 20                    | M20×1.5  | 21                    |
|                            | CFKR 52 R                            | CFKR 52                | CFKR 52 UUR        | CFKR 52 UU             | 453                     | 52       |          |                       |          |                       |
| 24                         | CFKR 62 R                            | CFKR 62                | CFKR 62 UUR        | CFKR 62 UU             | 795                     | 62       | 29       | 24                    | M24×1.5  | 25                    |
|                            | CFKR 72 R                            | CFKR 72                | CFKR 72 UUR        | CFKR 72 UU             | 1 120                   | 72       |          |                       |          |                       |
| 30                         | CFKR 80 R                            | CFKR 80                | CFKR 80 UUR        | CFKR 80 UU             | 1 860                   | 80       | 35       | 30                    | M30×1.5  | 32                    |
|                            | CFKR 85 R                            | CFKR 85                | CFKR 85 UUR        | CFKR 85 UU             | 2 020                   | 85       |          |                       |          |                       |
|                            | CFKR 90 R                            | CFKR 90                | CFKR 90 UUR        | CFKR 90 UU             | 2 210                   | 90       |          |                       |          |                       |

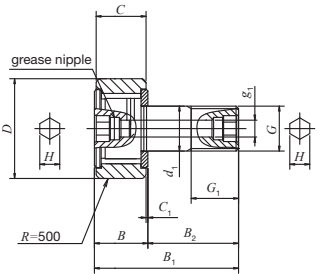
Note<sup>(1)</sup> The identification number indicates the outer ring outside diameter.  
<sup>(2)</sup> Minimum allowable value of chamfer dimension *r*.  
Remark Grease is pre-packed if the stud diameter *d*<sub>1</sub> of the shield type is 10 mm or less or if the seal structure is the sealed type. Other models are not provided with pre-packed grease. Perform proper lubrication for use.



| Boundary dimensions    mm |             |       |       |       |       |       |     |                   | Mounting dimension | Maximum tightening torque | Basic dynamic load rating | Basic static load rating | Maximum allowable static load |
|---------------------------|-------------|-------|-------|-------|-------|-------|-----|-------------------|--------------------|---------------------------|---------------------------|--------------------------|-------------------------------|
| $B_{\max}$                | $B_{I\max}$ | $B_2$ | $B_3$ | $C_1$ | $g_1$ | $g_2$ | $H$ | $r_{s\min}^{(2)}$ | $f$<br>Min.<br>mm  | N·m                       | N                         | N                        | N                             |
| 13.2                      | 36.2        | 23    | —     | 0.6   | 3     | —     | 5   | 0.3               | 16                 | 13.0                      | 5 430                     | 6 890                    | 6 890                         |
| 15.2                      | 40.2        | 25    | 6     | 0.6   | 4     | 3     | 6   | 0.6               | 21                 | 21.9                      | 7 910                     | 9 790                    | 9 790                         |
| 19.6                      | 52.1        | 32.5  | 8     | 0.8   | 4     | 3     | 8   | 0.6               | 26                 | 58.5                      | 12 000                    | 18 300                   | 18 300                        |
| 21.6                      | 58.1        | 36.5  | 8     | 0.8   | 6     | 3     | 8   | 1                 | 29                 | 86.2                      | 14 800                    | 25 200                   | 25 200                        |
| 25.6                      | 66.1        | 40.5  | 9     | 0.8   | 6     | 4     | 10  | 1                 | 34                 | 119                       | 20 700                    | 34 600                   | 34 600                        |
| 30.6                      | 80.1        | 49.5  | 11    | 0.8   | 6     | 4     | 14  | 1                 | 40                 | 215                       | 30 500                    | 52 600                   | 52 000                        |
| 37                        | 100         | 63    | 15    | 1     | 6     | 4     | 14  | 1                 | 49                 | 438                       | 45 400                    | 85 100                   | 85 100                        |

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Standard Type Cam Followers CFKR Full Complement Type/Stud Head Hex Hole

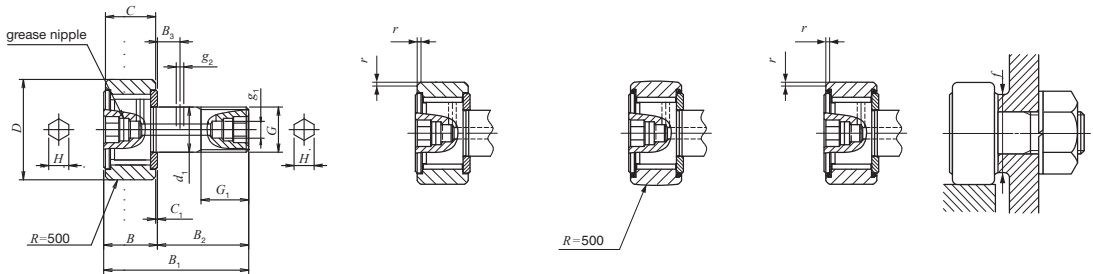


CFKR...VR  
Outside dia. of outer ring D 22, 26 mm

Stud dia.10 – 30mm

| Stud<br>diameter<br><br>mm | Identification number <sup>(1)</sup> |                        |                    |                        | Mass<br>(Ref.)<br><br>g |          |          |                       |          |                       |
|----------------------------|--------------------------------------|------------------------|--------------------|------------------------|-------------------------|----------|----------|-----------------------|----------|-----------------------|
|                            | Shield type                          |                        | Sealed type        |                        |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> | <i>G</i> | <i>G</i> <sub>I</sub> |
|                            | Crowned outer ring                   | Cylindrical outer ring | Crowned outer ring | Cylindrical outer ring |                         |          |          |                       |          |                       |
| 10                         | CFKR 22 VR                           | CFKR 22 V              | CFKR 22 VUUR       | CFKR 22 VUU            | 44                      | 22       | 12       | 10                    | M10×1.0  | 12                    |
|                            | CFKR 26 VR                           | CFKR 26 V              | CFKR 26 VUUR       | CFKR 26 VUU            | 59                      | 26       |          |                       |          |                       |
| 12                         | CFKR 30 VR                           | CFKR 30 V              | CFKR 30 VUUR       | CFKR 30 VUU            | 96                      | 30       | 14       | 12                    | M12×1.5  | 13                    |
|                            | CFKR 32 VR                           | CFKR 32 V              | CFKR 32 VUUR       | CFKR 32 VUU            | 106                     | 32       |          |                       |          |                       |
| 16                         | CFKR 35 VR                           | CFKR 35 V              | CFKR 35 VUUR       | CFKR 35 VUU            | 168                     | 35       | 18       | 16                    | M16×1.5  | 17                    |
| 18                         | CFKR 40 VR                           | CFKR 40 V              | CFKR 40 VUUR       | CFKR 40 VUU            | 253                     | 40       | 20       | 18                    | M18×1.5  | 19                    |
| 20                         | CFKR 47 VR                           | CFKR 47 V              | CFKR 47 VUUR       | CFKR 47 VUU            | 383                     | 47       | 24       | 20                    | M20×1.5  | 21                    |
|                            | CFKR 52 VR                           | CFKR 52 V              | CFKR 52 VUUR       | CFKR 52 VUU            | 458                     | 52       |          |                       |          |                       |
| 24                         | CFKR 62 VR                           | CFKR 62 V              | CFKR 62 VUUR       | CFKR 62 VUU            | 800                     | 62       | 29       | 24                    | M24×1.5  | 25                    |
|                            | CFKR 72 VR                           | CFKR 72 V              | CFKR 72 VUUR       | CFKR 72 VUU            | 1 120                   | 72       |          |                       |          |                       |
| 30                         | CFKR 80 VR                           | CFKR 80 V              | CFKR 80 VUUR       | CFKR 80 VUU            | 1 860                   | 80       | 35       | 30                    | M30×1.5  | 32                    |
|                            | CFKR 85 VR                           | CFKR 85 V              | CFKR 85 VUUR       | CFKR 85 VUU            | 2 020                   | 85       |          |                       |          |                       |
|                            | CFKR 90 VR                           | CFKR 90 V              | CFKR 90 VUUR       | CFKR 90 VUU            | 2 210                   | 90       |          |                       |          |                       |
|                            |                                      |                        |                    |                        |                         |          |          |                       |          |                       |

Note<sup>(1)</sup> The identification number indicates the outer ring outside diameter.  
Note<sup>(2)</sup> Minimum allowable value of chamfer dimension r.  
Remark Provided with prepacked grease.



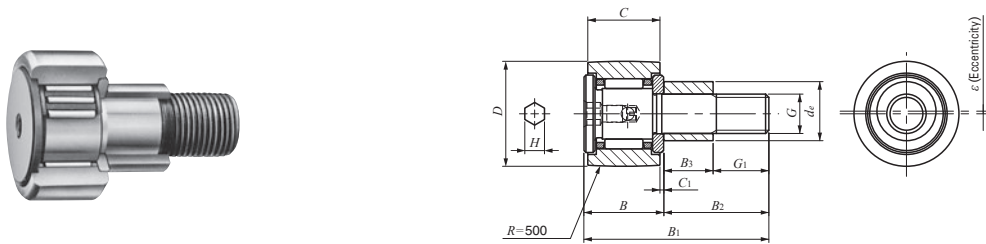
CFKR...VR  
Outside dia. of outer ring D 30 - 90 mm  
CFKR...V  
CFKR...VUUR  
CFKR...VUU

| Boundary dimensions mm |                   |                |                |                |                |                |    |                                   | Mounting dimension   | Maximum tightening torque | Basic dynamic load rating | Basic static load rating | Maximum allowable static load |
|------------------------|-------------------|----------------|----------------|----------------|----------------|----------------|----|-----------------------------------|----------------------|---------------------------|---------------------------|--------------------------|-------------------------------|
| B <sub>max</sub>       | B <sub>1max</sub> | B <sub>2</sub> | B <sub>3</sub> | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H  | r <sub>s min</sub> <sup>(2)</sup> | f <sub>Min.</sub> mm | N·m                       | C N                       | C <sub>0</sub> N         | N                             |
| 13.2                   | 36.2              | 23             | —              | 0.6            | 3              | —              | 5  | 0.3                               | 16                   | 13.0                      | 9 570                     | 14 500                   | 7 920                         |
| 15.2                   | 40.2              | 25             | 6              | 0.6            | 4              | 3              | 6  | 0.6                               | 21                   | 21.9                      | 13 500                    | 19 700                   | 13 200                        |
| 19.6                   | 52.1              | 32.5           | 8              | 0.8            | 4              | 3              | 8  | 0.6                               | 26                   | 58.5                      | 20 700                    | 37 600                   | 23 200                        |
| 21.6                   | 58.1              | 36.5           | 8              | 0.8            | 6              | 3              | 8  | 1                                 | 29                   | 86.2                      | 25 300                    | 51 300                   | 31 100                        |
| 25.6                   | 66.1              | 40.5           | 9              | 0.8            | 6              | 4              | 10 | 1                                 | 34                   | 119                       | 33 200                    | 64 500                   | 37 500                        |
| 30.6                   | 80.1              | 49.5           | 11             | 0.8            | 6              | 4              | 14 | 1                                 | 40                   | 215                       | 46 600                    | 92 000                   | 52 000                        |
| 37                     | 100               | 63             | 15             | 1              | 6              | 4              | 14 | 1                                 | 49                   | 438                       | 67 700                    | 144 000                  | 85 900                        |

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CAM FOLLOWERS

Eccentric Type Cam Followers CFE...B With Cage/Stud Head Hex Hole

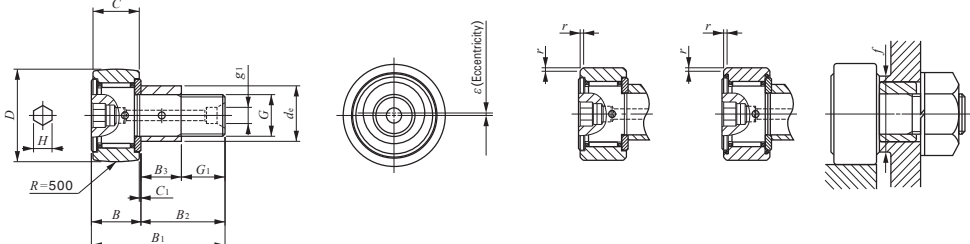


CFE...BR  
Outside diameter of eccentric collar  $d_e$  9-13mm

Outside diameter of eccentric collar 9—41mm

| Outside diameter of eccentric collar mm | Identification number   |                             |                         |                             | Mass (Ref.) |          |          |                      |
|-----------------------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------|-------------|----------|----------|----------------------|
|                                         | Shield type             |                             | Sealed type             |                             |             | <i>D</i> | <i>C</i> | <i>d<sub>e</sub></i> |
|                                         | With crowned outer ring | With cylindrical outer ring | With crowned outer ring | With cylindrical outer ring | g           |          |          |                      |
| 9                                       | CFE 6 BR                | CFE 6 B                     | CFE 6 BUUR              | CFE 6 BUU                   | 20.5        | 16       | 11       | 9                    |
| 11                                      | CFE 8 BR                | CFE 8 B                     | CFE 8 BUUR              | CFE 8 BUU                   | 32          | 19       | 11       | 11                   |
| 13                                      | CFE 10 BR               | CFE 10 B                    | CFE 10 BUUR             | CFE 10 BUU                  | 49.5        | 22       | 12       | 13                   |
|                                         | CFE 10-1 BR             | CFE 10-1 B                  | CFE 10-1 BUUR           | CFE 10-1 BUU                | 65          | 26       | 12       | 13                   |
| 16                                      | CFE 12 BR               | CFE 12 B                    | CFE 12 BUUR             | CFE 12 BUU                  | 105         | 30       | 14       | 16                   |
|                                         | CFE 12-1 BR             | CFE 12-1 B                  | CFE 12-1 BUUR           | CFE 12-1 BUU                | 115         | 32       | 14       | 16                   |
| 22                                      | CFE 16 BR               | CFE 16 B                    | CFE 16 BUUR             | CFE 16 BUU                  | 190         | 35       | 18       | 22                   |
| 24                                      | CFE 18 BR               | CFE 18 B                    | CFE 18 BUUR             | CFE 18 BUU                  | 280         | 40       | 20       | 24                   |
| 27                                      | CFE 20 BR               | CFE 20 B                    | CFE 20 BUUR             | CFE 20 BUU                  | 500         | 52       | 24       | 27                   |
|                                         | CFE 20-1 BR             | CFE 20-1 B                  | CFE 20-1 BUUR           | CFE 20-1 BUU                | 425         | 47       | 24       | 27                   |
| 33                                      | CFE 24 BR               | CFE 24 B                    | CFE 24 BUUR             | CFE 24 BUU                  | 895         | 62       | 29       | 33                   |
|                                         | CFE 24-1 BR             | CFE 24-1 B                  | CFE 24-1 BUUR           | CFE 24-1 BUU                | 1 220       | 72       | 29       | 33                   |
| 41                                      | CFE 30 BR               | CFE 30 B                    | CFE 30 BUUR             | CFE 30 BUU                  | 2 030       | 80       | 35       | 41                   |
|                                         | CFE 30-1 BR             | CFE 30-1 B                  | CFE 30-1 BUUR           | CFE 30-1 BUU                | 2 190       | 85       | 35       | 41                   |
|                                         | CFE 30-2 BR             | CFE 30-2 B                  | CFE 30-2 BUUR           | CFE 30-2 BUU                | 2 380       | 90       | 35       | 41                   |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
Remarks1. Models with a thread diameter  $G$  of 10 mm or less have an oil hole (re-greasing fitting) at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole on the end surface of the stud.  
2. Shield type models with a stud thread diameter  $G$  of 10 mm or less and the sealed type models are provided with prepacked grease. Other models are not provided with prepacked grease. Perform proper lubrication for use.



CFE...BR  
Outside diameter of eccentric collar  $d_e$  16-41mm

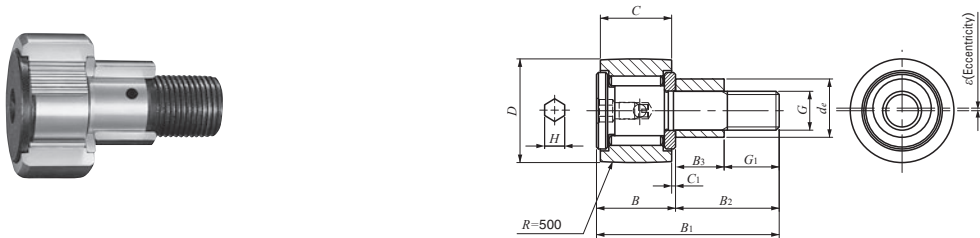
CFE...B CFE...BUU

| Boundary dimensions    mm |       |            |             |       |       |       |       |     |                   |            | Eccentricity<br>$\epsilon$ | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br><br>N·m | Basic dynamic<br>load rating<br><br>$C$<br><br>N | Basic static<br>load rating<br><br>$C_0$<br><br>N | Maximum<br>allowable<br>static load<br><br>N |
|---------------------------|-------|------------|-------------|-------|-------|-------|-------|-----|-------------------|------------|----------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------------|---------------------------------------------------|----------------------------------------------|
| $G$                       | $B_3$ | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $C_1$ | $g_1$ | $G_1$ | $H$ | $r_{s\min}^{(1)}$ | $\epsilon$ |                            |                                            |                                            |                                                  |                                                   |                                              |
| M 6×1                     | 7.5   | 12.2       | 28.2        | 16    | 0.6   | —     | 8.5   | 3   | 0.3               | 0.4        | 11                         | 2.7                                        | 3 660                                      | 3 650                                            | 1 950                                             |                                              |
| M 8×1.25                  | 9.5   | 12.2       | 32.2        | 20    | 0.6   | —     | 10.5  | 4   | 0.3               | 0.4        | 13                         | 6.5                                        | 4 250                                      | 4 740                                            | 4 620                                             |                                              |
| M10×1.25                  | 10.5  | 13.2       | 36.2        | 23    | 0.6   | —     | 12.5  | 4   | 0.3               | 0.4        | 16                         | 13.8                                       | 5 430                                      | 6 890                                            | 6 890                                             |                                              |
| M10×1.25                  | 10.5  | 13.2       | 36.2        | 23    | 0.6   | —     | 12.5  | 4   | 0.3               | 0.4        | 16                         | 13.8                                       | 5 430                                      | 6 890                                            | 6 890                                             |                                              |
| M12×1.5                   | 11.5  | 15.2       | 40.2        | 25    | 0.6   | 4     | 13.5  | 6   | 0.6               | 0.8        | 21                         | 21.9                                       | 7 910                                      | 9 790                                            | 9 790                                             |                                              |
| M12×1.5                   | 11.5  | 15.2       | 40.2        | 25    | 0.6   | 4     | 13.5  | 6   | 0.6               | 0.8        | 21                         | 21.9                                       | 7 910                                      | 9 790                                            | 9 790                                             |                                              |
| M16×1.5                   | 15.5  | 19.6       | 52.1        | 32.5  | 0.8   | 4     | 17    | 6   | 0.6               | 0.8        | 26                         | 58.5                                       | 12 000                                     | 18 300                                           | 18 300                                            |                                              |
| M18×1.5                   | 17.5  | 21.6       | 58.1        | 36.5  | 0.8   | 6     | 19    | 8   | 1                 | 0.8        | 29                         | 86.2                                       | 14 800                                     | 25 200                                           | 25 200                                            |                                              |
| M20×1.5                   | 19.5  | 25.6       | 66.1        | 40.5  | 0.8   | 6     | 21    | 8   | 1                 | 0.8        | 34                         | 119                                        | 20 700                                     | 34 600                                           | 34 600                                            |                                              |
| M20×1.5                   | 19.5  | 25.6       | 66.1        | 40.5  | 0.8   | 6     | 21    | 8   | 1                 | 0.8        | 34                         | 119                                        | 20 700                                     | 34 600                                           | 34 600                                            |                                              |
| M24×1.5                   | 25.5  | 30.6       | 80.1        | 49.5  | 0.8   | 6     | 24    | 12  | 1                 | 0.8        | 40                         | 215                                        | 30 500                                     | 52 600                                           | 52 000                                            |                                              |
| M24×1.5                   | 25.5  | 30.6       | 80.1        | 49.5  | 0.8   | 6     | 24    | 12  | 1                 | 0.8        | 40                         | 215                                        | 30 500                                     | 52 600                                           | 52 000                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                 | 1.5        | 49                         | 438                                        | 45 400                                     | 85 100                                           | 85 100                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                 | 1.5        | 49                         | 438                                        | 45 400                                     | 85 100                                           | 85 100                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                 | 1.5        | 49                         | 438                                        | 45 400                                     | 85 100                                           | 85 100                                            |                                              |

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CAM FOLLOWERS

Eccentric Type Cam Followers CFE...B Full Complement Type/Stud Head Hex Hole

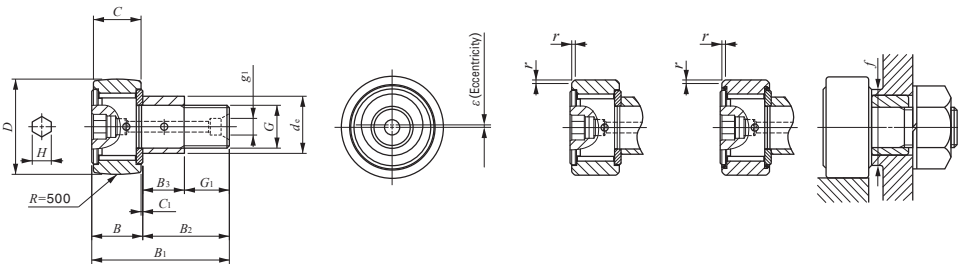


Outside diameter of eccentric collar 9—41mm

CFE ... VBR  
Outside diameter of eccentric collar  $d_e$  9-13mm

| Outside diameter of eccentric collar mm | Identification number   |                             |                         |                             | Mass (Ref.) |          |          |                      |
|-----------------------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------|-------------|----------|----------|----------------------|
|                                         | Shield type             |                             | Sealed type             |                             |             | <i>D</i> | <i>C</i> | <i>d<sub>e</sub></i> |
|                                         | With crowned outer ring | With cylindrical outer ring | With crowned outer ring | With cylindrical outer ring | g           |          |          |                      |
| 9                                       | CFE 6 VBR               | CFE 6 VB                    | CFE 6 VBUUR             | CFE 6 VBUU                  | 21          | 16       | 11       | 9                    |
| 11                                      | CFE 8 VBR               | CFE 8 VB                    | CFE 8 VBUUR             | CFE 8 VBUU                  | 32.5        | 19       | 11       | 11                   |
| 13                                      | CFE 10 VBR              | CFE 10 VB                   | CFE 10 VBUUR            | CFE 10 VBUU                 | 50.5        | 22       | 12       | 13                   |
|                                         | CFE 10-1 VBR            | CFE 10-1 VB                 | CFE 10-1 VBUUR          | CFE 10-1 VBUU               | 66          | 26       | 12       | 13                   |
| 16                                      | CFE 12 VBR              | CFE 12 VB                   | CFE 12 VBUUR            | CFE 12 VBUU                 | 107         | 30       | 14       | 16                   |
|                                         | CFE 12-1 VBR            | CFE 12-1 VB                 | CFE 12-1 VBUUR          | CFE 12-1 VBUU               | 117         | 32       | 14       | 16                   |
| 22                                      | CFE 16 VBR              | CFE 16 VB                   | CFE 16 VBUUR            | CFE 16 VBUU                 | 193         | 35       | 18       | 22                   |
| 24                                      | CFE 18 VBR              | CFE 18 VB                   | CFE 18 VBUUR            | CFE 18 VBUU                 | 285         | 40       | 20       | 24                   |
| 27                                      | CFE 20 VBR              | CFE 20 VB                   | CFE 20 VBUUR            | CFE 20 VBUU                 | 505         | 52       | 24       | 27                   |
|                                         | CFE 20-1 VBR            | CFE 20-1 VB                 | CFE 20-1 VBUUR          | CFE 20-1 VBUU               | 430         | 47       | 24       | 27                   |
| 33                                      | CFE 24 VBR              | CFE 24 VB                   | CFE 24 VBUUR            | CFE 24 VBUU                 | 900         | 62       | 29       | 33                   |
|                                         | CFE 24-1 VBR            | CFE 24-1 VB                 | CFE 24-1 VBUUR          | CFE 24-1 VBUU               | 1 220       | 72       | 29       | 33                   |
| 41                                      | CFE 30 VBR              | CFE 30 VB                   | CFE 30 VBUUR            | CFE 30 VBUU                 | 2 030       | 80       | 35       | 41                   |
|                                         | CFE 30-1 VBR            | CFE 30-1 VB                 | CFE 30-1 VBUUR          | CFE 30-1 VBUU               | 2 190       | 85       | 35       | 41                   |
|                                         | CFE 30-2 VBR            | CFE 30-2 VB                 | CFE 30-2 VBUUR          | CFE 30-2 VBUU               | 2 380       | 90       | 35       | 41                   |
|                                         |                         |                             |                         |                             |             |          |          |                      |

Note(1) Minimum allowable value of chamfer dimension  $r$   
Remarks1. Models with a thread diameter  $G$  of 10 mm or less have an oil hole (re-greasing fitting) at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole on the end surface of the stud.  
2. Provided with prepacked grease.



CFE ... VBR  
Outside diameter of eccentric collar  $d_e$  16-41mm

CFE ... VB

CFE ... VBUU

| Boundary dimensions    mm |       |            |             |       |       |       |       |     |                    |            | Eccentricity<br>$\epsilon$ | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br><br>N·m | Basic dynamic<br>load rating<br><br>$C$<br><br>N | Basic static<br>load rating<br><br>$C_0$<br><br>N | Maximum<br>allowable<br>static load<br><br>N |
|---------------------------|-------|------------|-------------|-------|-------|-------|-------|-----|--------------------|------------|----------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------------|---------------------------------------------------|----------------------------------------------|
| $G$                       | $B_3$ | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $C_1$ | $g_1$ | $G_1$ | $H$ | $r'_{s\min}^{(1)}$ | $\epsilon$ |                            |                                            |                                            |                                                  |                                                   |                                              |
| M 6×1                     | 7.5   | 12.2       | 28.2        | 16    | 0.6   | —     | 8.5   | 3   | 0.3                | 0.4        | 11                         | 2.7                                        | 6 980                                      | 8 500                                            | 1 950                                             |                                              |
| M 8×1.25                  | 9.5   | 12.2       | 32.2        | 20    | 0.6   | —     | 10.5  | 4   | 0.3                | 0.4        | 13                         | 6.5                                        | 8 170                                      | 11 200                                           | 4 620                                             |                                              |
| M10×1.25                  | 10.5  | 13.2       | 36.2        | 23    | 0.6   | —     | 12.5  | 4   | 0.3                | 0.4        | 16                         | 13.8                                       | 9 570                                      | 14 500                                           | 8 650                                             |                                              |
| M10×1.25                  | 10.5  | 13.2       | 36.2        | 23    | 0.6   | —     | 12.5  | 4   | 0.3                | 0.4        | 16                         | 13.8                                       | 9 570                                      | 14 500                                           | 8 650                                             |                                              |
| M12×1.5                   | 11.5  | 15.2       | 40.2        | 25    | 0.6   | 4     | 13.5  | 6   | 0.6                | 0.8        | 21                         | 21.9                                       | 13 500                                     | 19 700                                           | 13 200                                            |                                              |
| M12×1.5                   | 11.5  | 15.2       | 40.2        | 25    | 0.6   | 4     | 13.5  | 6   | 0.6                | 0.8        | 21                         | 21.9                                       | 13 500                                     | 19 700                                           | 13 200                                            |                                              |
| M16×1.5                   | 15.5  | 19.6       | 52.1        | 32.5  | 0.8   | 4     | 17    | 6   | 0.6                | 0.8        | 26                         | 58.5                                       | 20 700                                     | 37 600                                           | 23 200                                            |                                              |
| M18×1.5                   | 17.5  | 21.6       | 58.1        | 36.5  | 0.8   | 6     | 19    | 8   | 1                  | 0.8        | 29                         | 86.2                                       | 25 300                                     | 51 300                                           | 31 100                                            |                                              |
| M20×1.5                   | 19.5  | 25.6       | 66.1        | 40.5  | 0.8   | 6     | 21    | 8   | 1                  | 0.8        | 34                         | 119                                        | 33 200                                     | 64 500                                           | 37 500                                            |                                              |
| M20×1.5                   | 19.5  | 25.6       | 66.1        | 40.5  | 0.8   | 6     | 21    | 8   | 1                  | 0.8        | 34                         | 119                                        | 33 200                                     | 64 500                                           | 37 500                                            |                                              |
| M24×1.5                   | 25.5  | 30.6       | 80.1        | 49.5  | 0.8   | 6     | 24    | 12  | 1                  | 0.8        | 40                         | 215                                        | 46 600                                     | 92 000                                           | 52 000                                            |                                              |
| M24×1.5                   | 25.5  | 30.6       | 80.1        | 49.5  | 0.8   | 6     | 24    | 12  | 1                  | 0.8        | 40                         | 215                                        | 46 600                                     | 92 000                                           | 52 000                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                  | 1.5        | 49                         | 438                                        | 67 700                                     | 144 000                                          | 85 900                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                  | 1.5        | 49                         | 438                                        | 67 700                                     | 144 000                                          | 85 900                                            |                                              |
| M30×1.5                   | 32.5  | 37         | 100         | 63    | 1     | 6     | 30.5  | 17  | 1                  | 1.5        | 49                         | 438                                        | 67 700                                     | 144 000                                          | 85 900                                            |                                              |

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CAM FOLLOWERS

Eccentric Type Cam Followers CFKRE With Cage/Double Hex Hole

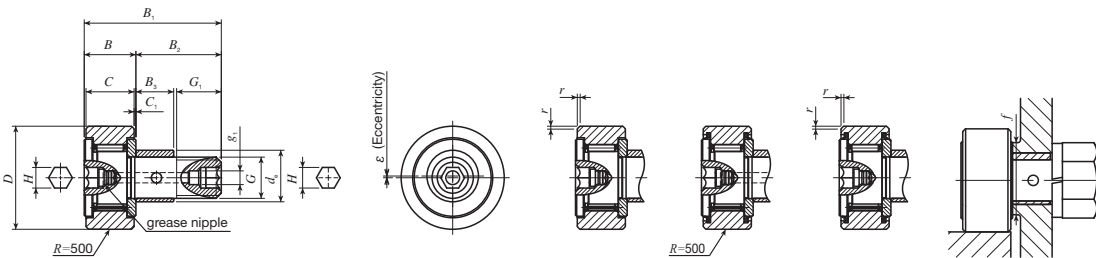


CFKRE ... R  
Outside diameter of eccentric collar  $d_e$  13mm

Outside diameter of eccentric collar 13—35mm

| Outside diameter of eccentric collar mm | Identification number <sup>(1)</sup> |                        |                    |                        | Mass (Ref.) |          |          |                       |
|-----------------------------------------|--------------------------------------|------------------------|--------------------|------------------------|-------------|----------|----------|-----------------------|
|                                         | Shield type                          |                        | Sealed type        |                        |             |          |          |                       |
|                                         | Crowned outer ring                   | Cylindrical outer ring | Crowned outer ring | Cylindrical outer ring | g           | <i>D</i> | <i>C</i> | <i>d</i> <sub>e</sub> |
| 13                                      | CFKRE 22 R                           | CFKRE 22               | CFKRE 22 UUR       | CFKRE 22 UU            | 47          | 22       | 12       | 13                    |
|                                         | CFKRE 26 R                           | CFKRE 26               | CFKRE 26 UUR       | CFKRE 26 UU            | 62          | 26       |          |                       |
| 15                                      | CFKRE 30 R                           | CFKRE 30               | CFKRE 30 UUR       | CFKRE 30 UU            | 100         | 30       | 14       | 15                    |
|                                         | CFKRE 32 R                           | CFKRE 32               | CFKRE 32 UUR       | CFKRE 32 UU            | 110         | 32       |          |                       |
| 20                                      | CFKRE 35 R                           | CFKRE 35               | CFKRE 35 UUR       | CFKRE 35 UU            | 177         | 35       | 18       | 20                    |
| 22                                      | CFKRE 40 R                           | CFKRE 40               | CFKRE 40 UUR       | CFKRE 40 UU            | 264         | 40       | 20       | 22                    |
| 24                                      | CFKRE 47 R                           | CFKRE 47               | CFKRE 47 UUR       | CFKRE 47 UU            | 397         | 47       | 24       | 24                    |
|                                         | CFKRE 52 R                           | CFKRE 52               | CFKRE 52 UUR       | CFKRE 52 UU            | 472         | 52       |          |                       |
| 28                                      | CFKRE 62 R                           | CFKRE 62               | CFKRE 62 UUR       | CFKRE 62 UU            | 823         | 62       | 29       | 28                    |
|                                         | CFKRE 72 R                           | CFKRE 72               | CFKRE 72 UUR       | CFKRE 72 UU            | 1 150       | 72       |          |                       |
| 35                                      | CFKRE 80 R                           | CFKRE 80               | CFKRE 80 UUR       | CFKRE 80 UU            | 1 920       | 80       | 35       | 35                    |
|                                         | CFKRE 85 R                           | CFKRE 85               | CFKRE 85 UUR       | CFKRE 85 UU            | 2 080       | 85       |          |                       |
|                                         | CFKRE 90 R                           | CFKRE 90               | CFKRE 90 UUR       | CFKRE 90 UU            | 2 270       | 90       |          |                       |

Note<sup>(1)</sup> The identification number indicates the outer ring outside diameter.  
Note<sup>(2)</sup> Minimum allowable value of chamfer dimension  $r$ .  
Remark Grease is pre-packed if the eccentric collar outer diameter  $d_e$  of the shield type is 13 mm or less or if the seal structure is the sealed type. Other models are not provided with pre-packed grease. Perform proper lubrication for use.



CFKRE ... R  
Outside diameter of eccentric collar  $d_e$  15~35mm

CFKRE CFKRE ... UUR CFKRE ... UU

| $G$     | Boundary dimensions    mm |            |             |       |       |       |       |     |                  | Eccentricity<br>$\varepsilon$ | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br><br>N·m | Basic dynamic<br>load rating<br>$C$<br><br>N | Basic static<br>load rating<br>$C_0$<br><br>N | Maximum<br>allowable<br>static load<br><br>N |
|---------|---------------------------|------------|-------------|-------|-------|-------|-------|-----|------------------|-------------------------------|--------------------------------------------|--------------------------------------------|----------------------------------------------|-----------------------------------------------|----------------------------------------------|
|         | $G_1$                     | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $B_3$ | $C_1$ | $g_1$ | $H$ | $r_{\min}^{(1)}$ |                               |                                            |                                            |                                              |                                               |                                              |
|         |                           |            |             |       |       |       |       |     |                  |                               |                                            |                                            |                                              |                                               |                                              |
| M10×1.0 | 12                        | 13.2       | 36.2        | 23    | 10    | 0.6   | 3     | 5   | 0.3              | 0.5                           | 16                                         | 13.0                                       | 5 430                                        | 6 890                                         | 6 890                                        |
| M12×1.5 | 13                        | 15.2       | 40.2        | 25    | 11    | 0.6   | 4     | 6   | 0.6              | 0.5                           | 21                                         | 21.9                                       | 7 910                                        | 9 790                                         | 9 790                                        |
| M16×1.5 | 17                        | 19.6       | 52.1        | 32.5  | 14    | 0.8   | 4     | 8   | 0.6              | 1                             | 26                                         | 58.5                                       | 12 000                                       | 18 300                                        | 18 300                                       |
| M18×1.5 | 19                        | 21.6       | 58.1        | 36.5  | 16    | 0.8   | 6     | 8   | 1                | 1                             | 29                                         | 86.2                                       | 14 800                                       | 25 200                                        | 25 200                                       |
| M20×1.5 | 21                        | 25.6       | 66.1        | 40.5  | 18    | 0.8   | 6     | 10  | 1                | 1                             | 34                                         | 119                                        | 20 700                                       | 34 600                                        | 34 600                                       |
| M24×1.5 | 25                        | 30.6       | 80.1        | 49.5  | 22    | 0.8   | 6     | 14  | 1                | 1                             | 40                                         | 215                                        | 30 500                                       | 52 600                                        | 52 000                                       |
| M30×1.5 | 32                        | 37         | 100         | 63    | 29    | 1     | 6     | 14  | 1                | 1.5                           | 49                                         | 438                                        | 45 400                                       | 85 100                                        | 85 100                                       |

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CAM FOLLOWERS

Eccentric Type Cam Followers CFKRE Full complement/Double Hex Hole

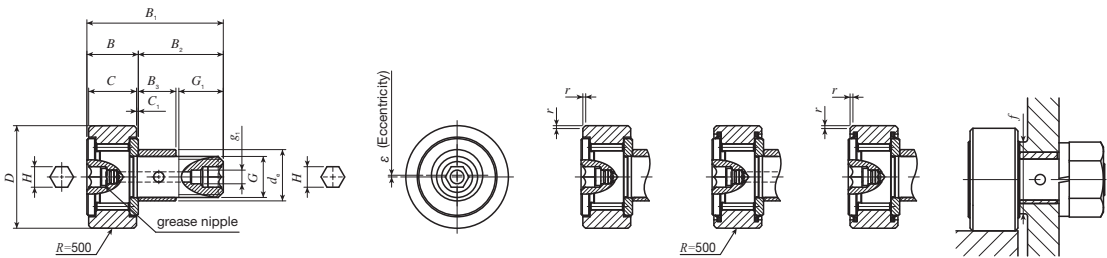


CFKRE ... VR  
Outside diameter of eccentric collar  $d_e$  13mm

Outside diameter of eccentric collar 13—35mm

| Outside diameter of eccentric collar mm | Identification number <sup>(1)</sup>      |                                        |                                                 |                                              | Mass (Ref.)<br><br>g    |                |          |                      |
|-----------------------------------------|-------------------------------------------|----------------------------------------|-------------------------------------------------|----------------------------------------------|-------------------------|----------------|----------|----------------------|
|                                         | Shield type                               |                                        | Sealed type                                     |                                              |                         | <i>D</i>       | <i>C</i> | <i>d<sub>e</sub></i> |
|                                         | Crowned outer ring                        | Cylindrical outer ring                 | Crowned outer ring                              | Cylindrical outer ring                       |                         |                |          |                      |
| 13                                      | CFKRE 22 VR<br>CFKRE 26 VR                | CFKRE 22 V<br>CFKRE 26 V               | CFKRE 22 VUUR<br>CFKRE 26 VUUR                  | CFKRE 22 VUU<br>CFKRE 26 VUU                 | 48<br>63                | 22<br>26       | 12       | 13                   |
| 15                                      | CFKRE 30 VR<br>CFKRE 32 VR                | CFKRE 30 V<br>CFKRE 32 V               | CFKRE 30 VUUR<br>CFKRE 32 VUUR                  | CFKRE 30 VUU<br>CFKRE 32 VUU                 | 101<br>111              | 30<br>32       | 14       | 15                   |
| 20                                      | CFKRE 35 VR                               | CFKRE 35 V                             | CFKRE 35 VUUR                                   | CFKRE 35 VUU                                 | 180                     | 35             | 18       | 20                   |
| 22                                      | CFKRE 40 VR                               | CFKRE 40 V                             | CFKRE 40 VUUR                                   | CFKRE 40 VUU                                 | 269                     | 40             | 20       | 22                   |
| 24                                      | CFKRE 47 VR<br>CFKRE 52 VR                | CFKRE 47 V<br>CFKRE 52 V               | CFKRE 47 VUUR<br>CFKRE 52 VUUR                  | CFKRE 47 VUU<br>CFKRE 52 VUU                 | 402<br>477              | 47<br>52       | 24       | 24                   |
| 28                                      | CFKRE 62 VR<br>CFKRE 72 VR                | CFKRE 62 V<br>CFKRE 72 V               | CFKRE 62 VUUR<br>CFKRE 72 VUUR                  | CFKRE 62 VUU<br>CFKRE 72 VUU                 | 828<br>1 150            | 62<br>72       | 29       | 28                   |
| 35                                      | CFKRE 80 VR<br>CFKRE 85 VR<br>CFKRE 90 VR | CFKRE 80 V<br>CFKRE 85 V<br>CFKRE 90 V | CFKRE 80 VUUR<br>CFKRE 85 VUUR<br>CFKRE 90 VUUR | CFKRE 80 VUU<br>CFKRE 85 VUU<br>CFKRE 90 VUU | 1 920<br>2 080<br>2 270 | 80<br>85<br>90 | 35       | 35                   |

Note<sup>(1)</sup> The identification number indicates the outer ring outside diameter.  
Note<sup>(2)</sup> Minimum allowable value of chamfer dimension  $r$ .  
Remark Grease is prepacked.



CFKRE ... VR  
Outside diameter of eccentric collar  $d_e$  15~35mm

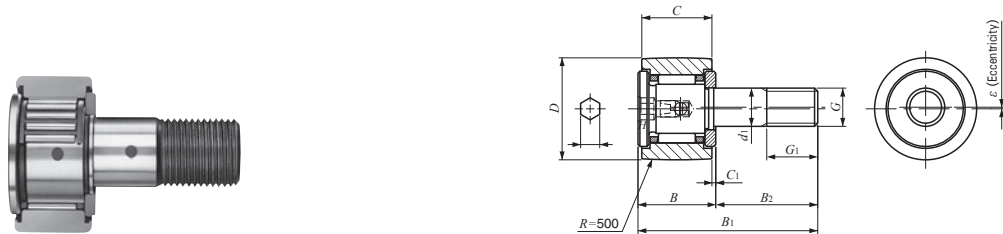
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| $G$     | Boundary dimensions    mm |            |             |       |       |       |       |     |                  | Eccentricity<br>$\varepsilon$ | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br><br>N·m | Basic dynamic<br>load rating<br>$C$<br><br>N | Basic static<br>load rating<br>$C_0$<br><br>N | Maximum<br>allowable<br>static load<br><br>N |
|---------|---------------------------|------------|-------------|-------|-------|-------|-------|-----|------------------|-------------------------------|--------------------------------------------|--------------------------------------------|----------------------------------------------|-----------------------------------------------|----------------------------------------------|
|         | $G_1$                     | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $B_3$ | $C_1$ | $g_1$ | $H$ | $r_{\min}^{(2)}$ |                               |                                            |                                            |                                              |                                               |                                              |
|         |                           |            |             |       |       |       |       |     |                  |                               |                                            |                                            |                                              |                                               |                                              |
| M10×1.0 | 12                        | 13.2       | 36.2        | 23    | 10    | 0.6   | 3     | 5   | 0.3              | 0.5                           | 16                                         | 13.0                                       | 9 570                                        | 14 500                                        | 7 920                                        |
| M12×1.5 | 13                        | 15.2       | 40.2        | 25    | 11    | 0.6   | 4     | 6   | 0.6              | 0.5                           | 21                                         | 21.9                                       | 13 500                                       | 19 700                                        | 13 200                                       |
| M16×1.5 | 17                        | 19.6       | 52.1        | 32.5  | 14    | 0.8   | 4     | 8   | 0.6              | 1                             | 26                                         | 58.5                                       | 20 700                                       | 37 600                                        | 23 200                                       |
| M18×1.5 | 19                        | 21.6       | 58.1        | 36.5  | 16    | 0.8   | 6     | 8   | 1                | 1                             | 29                                         | 86.2                                       | 25 300                                       | 51 300                                        | 31 100                                       |
| M20×1.5 | 21                        | 25.6       | 66.1        | 40.5  | 18    | 0.8   | 6     | 10  | 1                | 1                             | 34                                         | 119                                        | 33 200                                       | 64 500                                        | 37 500                                       |
| M24×1.5 | 25                        | 30.6       | 80.1        | 49.5  | 22    | 0.8   | 6     | 14  | 1                | 1                             | 40                                         | 215                                        | 46 600                                       | 92 000                                        | 52 000                                       |
| M30×1.5 | 32                        | 37         | 100         | 63    | 29    | 1     | 6     | 14  | 1                | 1.5                           | 49                                         | 438                                        | 67 700                                       | 144 000                                       | 85 900                                       |

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CAM FOLLOWERS

Solid Eccentric Stud Type Cam Followers With Cage/Stud Head Hex Hole

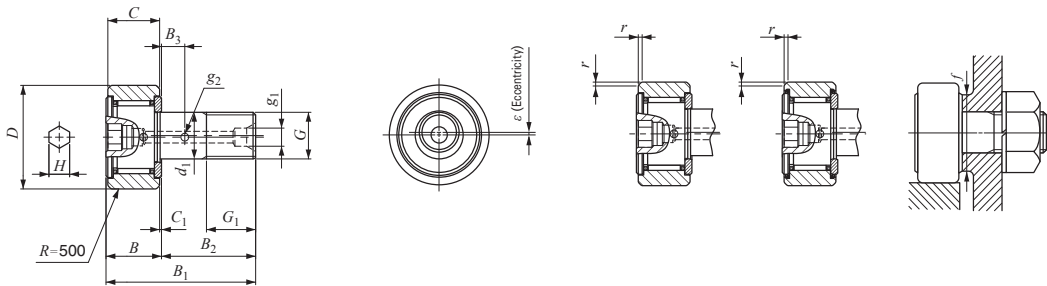


Stud dia. 6—18mm

CFES...BR  
Stud dia.  $d_1$  6-10mm

| Stud<br>dia.<br><br>mm | Identification number      |             |                                |               |                            |    |                                |    | Mass<br>(Ref.)<br><br>g |          |          |                       |
|------------------------|----------------------------|-------------|--------------------------------|---------------|----------------------------|----|--------------------------------|----|-------------------------|----------|----------|-----------------------|
|                        | Shield type                |             |                                |               | Sealed type                |    |                                |    |                         | <i>D</i> | <i>C</i> | <i>d</i> <sub>1</sub> |
|                        | With crowned<br>outer ring |             | With cylindrical<br>outer ring |               | With crowned<br>outer ring |    | With cylindrical<br>outer ring |    |                         |          |          |                       |
| 6                      | CFES 6 BR                  | CFES 6 B    | CFES 6 BUUR                    | CFES 6 BUU    | 18.5                       | 16 | 11                             | 6  |                         |          |          |                       |
| 8                      | CFES 8 BR                  | CFES 8 B    | CFES 8 BUUR                    | CFES 8 BUU    | 28.5                       | 19 | 11                             | 8  |                         |          |          |                       |
| 10                     | CFES 10 BR                 | CFES 10 B   | CFES 10 BUUR                   | CFES 10 BUU   | 45                         | 22 | 12                             | 10 |                         |          |          |                       |
|                        | CFES 10-1 BR               | CFES 10-1 B | CFES 10-1 BUUR                 | CFES 10-1 BUU | 60                         | 26 | 12                             | 10 |                         |          |          |                       |
| 12                     | CFES 12 BR                 | CFES 12 B   | CFES 12 BUUR                   | CFES 12 BUU   | 95                         | 30 | 14                             | 12 |                         |          |          |                       |
|                        | CFES 12-1 BR               | CFES 12-1 B | CFES 12-1 BUUR                 | CFES 12-1 BUU | 105                        | 32 | 14                             | 12 |                         |          |          |                       |
| 16                     | CFES 16 BR                 | CFES 16 B   | CFES 16 BUUR                   | CFES 16 BUU   | 170                        | 35 | 18                             | 16 |                         |          |          |                       |
| 18                     | CFES 18 BR                 | CFES 18 B   | CFES 18 BUUR                   | CFES 18 BUU   | 250                        | 40 | 20                             | 18 |                         |          |          |                       |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$   
Remarks1. Models with a stud diameter  $d_1$  of 10 mm or less have an oil hole (re-greasing fitting) at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.  
2. Shield type models with a stud diameter  $d_1$  of 10 mm or less and the sealed type models are provided with prepacked grease. Other models are not provided with prepacked grease. Perform proper lubrication for use.



CFES...BR  
Stud dia.  $d_1$  12-18mm

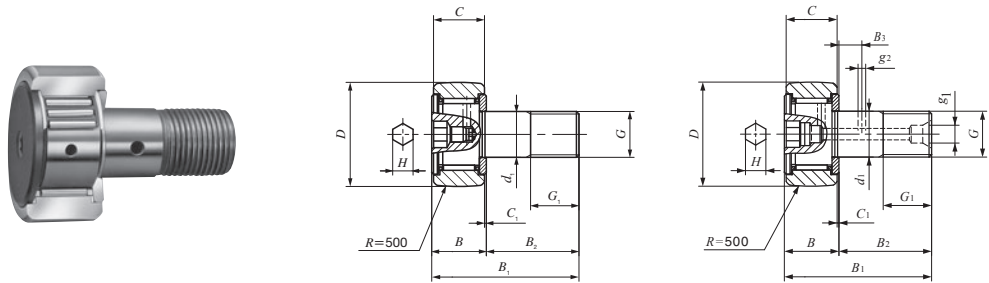
CFES...B    CFES...BUU

| Boundary dimensions    mm |       |            |             |       |       |       |       |       |     |                   |               | Eccentricity | Mounting dimension<br>$f$<br>Min.<br>mm | Maximum tightening torque<br><br>N·m | Basic dynamic load rating<br><br>$C$<br><br>N | Basic static load rating<br><br>$C_0$<br><br>N | Maximum allowable static load<br><br>N |
|---------------------------|-------|------------|-------------|-------|-------|-------|-------|-------|-----|-------------------|---------------|--------------|-----------------------------------------|--------------------------------------|-----------------------------------------------|------------------------------------------------|----------------------------------------|
| $G$                       | $G_1$ | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $B_3$ | $C_1$ | $g_1$ | $g_2$ | $H$ | $r_{s\min}^{(1)}$ | $\varepsilon$ |              |                                         |                                      |                                               |                                                |                                        |
| M 6×1                     | 8     | 12.2       | 28.2        | 16    | —     | 0.6   | —     | —     | 3   | 0.3               | 0.25          | 11           | 2.7                                     | 3 660                                | 3 650                                         | 1 980                                          |                                        |
| M 8×1.25                  | 10    | 12.2       | 32.2        | 20    | —     | 0.6   | —     | —     | 4   | 0.3               | 0.25          | 13           | 6.5                                     | 4 250                                | 4 740                                         | 4 670                                          |                                        |
| M10×1.25                  | 12    | 13.2       | 36.2        | 23    | —     | 0.6   | —     | —     | 4   | 0.3               | 0.3           | 16           | 13.8                                    | 5 430                                | 6 890                                         | 6 890                                          |                                        |
| M10×1.25                  | 12    | 13.2       | 36.2        | 23    | —     | 0.6   | —     | —     | 4   | 0.3               | 0.3           | 16           | 13.8                                    | 5 430                                | 6 890                                         | 6 890                                          |                                        |
| M12×1.5                   | 13    | 15.2       | 40.2        | 25    | 6     | 0.6   | 4     | 3     | 6   | 0.6               | 0.4           | 21           | 21.9                                    | 7 910                                | 9 790                                         | 9 790                                          |                                        |
| M12×1.5                   | 13    | 15.2       | 40.2        | 25    | 6     | 0.6   | 4     | 3     | 6   | 0.6               | 0.4           | 21           | 21.9                                    | 7 910                                | 9 790                                         | 9 790                                          |                                        |
| M16×1.5                   | 17    | 19.6       | 52.1        | 32.5  | 8     | 0.8   | 4     | 3     | 6   | 0.6               | 0.5           | 26           | 58.5                                    | 12 000                               | 18 300                                        | 18 300                                         |                                        |
| M18×1.5                   | 19    | 21.6       | 58.1        | 36.5  | 8     | 0.8   | 6     | 3     | 8   | 1                 | 0.6           | 29           | 86.2                                    | 14 800                               | 25 200                                        | 25 200                                         |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |
|                           |       |            |             |       |       |       |       |       |     |                   |               |              |                                         |                                      |                                               |                                                |                                        |

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CAM FOLLOWERS

Thrust Disk Type Cam Followers With Cage/Stud Head Hex Hole



Stud dia. 3 – 20mm

| Stud dia.<br>mm | Identification number |               | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |                |            |                |
|-----------------|-----------------------|---------------|---------------------|------------------------|----|----------------|------------|----------------|
|                 | Shield type           | Sealed type   |                     | D                      | C  | d <sub>1</sub> | G          | G <sub>1</sub> |
| 3               | CF 3 WBR              | CF 3 WBUUR    | 4.3                 | 10                     | 7  | 3              | M 3 × 0.5  | 5              |
| 4               | CF 4 WBR              | CF 4 WBUUR    | 7.4                 | 12                     | 8  | 4              | M 4 × 0.7  | 6              |
| 5               | CF 5 WBR              | CF 5 WBUUR    | 10.3                | 13                     | 9  | 5              | M 5 × 0.8  | 7.5            |
| 6               | CF 6 WBR              | CF 6 WBUUR    | 18.5                | 16                     | 11 | 6              | M 6 × 1    | 8              |
| 8               | CF 8 WBR              | CF 8 WBUUR    | 28.5                | 19                     | 11 | 8              | M 8 × 1.25 | 10             |
| 10              | CF 10 WBR             | CF 10 WBUUR   | 45                  | 22                     | 12 | 10             | M10 × 1.25 | 12             |
|                 | CF 10-1 WBR           | CF 10-1 WBUUR | 60                  | 26                     | 12 | 10             | M10 × 1.25 | 12             |
| 12              | CF 12 WBR             | CF 12 WBUUR   | 95                  | 30                     | 14 | 12             | M12 × 1.5  | 13             |
|                 | CF 12-1 WBR           | CF 12-1 WBUUR | 105                 | 32                     | 14 | 12             | M12 × 1.5  | 13             |
| 16              | CF 16 WBR             | CF 16 WBUUR   | 170                 | 35                     | 18 | 16             | M16 × 1.5  | 17             |
| 18              | CF 18 WBR             | CF 18 WBUUR   | 250                 | 40                     | 20 | 18             | M18 × 1.5  | 19             |
| 20              | CF 20 WBR             | CF 20 WBUUR   | 460                 | 52                     | 24 | 20             | M20 × 1.5  | 21             |
|                 | CF 20-1 WBR           | CF 20-1 WBUUR | 385                 | 47                     | 24 | 20             | M20 × 1.5  | 21             |

Remarks1. Models with a stud diameter  $d_1$  of 4 mm or less have no oil hole. For Models with a stud dia. 5 to 10 mm, oil hole (re-greasing fitting) is provided at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.

2. Shield type models with a stud diameter  $d_1$  of 10 mm or less and the sealed type models are provided with prepacked grease. Other models are not provided with prepacked grease. Perform proper lubrication for use.

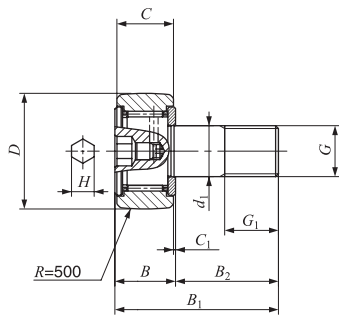
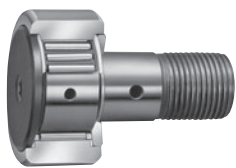


CF ... WBUUR

| B           | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H   | Mounting dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|-----|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|------------------------------------------|
| 8           | 17             | 9              | —              | 0.5            | —              | —              | 2   | 6.8                                   | 0.34                                   | 1 500                                  | 1 020                                              | 384                                      |
| 9           | 20             | 11             | —              | 0.5            | —              | —              | 2.5 | 8.3                                   | 0.78                                   | 2 070                                  | 1 590                                              | 834                                      |
| 10          | 23             | 13             | —              | 0.5            | —              | —              | 3   | 9.3                                   | 1.6                                    | 2 520                                  | 2 140                                              | 1 260                                    |
| 12.2<br>max | 28.2<br>max    | 16             | —              | 0.6            | —              | —              | 3   | 11                                    | 2.7                                    | 3 660                                  | 3 650                                              | 1 950                                    |
| 12.2<br>max | 32.2<br>max    | 20             | —              | 0.6            | —              | —              | 4   | 13                                    | 6.5                                    | 4 250                                  | 4 740                                              | 4 620                                    |
| 13.2<br>max | 36.2<br>max    | 23             | —              | 0.6            | —              | —              | 4   | 16                                    | 13.8                                   | 5 430                                  | 6 890                                              | 6 890                                    |
| 13.2<br>max | 36.2<br>max    | 23             | —              | 0.6            | —              | —              | 4   | 16                                    | 13.8                                   | 5 430                                  | 6 890                                              | 6 890                                    |
| 15.2<br>max | 40.2<br>max    | 25             | 6              | 0.6            | 4              | 3              | 6   | 21                                    | 21.9                                   | 7 910                                  | 9 790                                              | 9 790                                    |
| 15.2<br>max | 40.2<br>max    | 25             | 6              | 0.6            | 4              | 3              | 6   | 21                                    | 21.9                                   | 7 910                                  | 9 790                                              | 9 790                                    |
| 19.6<br>max | 52.1<br>max    | 32.5           | 8              | 0.8            | 4              | 3              | 6   | 26                                    | 58.5                                   | 12 000                                 | 18 300                                             | 18 300                                   |
| 21.6<br>max | 58.1<br>max    | 36.5           | 8              | 0.8            | 6              | 3              | 8   | 29                                    | 86.2                                   | 14 800                                 | 25 200                                             | 25 200                                   |
| 25.6<br>max | 66.1<br>max    | 40.5           | 9              | 0.8            | 6              | 4              | 8   | 34                                    | 119                                    | 20 700                                 | 34 600                                             | 34 600                                   |
| 25.6<br>max | 66.1<br>max    | 40.5           | 9              | 0.8            | 6              | 4              | 8   | 34                                    | 119                                    | 20 700                                 | 34 600                                             | 34 600                                   |

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Thrust Disk Type Cam Followers / Stainless Steel Made With Cage/Stud Head Hex Hole

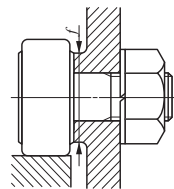
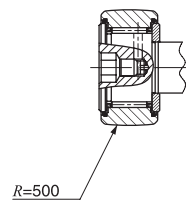


Stud dia. 3 – 5mm

CF...FWBR

| Stud dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>g | Boundary dimensions mm |   |                |           |                |
|-----------------|-----------------------|-------------|---------------------|------------------------|---|----------------|-----------|----------------|
|                 | Shield type           | Sealed type |                     | D                      | C | d <sub>1</sub> | G         | G <sub>1</sub> |
| 3               | CF 3 FWBR             | CF 3 FWBUUR | 4.3                 | 10                     | 7 | 3              | M 3 × 0.5 | 5              |
| 4               | CF 4 FWBR             | CF 4 FWBUUR | 7.4                 | 12                     | 8 | 4              | M 4 × 0.7 | 6              |
| 5               | CF 5 FWBR             | CF 5 FWBUUR | 10.3                | 13                     | 9 | 5              | M 5 × 0.8 | 7.5            |

Remarks1. Models with a stud diameter *d*<sub>1</sub> of 4 mm or less have no oil hole. For Models with a stud dia. 5 mm, oil hole (re-greasing fitting) is provided at the head.  
2. Provided with prepacked grease.



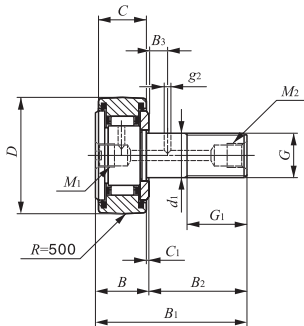
CF...FWBUUR

|          |                       |                       |                       |                       |                       |                       |          | Mounting<br>dimension<br><i>f</i><br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|-------------------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------------------|------------------------------------------|
| <i>B</i> | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>g</i> <sub>1</sub> | <i>g</i> <sub>2</sub> | <i>H</i> |                                                 |                                        |                                               |                                                           |                                          |
| 8        | 17                    | 9                     | —                     | 0.5                   | —                     | —                     | 2        | 6.8                                             | 0.34                                   | 1 200                                         | 813                                                       | 384                                      |
| 9        | 20                    | 11                    | —                     | 0.5                   | —                     | —                     | 2.5      | 8.3                                             | 0.78                                   | 1 650                                         | 1 270                                                     | 834                                      |
| 10       | 23                    | 13                    | —                     | 0.5                   | —                     | —                     | 3        | 9.3                                             | 1.6                                    | 1 930                                         | 1 730                                                     | 1 260                                    |

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CAM FOLLOWERS

Centralized Lubrication Type Cam Followers With Cage/Stud Head Hex Hole

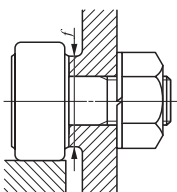
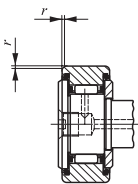


CF-RU1

Stud dia. 6 – 30mm

| Stud dia.<br>mm | Identification number                   |                                         | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |                |            |                |
|-----------------|-----------------------------------------|-----------------------------------------|---------------------|------------------------|----|----------------|------------|----------------|
|                 | With crowned<br>outer ring              | With cylindrical<br>outer ring          |                     | D                      | C  | d <sub>1</sub> | G          | G <sub>1</sub> |
| 6               | CF-RU1- 6                               | CF-FU1- 6                               | 18.5                | 16                     | 11 | 6              | M 6 × 1    | 8              |
| 8               | CF-RU1- 8                               | CF-FU1- 8                               | 28.5                | 19                     | 11 | 8              | M 8 × 1.25 | 10             |
| 10              | CF-RU1-10<br>CF-RU1-10-1                | CF-FU1-10<br>CF-FU1-10-1                | 45                  | 22                     | 12 | 10             | M10 × 1.25 | 12             |
|                 |                                         |                                         | 60                  | 26                     | 12 | 10             | M10 × 1.25 | 12             |
| 12              | CF-RU1-12<br>CF-RU1-12-1                | CF-FU1-12<br>CF-FU1-12-1                | 95                  | 30                     | 14 | 12             | M12 × 1.5  | 13             |
|                 |                                         |                                         | 105                 | 32                     | 14 | 12             | M12 × 1.5  | 13             |
| 16              | CF-RU1-16                               | CF-FU1-16                               | 170                 | 35                     | 18 | 16             | M16 × 1.5  | 17             |
| 18              | CF-RU1-18                               | CF-FU1-18                               | 250                 | 40                     | 20 | 18             | M18 × 1.5  | 19             |
| 20              | CF-RU1-20<br>CF-RU1-20-1                | CF-FU1-20<br>CF-FU1-20-1                | 460                 | 52                     | 24 | 20             | M20 × 1.5  | 21             |
|                 |                                         |                                         | 385                 | 47                     | 24 | 20             | M20 × 1.5  | 21             |
| 24              | CF-RU1-24<br>CF-RU1-24-1                | CF-FU1-24<br>CF-FU1-24-1                | 815                 | 62                     | 29 | 24             | M24 × 1.5  | 25             |
|                 |                                         |                                         | 1 140               | 72                     | 29 | 24             | M24 × 1.5  | 25             |
| 30              | CF-RU1-30<br>CF-RU1-30-1<br>CF-RU1-30-2 | CF-FU1-30<br>CF-FU1-30-1<br>CF-FU1-30-2 | 1 870               | 80                     | 35 | 30             | M30 × 1.5  | 32             |
|                 |                                         |                                         | 2 030               | 85                     | 35 | 30             | M30 × 1.5  | 32             |
|                 |                                         |                                         | 2 220               | 90                     | 35 | 30             | M30 × 1.5  | 32             |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remarks1. Models with a stud diameter *d*<sub>1</sub> of 12 mm or less are provided with a lubrication tapped hole on the stud head only. Other models are provided with one lubrication tapped hole each on the head and end surface of the stud.  
2. Provided with prepacked grease.



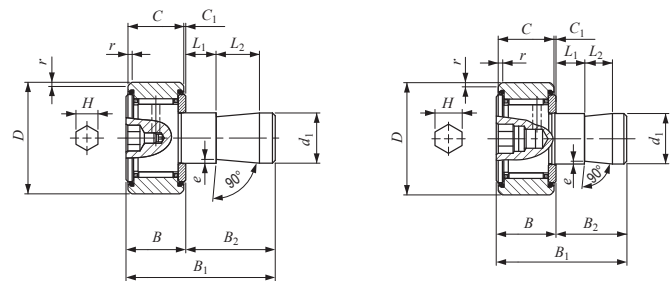
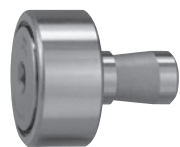
CF-FU1

| <i>B</i> <sub>max</sub> | <i>B</i> <sub>1max</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>g</i> <sub>2</sub> | <i>M</i> <sub>1</sub> | <i>M</i> <sub>2</sub> | <i>r</i> <sub>s min</sub> <sup>(1)</sup> | Mounting<br>dimension<br><i>f</i><br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br><i>C</i><br>N | Basic static<br>load rating<br><i>C</i> <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|-------------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------------------------|-------------------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------------------|------------------------------------------|
| 12.2                    | 28.2                     | 16                    | —                     | 0.6                   | —                     | M6 ×<br>0.75          | —                     | 0.3                                      | 11                                              | 2.7                                    | 3 660                                         | 3 650                                                     | 1 950                                    |
| 12.2                    | 32.2                     | 20                    | —                     | 0.6                   | —                     |                       |                       | 0.3                                      | 13                                              | 6.5                                    | 4 250                                         | 4 740                                                     | 4 620                                    |
| 13.2                    | 36.2                     | 23                    | —                     | 0.6                   | —                     |                       |                       | 0.3                                      | 16                                              | 13.8                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 13.2                    | 36.2                     | 23                    | —                     | 0.6                   | —                     |                       |                       | 0.3                                      | 16                                              | 13.8                                   | 5 430                                         | 6 890                                                     | 6 890                                    |
| 15.2                    | 40.2                     | 25                    | —                     | 0.6                   | —                     |                       |                       | 0.6                                      | 21                                              | 23.9                                   | 7 910                                         | 9 790                                                     | 9 790                                    |
| 15.2                    | 40.2                     | 25                    | —                     | 0.6                   | —                     | PT<br>1/8             | PT<br>1/8             | 0.6                                      | 21                                              | 23.9                                   | 7 910                                         | 9 790                                                     | 9 790                                    |
| 19.6                    | 52.1                     | 32.5                  | 8                     | 0.8                   | 3                     |                       |                       | 0.6                                      | 26                                              | 58.5                                   | 12 000                                        | 18 300                                                    | 18 300                                   |
| 21.6                    | 58.1                     | 36.5                  | 8                     | 0.8                   | 3                     |                       |                       | 1                                        | 29                                              | 86.2                                   | 14 800                                        | 25 200                                                    | 25 200                                   |
| 25.6                    | 66.1                     | 40.5                  | 9                     | 0.8                   | 4                     |                       |                       | 1                                        | 34                                              | 119                                    | 20 700                                        | 34 600                                                    | 34 600                                   |
| 25.6                    | 66.1                     | 40.5                  | 9                     | 0.8                   | 4                     |                       |                       | 1                                        | 34                                              | 119                                    | 20 700                                        | 34 600                                                    | 34 600                                   |
| 30.6                    | 80.1                     | 49.5                  | 11                    | 0.8                   | 4                     |                       |                       | 1                                        | 40                                              | 215                                    | 30 500                                        | 52 600                                                    | 52 000                                   |
| 30.6                    | 80.1                     | 49.5                  | 11                    | 0.8                   | 4                     |                       |                       | 1                                        | 40                                              | 215                                    | 30 500                                        | 52 600                                                    | 52 000                                   |
| 37                      | 100                      | 63                    | 15                    | 1                     | 4                     |                       |                       | 1                                        | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |
| 37                      | 100                      | 63                    | 15                    | 1                     | 4                     |                       |                       | 1                                        | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |
| 37                      | 100                      | 63                    | 15                    | 1                     | 4                     |                       |                       | 1                                        | 49                                              | 438                                    | 45 400                                        | 85 100                                                    | 85 100                                   |

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CAM FOLLOWERS

Easy Mounting Type Cam Followers With Cage/Stud Head Hex Hole



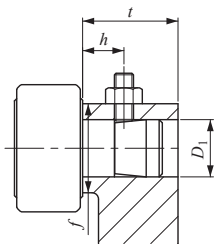
CF-SFU...B  
Stud dia.  $d_1$  6-10mm

CF-SFU...B  
Stud dia.  $d_1$  12-20mm

Stud dia. 6—20mm

| Stud dia.<br>mm | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |     |       |            |             |       |       |       |
|-----------------|--------------------------|---------------------|------------------------|-----|-------|------------|-------------|-------|-------|-------|
|                 |                          |                     | $D$                    | $C$ | $d_1$ | $B_{\max}$ | $B_{1\max}$ | $B_2$ | $C_1$ | $L_1$ |
| 6               | CF-SFU- 6 B              | 19.5                | 16                     | 11  | 6     | 12.2       | 32          | 19.8  | 0.6   | 5     |
| 8               | CF-SFU- 8 B              | 29                  | 19                     | 11  | 8     | 12.2       | 32          | 19.8  | 0.6   | 5     |
| 10              | CF-SFU-10 B              | 44                  | 22                     | 12  | 10    | 13.2       | 33          | 19.8  | 0.6   | 5     |
|                 | CF-SFU-10-1 B            | 59                  | 26                     | 12  | 10    | 13.2       | 33          | 19.8  | 0.6   | 5     |
| 12              | CF-SFU-12 B              | 94                  | 30                     | 14  | 12    | 15.2       | 35          | 19.8  | 0.6   | 5     |
|                 | CF-SFU-12-1 B            | 104                 | 32                     | 14  | 12    | 15.2       | 35          | 19.8  | 0.6   | 5     |
| 16              | CF-SFU-16 B              | 164                 | 35                     | 18  | 16    | 19.6       | 44.5        | 24.9  | 0.8   | 10    |
| 18              | CF-SFU-18 B              | 235                 | 40                     | 20  | 18    | 21.6       | 46.5        | 24.9  | 0.8   | 10    |
| 20              | CF-SFU-20 B              | 435                 | 52                     | 24  | 20    | 25.6       | 50.5        | 24.9  | 0.8   | 10    |
|                 | CF-SFU-20-1 B            | 360                 | 47                     | 24  | 20    | 25.6       | 50.5        | 24.9  | 0.8   | 10    |

Note(1) Minimum allowable value of chamfer dimension  $r$   
Remarks1. Models with a stud diameter  $d_1$  of 10 mm or less have an oil hole (re-greasing fitting) at the head. Other models are provided with an oil hole (grease nipple) at the head.  
2. Provided with prepacked grease.

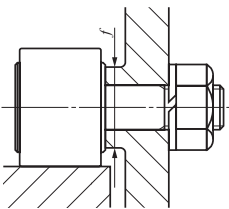
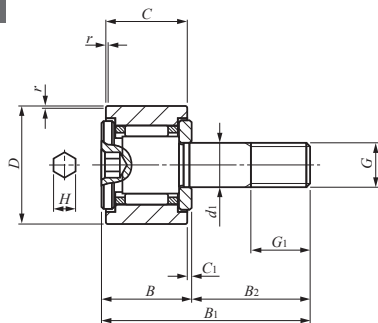
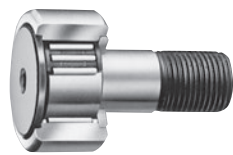


|       |     |     |                   | Mounting dimensions mm |               |             |             |               | Basic dynamic<br>load rating<br>$C$<br>N | Basic static<br>load rating<br>$C_0$<br>N | Maximum<br>allowable<br>static load<br>N |
|-------|-----|-----|-------------------|------------------------|---------------|-------------|-------------|---------------|------------------------------------------|-------------------------------------------|------------------------------------------|
| $L_2$ | $H$ | $e$ | $r_{s\min}^{(1)}$ | $D_1$                  | Tolerance     | $t$<br>Min. | $f$<br>Min. | $h$<br>(Ref.) |                                          |                                           |                                          |
| 10    | 3   | 0.3 | 0.3               | 6                      | $+0.012$<br>0 | 20          | 11          | 10            | 3 660                                    | 3 650                                     | 1 950                                    |
| 10    | 4   | 0.5 | 0.3               | 8                      | $+0.015$<br>0 | 20          | 13          | 10            | 4 250                                    | 4 740                                     | 4 620                                    |
| 10    | 4   | 0.5 | 0.3               | 10                     |               | 20          | 16          | 10            | 5 430                                    | 6 890                                     | 6 890                                    |
| 10    | 4   | 0.5 | 0.3               | 10                     | $+0.018$<br>0 | 20          | 16          | 10            | 5 430                                    | 6 890                                     | 6 890                                    |
| 10    | 6   | 1   | 0.6               | 12                     |               | 20          | 21          | 10            | 7 910                                    | 9 790                                     | 9 790                                    |
| 10    | 6   | 1   | 0.6               | 12                     |               | 20          | 21          | 10            | 7 910                                    | 9 790                                     | 9 790                                    |
| 10    | 6   | 1   | 0.6               | 16                     |               | 25          | 26          | 15            | 12 000                                   | 18 300                                    | 18 300                                   |
| 10    | 8   | 1   | 1                 | 18                     | $+0.021$<br>0 | 25          | 29          | 15            | 14 800                                   | 25 200                                    | 25 200                                   |
| 10    | 8   | 1   | 1                 | 20                     |               | 25          | 34          | 15            | 20 700                                   | 34 600                                    | 34 600                                   |
| 10    | 8   | 1   | 1                 | 20                     |               | 25          | 34          | 15            | 20 700                                   | 34 600                                    | 34 600                                   |
| 10    | 8   | 1   | 1                 | 20                     |               | 25          | 34          | 15            | 20 700                                   | 34 600                                    | 34 600                                   |

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CAM FOLLOWERS

Cam Follower G With Cage/Stud Head Hex Hole



Stud dia. 6 – 20mm

CF...G

| Stud dia.<br>mm | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |                |            |                |                  |                   |
|-----------------|--------------------------|---------------------|------------------------|----|----------------|------------|----------------|------------------|-------------------|
|                 |                          |                     | D                      | C  | d <sub>1</sub> | G          | G <sub>1</sub> | B <sub>max</sub> | B <sub>1max</sub> |
| 6               | CF 6 G                   | 19.5                | 16                     | 11 | 6              | M 6 × 1    | 8              | 12.2             | 28.2              |
| 8               | CF 8 G                   | 29.5                | 19                     | 11 | 8              | M 8 × 1.25 | 10             | 12.2             | 32.2              |
| 10              | CF 10 G                  | 47.5                | 22                     | 12 | 10             | M10 × 1.25 | 12             | 13.2             | 36.2              |
|                 | CF 10-1 G                | 61.5                | 26                     | 12 | 10             | M10 × 1.25 | 12             | 13.2             | 36.2              |
| 12              | CF 12 G                  | 95.0                | 30                     | 14 | 12             | M12 × 1.5  | 13             | 15.2             | 40.2              |
|                 | CF 12-1 G                | 105                 | 32                     | 14 | 12             | M12 × 1.5  | 13             | 15.2             | 40.2              |
| 16              | CF 16 G                  | 175                 | 35                     | 18 | 16             | M16 × 1.5  | 17             | 19.6             | 52.1              |
| 18              | CF 18 G                  | 255                 | 40                     | 20 | 18             | M18 × 1.5  | 19             | 21.6             | 58.1              |
| 20              | CF 20 G                  | 470                 | 52                     | 24 | 20             | M20 × 1.5  | 21             | 25.6             | 66.1              |
|                 | CF 20-1 G                | 400                 | 47                     | 24 | 20             | M20 × 1.5  | 21             | 25.6             | 66.1              |

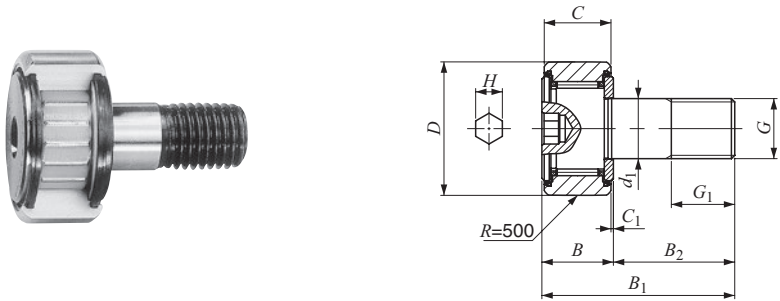
Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*.  
Remarks1. This type of bearings cannot be re-lubricated due to the structure. If the environment requires re-lubrication, please use Standard Type Cam Followers.  
2. Provided with prepacked grease.

| B <sub>2</sub> | C <sub>1</sub> | H | r <sub>s min</sub> <sup>(1)</sup> | Mounting<br>dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum<br>allowable static<br>load<br>N |
|----------------|----------------|---|-----------------------------------|------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|------------------------------------------|
|                |                |   |                                   |                                          |                                        |                                        |                                                    |                                          |
| 16             | 0.6            | 3 | 0.3                               | 11                                       | 2.7                                    | 3 660                                  | 3 650                                              | 1 950                                    |
| 20             | 0.6            | 4 | 0.3                               | 13                                       | 6.5                                    | 4 250                                  | 4 740                                              | 4 620                                    |
| 23             | 0.6            | 4 | 0.3                               | 16                                       | 13.8                                   | 5 430                                  | 6 890                                              | 6 890                                    |
| 23             | 0.6            | 4 | 0.3                               | 16                                       | 13.8                                   | 5 430                                  | 6 890                                              | 6 890                                    |
| 25             | 0.6            | 6 | 0.6                               | 21                                       | 23.9                                   | 7 910                                  | 9 790                                              | 9 790                                    |
| 25             | 0.6            | 6 | 0.6                               | 21                                       | 23.9                                   | 7 910                                  | 9 790                                              | 9 790                                    |
| 32.5           | 0.8            | 6 | 0.6                               | 26                                       | 61.1                                   | 12 000                                 | 18 300                                             | 18 300                                   |
| 36.5           | 0.8            | 8 | 1                                 | 29                                       | 89.2                                   | 14 800                                 | 25 200                                             | 25 200                                   |
| 40.5           | 0.8            | 8 | 1                                 | 34                                       | 125                                    | 20 700                                 | 34 600                                             | 34 600                                   |
| 40.5           | 0.8            | 8 | 1                                 | 34                                       | 125                                    | 20 700                                 | 34 600                                             | 34 600                                   |

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CAM FOLLOWERS

C-Lube Cam Followers With Cage / Stud Head Hex Hole

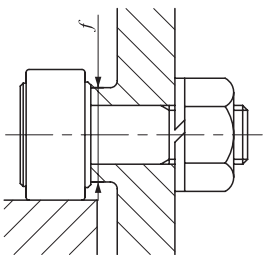


Stud dia. 5 – 20mm

CF ... WB ... /SG

| Stud dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |                |            |                |          |                |
|-----------------|-----------------------|---------------------|------------------------|----|----------------|------------|----------------|----------|----------------|
|                 |                       |                     | D                      | C  | d <sub>1</sub> | G          | G <sub>1</sub> | B        | B <sub>1</sub> |
| 5               | CF 5 WBUUR/SG         | 10.3                | 13                     | 9  | 5              | M 5 × 0.8  | 7.5            | 10       | 23             |
| 6               | CF 6 WBUUR/SG         | 18.5                | 16                     | 11 | 6              | M 6 × 1    | 8              | 12.2 max | 28.2 max       |
| 8               | CF 8 WBUUR/SG         | 28.5                | 19                     | 11 | 8              | M 8 × 1.25 | 10             | 12.2 max | 32.2 max       |
| 10              | CF 10 WBUUR/SG        | 45                  | 22                     | 12 | 10             | M10 × 1.25 | 12             | 13.2 max | 36.2 max       |
|                 | CF 10-1 WBUUR/SG      | 60                  | 26                     | 12 | 10             | M10 × 1.25 | 12             | 13.2 max | 36.2 max       |
| 12              | CF 12 WBUUR/SG        | 95                  | 30                     | 14 | 12             | M12 × 1.5  | 13             | 15.2 max | 40.2 max       |
|                 | CF 12-1 WBUUR/SG      | 105                 | 32                     | 14 | 12             | M12 × 1.5  | 13             | 15.2 max | 40.2 max       |
| 16              | CF 16 WBUUR/SG        | 170                 | 35                     | 18 | 16             | M16 × 1.5  | 17             | 19.6 max | 52.1 max       |
| 18              | CF 18 WBUUR/SG        | 250                 | 40                     | 20 | 18             | M18 × 1.5  | 19             | 21.6 max | 58.1 max       |
| 20              | CF 20 WBUUR/SG        | 460                 | 52                     | 24 | 20             | M20 × 1.5  | 21             | 25.6 max | 66.1 max       |
|                 | CF 20-1 WBUUR/SG      | 385                 | 47                     | 24 | 20             | M20 × 1.5  | 21             | 25.6 max | 66.1 max       |

Remark This bearing cannot be re-lubricated as thermosetting solid-type lubricant C-Lube fills its inner space.

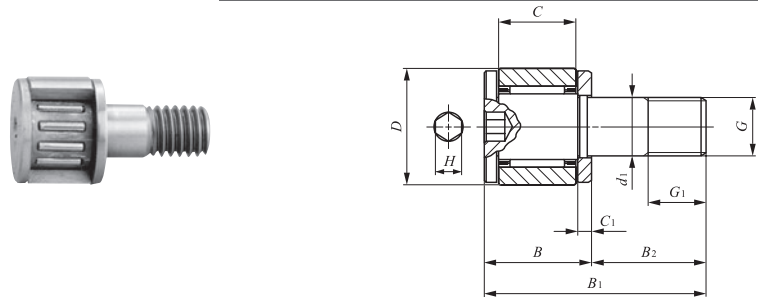


| B <sub>2</sub> | C <sub>1</sub> | H | Mounting dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N-m | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Maximum<br>allowable<br>static load |
|----------------|----------------|---|---------------------------------------|----------------------------------------|-----------------------------------|-----------------------------------------------|-------------------------------------|
|                |                |   |                                       |                                        | N                                 | N                                             | N                                   |
| 13             | 0.5            | 3 | 9.3                                   | 1.6                                    | 2 520                             | 2 140                                         | 1 260                               |
| 16             | 0.6            | 3 | 11                                    | 2.7                                    | 3 660                             | 3 650                                         | 1 950                               |
| 20             | 0.6            | 4 | 13                                    | 6.5                                    | 4 250                             | 4 740                                         | 4 620                               |
| 23             | 0.6            | 4 | 16                                    | 13.8                                   | 5 430                             | 6 890                                         | 6 890                               |
| 23             | 0.6            | 4 | 16                                    | 13.8                                   | 5 430                             | 6 890                                         | 6 890                               |
| 25             | 0.6            | 6 | 21                                    | 21.9                                   | 7 910                             | 9 790                                         | 9 790                               |
| 25             | 0.6            | 6 | 21                                    | 21.9                                   | 7 910                             | 9 790                                         | 9 790                               |
| 32.5           | 0.8            | 6 | 26                                    | 58.5                                   | 12 000                            | 18 300                                        | 18 300                              |
| 36.5           | 0.8            | 8 | 29                                    | 86.2                                   | 14 800                            | 25 200                                        | 25 200                              |
| 40.5           | 0.8            | 8 | 34                                    | 119                                    | 20 700                            | 34 600                                        | 34 600                              |
| 40.5           | 0.8            | 8 | 34                                    | 119                                    | 20 700                            | 34 600                                        | 34 600                              |

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CAM FOLLOWERS

Miniature Type Cam Followers **With Cage/Stud Head Hex Hole**  
**Full Complement Type/Stud Head Hex Hole**

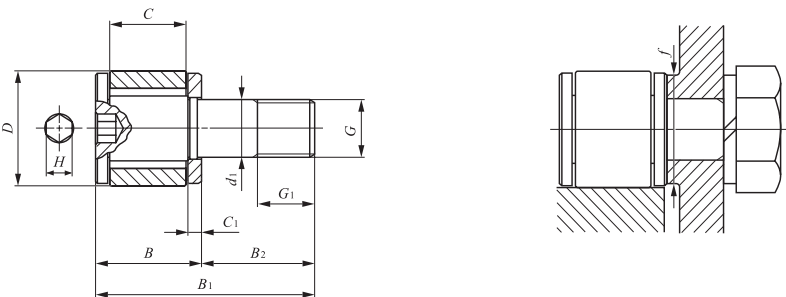


CFS

Stud dia. 2 – 6mm

| Stud dia.<br>mm | Identification number |                 | Mass<br>(Ref.)<br>g | Boundary dimensions mm |     |                |             |                |     |
|-----------------|-----------------------|-----------------|---------------------|------------------------|-----|----------------|-------------|----------------|-----|
|                 | With cage             | Full complement |                     | D                      | C   | d <sub>1</sub> | G           | G <sub>1</sub> | B   |
| 2               | CFS 2                 | —               | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4   |
|                 | —                     | CFS 2 V         | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4   |
| 2.5             | CFS 2.5               | —               | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 4.5 |
|                 | —                     | CFS 2.5 V       | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 4.5 |
| 3               | CFS 3                 | —               | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 5.5 |
|                 | —                     | CFS 3 V         | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 5.5 |
| 4               | CFS 4                 | —               | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 7   |
|                 | —                     | CFS 4 V         | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 7   |
| 5               | CFS 5                 | —               | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 8   |
|                 | —                     | CFS 5 V         | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 8   |
| 6               | CFS 6                 | —               | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 9.5 |
|                 | —                     | CFS 6 V         | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 9.5 |

Remarks1. No oil hole is provided.  
2. Provided with prepacked grease.



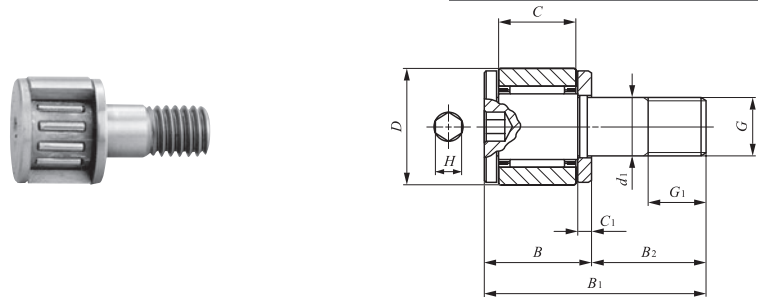
CFS...V

|                |                |                |     | Mounting dimension<br>f<br>Min. mm | Maximum tightening torque<br>N·m | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N | Maximum allowable static load<br>N |
|----------------|----------------|----------------|-----|------------------------------------|----------------------------------|-------------------------------------|-------------------------------------------------|------------------------------------|
| B <sub>1</sub> | B <sub>2</sub> | C <sub>1</sub> | H   |                                    |                                  |                                     |                                                 |                                    |
| 8              | 4              | 0.7            | 0.9 | 4.3                                | 9.1                              | 288                                 | 202                                             | 202                                |
| 8              | 4              | 0.7            | 0.9 | 4.3                                | 9.1                              | 768                                 | 734                                             | 229                                |
| 9.5            | 5              | 0.7            | 0.9 | 4.8                                | 18.7                             | 428                                 | 351                                             | 351                                |
| 9.5            | 5              | 0.7            | 0.9 | 4.8                                | 18.7                             | 1 000                               | 1 080                                           | 360                                |
| 11.5           | 6              | 0.7            | 1.3 | 5.8                                | 33.5                             | 629                                 | 611                                             | 484                                |
| 11.5           | 6              | 0.7            | 1.3 | 5.8                                | 33.5                             | 1 420                               | 1 790                                           | 484                                |
| 15             | 8              | 1.0            | 1.5 | 7.7                                | 77.7                             | 1 120                               | 1 120                                           | 919                                |
| 15             | 8              | 1.0            | 1.5 | 7.7                                | 77.7                             | 2 370                               | 3 000                                           | 919                                |
| 18             | 10             | 1.0            | 2   | 9.6                                | 158                              | 1 570                               | 1 850                                           | 1 570                              |
| 18             | 10             | 1.0            | 2   | 9.6                                | 158                              | 3 180                               | 4 700                                           | 1 570                              |
| 21.5           | 12             | 1.2            | 2.5 | 11.6                               | 268                              | 2 090                               | 2 200                                           | 2 150                              |
| 21.5           | 12             | 1.2            | 2.5 | 11.6                               | 268                              | 4 610                               | 6 250                                           | 2 150                              |

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CAM FOLLOWERS

Miniature Type Cam Followers / Stainless Steel Made **With Cage/Stud Head Hex Hole**  
**Full Complement Type/Stud Head Hex Hole**

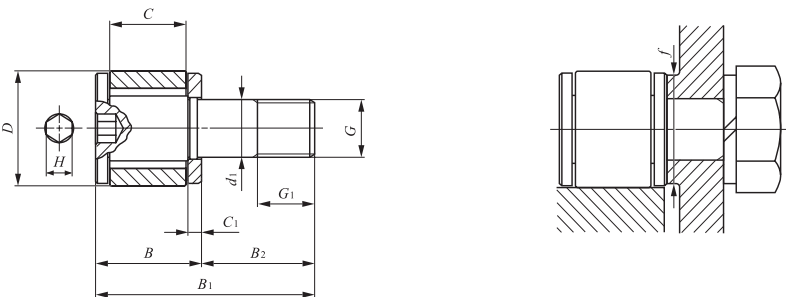


CFS...F

Stud dia. 2 – 6mm

| Stud dia.<br>mm | Identification number |                 | Mass<br>(Ref.)<br>g | Boundary dimensions mm |     |                |             |                |     |
|-----------------|-----------------------|-----------------|---------------------|------------------------|-----|----------------|-------------|----------------|-----|
|                 | With cage             | Full complement |                     | D                      | C   | d <sub>1</sub> | G           | G <sub>1</sub> | B   |
| 2               | CFS 2 F               | —               | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4   |
|                 | —                     | CFS 2 FV        | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4   |
| 2.5             | CFS 2.5 F             | —               | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 4.5 |
|                 | —                     | CFS 2.5 FV      | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 4.5 |
| 3               | CFS 3 F               | —               | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 5.5 |
|                 | —                     | CFS 3 FV        | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 5.5 |
| 4               | CFS 4 F               | —               | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 7   |
|                 | —                     | CFS 4 FV        | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 7   |
| 5               | CFS 5 F               | —               | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 8   |
|                 | —                     | CFS 5 FV        | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 8   |
| 6               | CFS 6 F               | —               | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 9.5 |
|                 | —                     | CFS 6 FV        | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 9.5 |

Remarks1. No oil hole is provided.  
2. Provided with prepacked grease.



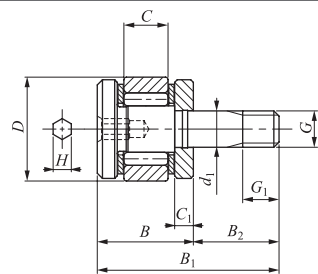
CFS...FV

| B <sub>1</sub> | B <sub>2</sub> | C <sub>1</sub> | H   | Mounting<br>dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N-cm | Basic dynamic<br>load rating | Basic static<br>load rating | Maximum<br>allowable<br>static load |
|----------------|----------------|----------------|-----|------------------------------------------|-----------------------------------------|------------------------------|-----------------------------|-------------------------------------|
|                |                |                |     |                                          |                                         | C<br>N                       | C <sub>0</sub><br>N         | N                                   |
| 8              | 4              | 0.7            | 0.9 | 4.3                                      | 9.1                                     | 230                          | 161                         | 161                                 |
| 8              | 4              | 0.7            | 0.9 | 4.3                                      | 9.1                                     | 614                          | 587                         | 229                                 |
| 9.5            | 5              | 0.7            | 0.9 | 4.8                                      | 18.7                                    | 342                          | 281                         | 281                                 |
| 9.5            | 5              | 0.7            | 0.9 | 4.8                                      | 18.7                                    | 800                          | 862                         | 360                                 |
| 11.5           | 6              | 0.7            | 1.3 | 5.8                                      | 33.5                                    | 504                          | 488                         | 484                                 |
| 11.5           | 6              | 0.7            | 1.3 | 5.8                                      | 33.5                                    | 1 140                        | 1 430                       | 484                                 |
| 15             | 8              | 1.0            | 1.5 | 7.7                                      | 77.7                                    | 897                          | 894                         | 894                                 |
| 15             | 8              | 1.0            | 1.5 | 7.7                                      | 77.7                                    | 1 900                        | 2 400                       | 919                                 |
| 18             | 10             | 1.0            | 2   | 9.6                                      | 158                                     | 1 250                        | 1 480                       | 1 480                               |
| 18             | 10             | 1.0            | 2   | 9.6                                      | 158                                     | 2 540                        | 3 760                       | 1 570                               |
| 21.5           | 12             | 1.2            | 2.5 | 11.6                                     | 268                                     | 1 670                        | 1 760                       | 1 760                               |
| 21.5           | 12             | 1.2            | 2.5 | 11.6                                     | 268                                     | 3 690                        | 5 000                       | 2 150                               |

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CAM FOLLOWERS

Thrust Disk Type Miniature Cam Followers **With Cage/Stud Head Hex Hole**  
**Full Complement Type/Stud Head Hex Hole**

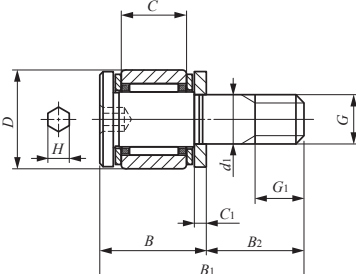


CFS1.4 WV

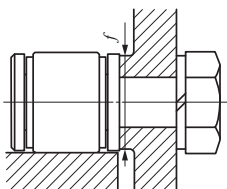
Stud dia. 1.4 — 6mm

| Stud dia.<br>mm | Identification number |                 | Mass<br>(Ref.)<br>g | Boundary dimensions mm |     |                |             |                |      |
|-----------------|-----------------------|-----------------|---------------------|------------------------|-----|----------------|-------------|----------------|------|
|                 | With cage             | Full complement |                     | D                      | C   | d <sub>1</sub> | G           | G <sub>1</sub> | B    |
| 1.4             | —                     | CFS 1.4 WV      | 0.35                | 4                      | 1.7 | 1.4            | M1.4 × 0.3  | 1.4            | 3.7  |
| 2               | CFS 2 W               | —               | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4.5  |
| 2.5             | CFS 2.5 W             | —               | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 5    |
| 3               | CFS 3 W               | —               | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 6.5  |
| 4               | CFS 4 W               | —               | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 8    |
| 5               | CFS 5 W               | —               | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 9    |
| 6               | CFS 6 W               | —               | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 10.5 |

Remarks1. No oil hole is provided.  
2. Provided with prepacked grease.



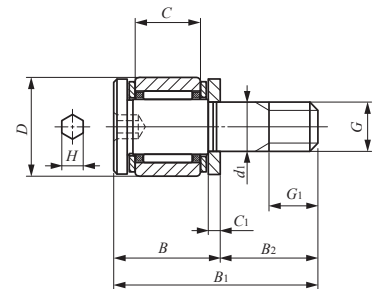
CFS... W



| B <sub>1</sub> | B <sub>2</sub> | C <sub>1</sub> | H   | Mounting<br>dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N-cm | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|----------------|----------------|----------------|-----|------------------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------------------|------------------------------------------|
|                |                |                |     |                                          |                                         |                                        |                                                    |                                          |
| 7              | 3.3            | 0.7            | 0.9 | 3.8                                      | 3.0                                     | 481                                    | 385                                                | 105                                      |
| 8.5            | 4              | 0.7            | 0.9 | 4.3                                      | 9.1                                     | 288                                    | 202                                                | 194                                      |
| 10             | 5              | 0.7            | 0.9 | 4.8                                      | 18.7                                    | 428                                    | 351                                                | 313                                      |
| 12.5           | 6              | 0.7            | 1.3 | 5.8                                      | 33.5                                    | 629                                    | 611                                                | 399                                      |
| 16             | 8              | 1              | 1.5 | 7.7                                      | 77.7                                    | 1120                                   | 1120                                               | 785                                      |
| 19             | 10             | 1              | 2   | 9.6                                      | 158                                     | 1570                                   | 1850                                               | 1370                                     |
| 22.5           | 12             | 1.2            | 2.5 | 11.6                                     | 268                                     | 2090                                   | 2200                                               | 1920                                     |

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Thrust Disk Type Miniature Cam Followers · Stainless Steel Made With Cage/Stud Head Hex Hole

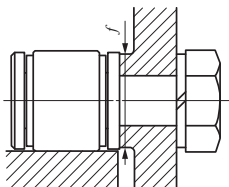


CFS···FW

Stud dia. 2 – 6mm

| Stud dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |     |                |             |                |      |
|-----------------|-----------------------|---------------------|------------------------|-----|----------------|-------------|----------------|------|
|                 |                       |                     | D                      | C   | d <sub>1</sub> | G           | G <sub>1</sub> | B    |
| 2               | CFS 2 FW              | 0.6                 | 4.5                    | 2.5 | 2              | M2 × 0.4    | 2              | 4.5  |
| 2.5             | CFS 2.5 FW            | 1                   | 5                      | 3   | 2.5            | M2.5 × 0.45 | 2.5            | 5    |
| 3               | CFS 3 FW              | 2                   | 6                      | 4   | 3              | M3 × 0.5    | 3              | 6.5  |
| 4               | CFS 4 FW              | 4                   | 8                      | 5   | 4              | M4 × 0.7    | 4              | 8    |
| 5               | CFS 5 FW              | 7                   | 10                     | 6   | 5              | M5 × 0.8    | 5              | 9    |
| 6               | CFS 6 FW              | 13                  | 12                     | 7   | 6              | M6 × 1      | 6              | 10.5 |

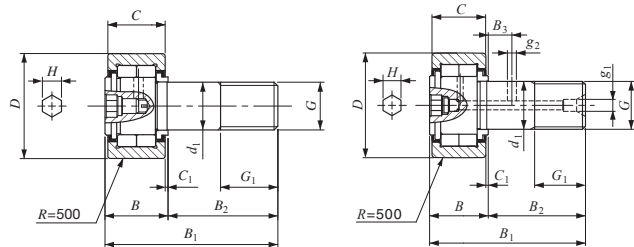
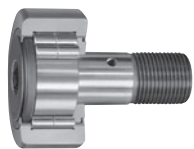
Remarks1. No oil hole is provided.  
2. Provided with prepacked grease.



| B <sub>1</sub> | B <sub>2</sub> | C <sub>1</sub> | H   | Mounting<br>dimension<br>f<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·cm | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|----------------|----------------|----------------|-----|------------------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------------------|------------------------------------------|
| 8.5            | 4              | 0.7            | 0.9 | 4.3                                      | 9.1                                     | 230                                    | 161                                                | 161                                      |
| 10             | 5              | 0.7            | 0.9 | 4.8                                      | 18.7                                    | 342                                    | 281                                                | 281                                      |
| 12.5           | 6              | 0.7            | 1.3 | 5.8                                      | 33.5                                    | 504                                    | 488                                                | 399                                      |
| 16             | 8              | 1.0            | 1.5 | 7.7                                      | 77.7                                    | 897                                    | 894                                                | 785                                      |
| 19             | 10             | 1.0            | 2   | 9.6                                      | 158                                     | 1 250                                  | 1 480                                              | 1 370                                    |
| 22.5           | 12             | 1.2            | 2.5 | 11.6                                     | 268                                     | 1 670                                  | 1 760                                              | 1 760                                    |

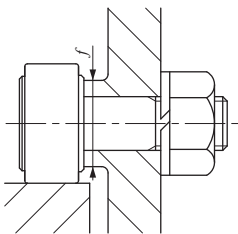
CAM FOLLOWERS

Cylindrical Roller Cam Followers Full Complement Type/Stud Head Hex Hole



NUCF...BR  
Stud dia.  $d_1$  10mm

NUCF...BR  
Stud dia.  $d_1$  12-30mm



Stud dia. 10—30mm

| Stud dia.<br>mm | Identification<br>number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |    |       |            |       |            |             |       |
|-----------------|--------------------------|---------------------|------------------------|----|-------|------------|-------|------------|-------------|-------|
|                 |                          |                     | D                      | C  | $d_1$ | G          | $G_1$ | $B_{\max}$ | $B_{1\max}$ | $B_2$ |
| 10              | NUCF 10 BR               | 44                  | 22                     | 12 | 10    | M10 × 1.25 | 12    | 13.2       | 36.2        | 23    |
|                 | NUCF 10-1 BR             | 58                  | 26                     | 12 | 10    | M10 × 1.25 | 12    | 13.2       | 36.2        | 23    |
| 12              | NUCF 12 BR               | 86                  | 30                     | 14 | 12    | M12 × 1.5  | 13    | 15.2       | 40.2        | 25    |
|                 | NUCF 12-1 BR             | 97                  | 32                     | 14 | 12    | M12 × 1.5  | 13    | 15.2       | 40.2        | 25    |
| 16              | NUCF 16 BR               | 167                 | 35                     | 18 | 16    | M16 × 1.5  | 17    | 19.6       | 52.1        | 32.5  |
| 18              | NUCF 18 BR               | 244                 | 40                     | 20 | 18    | M18 × 1.5  | 19    | 21.6       | 58.1        | 36.5  |
| 20              | NUCF 20 BR               | 457                 | 52                     | 24 | 20    | M20 × 1.5  | 21    | 25.6       | 66.1        | 40.5  |
|                 | NUCF 20-1 BR             | 384                 | 47                     | 24 | 20    | M20 × 1.5  | 21    | 25.6       | 66.1        | 40.5  |
| 24              | NUCF 24 BR               | 789                 | 62                     | 29 | 24    | M24 × 1.5  | 25    | 30.6       | 80.1        | 49.5  |
|                 | NUCF 24-1 BR             | 1 020               | 72                     | 29 | 24    | M24 × 1.5  | 25    | 30.6       | 80.1        | 49.5  |
| 30              | NUCF 30 BR               | 1 600               | 80                     | 35 | 30    | M30 × 1.5  | 32    | 37         | 100         | 63    |
|                 | NUCF 30-2 BR             | 1 970               | 90                     | 35 | 30    | M30 × 1.5  | 32    | 37         | 100         | 63    |

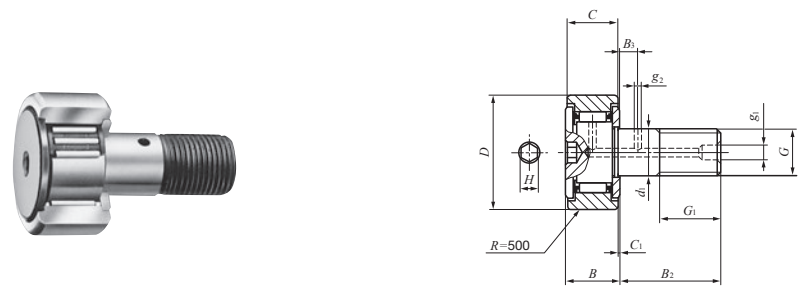
Remarks1. For models with a stud diameter  $d_1$  of 10mm, oil hole (re-greasing fitting) is provided at the head. Other models are provided with an oil hole (grease nipple) at the head and an oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.

| $B_3$ | $C_1$ | $g_1$ | $g_2$ | H  | Mounting<br>dimension<br>$f$<br>Min.<br>mm | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>$C_0$<br>N | Maximum<br>allowable<br>static load<br>N |
|-------|-------|-------|-------|----|--------------------------------------------|----------------------------------------|----------------------------------------|-------------------------------------------|------------------------------------------|
| —     | 0.6   | —     | —     | 4  | 12                                         | 13.8                                   | 10 400                                 | 11 500                                    | 5 300                                    |
| —     | 0.6   | —     | —     | 4  | 12                                         | 13.8                                   | 10 400                                 | 11 500                                    | 9 210                                    |
| 6     | 0.6   | 4     | 3     | 6  | 17                                         | 21.9                                   | 14 000                                 | 13 400                                    | 5 650                                    |
| 6     | 0.6   | 4     | 3     | 6  | 17                                         | 21.9                                   | 14 000                                 | 13 400                                    | 9 040                                    |
| 8     | 0.8   | 4     | 3     | 6  | 20                                         | 58.5                                   | 23 400                                 | 27 300                                    | 11 800                                   |
| 8     | 0.8   | 6     | 3     | 8  | 22                                         | 86.2                                   | 25 200                                 | 30 900                                    | 20 300                                   |
| 9     | 0.8   | 6     | 4     | 8  | 31                                         | 119                                    | 43 100                                 | 58 100                                    | 30 000                                   |
| 9     | 0.8   | 6     | 4     | 8  | 27                                         | 119                                    | 38 900                                 | 49 000                                    | 27 200                                   |
| 11    | 0.8   | 6     | 4     | 12 | 38                                         | 215                                    | 58 200                                 | 75 300                                    | 35 200                                   |
| 11    | 0.8   | 6     | 4     | 12 | 44                                         | 215                                    | 63 900                                 | 88 800                                    | 57 000                                   |
| 15    | 1     | 6     | 4     | 17 | 45                                         | 438                                    | 90 300                                 | 121 000                                   | 98 300                                   |
| 15    | 1     | 6     | 4     | 17 | 45                                         | 438                                    | 90 300                                 | 121 000                                   | 98 300                                   |

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CAM FOLLOWERS

Inch Series Cam Followers With Cage/Stud Head Hex Hole

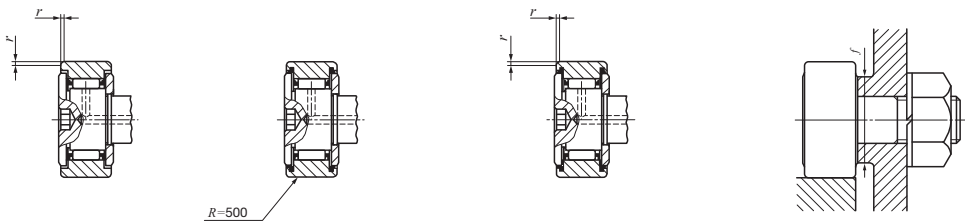


Stud dia. 4.826 – 22.225mm

CR···BR

| Stud<br>dia.<br>mm<br>(inch)               | Identification number      |                                |                            |                                | Mass<br>(Ref.) |                                        |                                          |                                         |                                   |                                        |
|--------------------------------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|----------------|----------------------------------------|------------------------------------------|-----------------------------------------|-----------------------------------|----------------------------------------|
|                                            | Shield type                |                                | Sealed type                |                                | g              | <i>D</i>                               | <i>C</i>                                 | <i>d</i> <sub>1</sub>                   | <i>G</i><br>UNF                   | <i>G</i> <sub>1</sub>                  |
|                                            | With crowned<br>outer ring | With cylindrical<br>outer ring | With crowned<br>outer ring | With cylindrical<br>outer ring |                |                                        |                                          |                                         |                                   |                                        |
| 4.826                                      | CR 8 BR                    | CR 8 B                         | CR 8 BUUR                  | CR 8 BUU                       | 9              | 12.700 ( <sup>1</sup> / <sub>2</sub> ) | 8.731 ( <sup>11</sup> / <sub>32</sub> )  | 4.826                                   | No.10-32                          | 6.350 ( <sup>1</sup> / <sub>4</sub> )  |
|                                            | CR 8-1 BR                  | CR 8-1 B                       | CR 8-1 BUUR                | CR 8-1 BUU                     | 10             | 12.700 ( <sup>1</sup> / <sub>2</sub> ) | 9.525 ( <sup>3</sup> / <sub>8</sub> )    | 4.826                                   | No.10-32                          | 6.350 ( <sup>1</sup> / <sub>4</sub> )  |
| 6.350<br>( <sup>1</sup> / <sub>4</sub> )   | CR 10 BR                   | CR 10 B                        | CR 10 BUUR                 | CR 10 BUU                      | 19             | 15.875 ( <sup>5</sup> / <sub>8</sub> ) | 10.319 ( <sup>13</sup> / <sub>32</sub> ) | 6.350 ( <sup>1</sup> / <sub>4</sub> )   | <sup>1</sup> / <sub>4</sub> - 28  | 7.938 ( <sup>5</sup> / <sub>16</sub> ) |
|                                            | CR 10-1 BR                 | CR 10-1 B                      | CR 10-1 BUUR               | CR 10-1 BUU                    | 21             | 15.875 ( <sup>5</sup> / <sub>8</sub> ) | 11.112 ( <sup>7</sup> / <sub>16</sub> )  | 6.350 ( <sup>1</sup> / <sub>4</sub> )   | <sup>1</sup> / <sub>4</sub> - 28  | 7.938 ( <sup>5</sup> / <sub>16</sub> ) |
| 9.525<br>( <sup>3</sup> / <sub>8</sub> )   | CR 12 BR                   | CR 12 B                        | CR 12 BUUR                 | CR 12 BUU                      | 35             | 19.050 ( <sup>3</sup> / <sub>4</sub> ) | 12.700 ( <sup>1</sup> / <sub>2</sub> )   | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | <sup>3</sup> / <sub>8</sub> - 24  | 9.525 ( <sup>3</sup> / <sub>8</sub> )  |
|                                            | CR 14 BR                   | CR 14 B                        | CR 14 BUUR                 | CR 14 BUU                      | 46             | 22.225 ( <sup>7</sup> / <sub>8</sub> ) | 12.700 ( <sup>1</sup> / <sub>2</sub> )   | 9.525 ( <sup>3</sup> / <sub>8</sub> )   | <sup>3</sup> / <sub>8</sub> - 24  | 9.525 ( <sup>3</sup> / <sub>8</sub> )  |
| 11.112<br>( <sup>7</sup> / <sub>16</sub> ) | CR 16 BR                   | CR 16 B                        | CR 16 BUUR                 | CR 16 BUU                      | 73             | 25.400 ( 1 )                           | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | <sup>7</sup> / <sub>16</sub> - 20 | 12.700 ( <sup>1</sup> / <sub>2</sub> ) |
|                                            | CR 18 BR                   | CR 18 B                        | CR 18 BUUR                 | CR 18 BUU                      | 99             | 28.575 ( <sup>1</sup> / <sub>8</sub> ) | 15.875 ( <sup>5</sup> / <sub>8</sub> )   | 11.112 ( <sup>7</sup> / <sub>16</sub> ) | <sup>7</sup> / <sub>16</sub> - 20 | 12.700 ( <sup>1</sup> / <sub>2</sub> ) |
| 12.700<br>( <sup>1</sup> / <sub>2</sub> )  | CR 20 BR                   | CR 20 B                        | CR 20 BUUR                 | CR 20 BUU                      | 132            | 31.750 ( <sup>1</sup> / <sub>4</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | <sup>1</sup> / <sub>2</sub> - 20  | 15.875 ( <sup>5</sup> / <sub>8</sub> ) |
|                                            | CR 22 BR                   | CR 22 B                        | CR 22 BUUR                 | CR 22 BUU                      | 157            | 34.925 ( <sup>1</sup> / <sub>8</sub> ) | 19.050 ( <sup>3</sup> / <sub>4</sub> )   | 12.700 ( <sup>1</sup> / <sub>2</sub> )  | <sup>1</sup> / <sub>2</sub> - 20  | 15.875 ( <sup>5</sup> / <sub>8</sub> ) |
| 15.875<br>( <sup>5</sup> / <sub>8</sub> )  | CR 24 BR                   | CR 24 B                        | CR 24 BUUR                 | CR 24 BUU                      | 225            | 38.100 ( <sup>1</sup> / <sub>2</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | <sup>5</sup> / <sub>8</sub> - 18  | 19.050 ( <sup>3</sup> / <sub>4</sub> ) |
|                                            | CR 26 BR                   | CR 26 B                        | CR 26 BUUR                 | CR 26 BUU                      | 260            | 41.275 ( <sup>1</sup> / <sub>8</sub> ) | 22.225 ( <sup>7</sup> / <sub>8</sub> )   | 15.875 ( <sup>5</sup> / <sub>8</sub> )  | <sup>5</sup> / <sub>8</sub> - 18  | 19.050 ( <sup>3</sup> / <sub>4</sub> ) |
| 19.050<br>( <sup>3</sup> / <sub>4</sub> )  | CR 28 BR                   | CR 28 B                        | CR 28 BUUR                 | CR 28 BUU                      | 365            | 44.450 ( <sup>3</sup> / <sub>4</sub> ) | 25.400 ( 1 )                             | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | <sup>3</sup> / <sub>4</sub> - 16  | 22.225 ( <sup>7</sup> / <sub>8</sub> ) |
|                                            | CR 30 BR                   | CR 30 B                        | CR 30 BUUR                 | CR 30 BUU                      | 410            | 47.625 ( <sup>1</sup> / <sub>8</sub> ) | 25.400 ( 1 )                             | 19.050 ( <sup>3</sup> / <sub>4</sub> )  | <sup>3</sup> / <sub>4</sub> - 16  | 22.225 ( <sup>7</sup> / <sub>8</sub> ) |
| 22.225<br>( <sup>7</sup> / <sub>8</sub> )  | CR 32 BR                   | CR 32 B                        | CR 32 BUUR                 | CR 32 BUU                      | 615            | 50.800 ( 2 )                           | 31.750 ( <sup>1</sup> / <sub>4</sub> )   | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | <sup>7</sup> / <sub>8</sub> - 14  | 25.400 ( 1 )                           |
|                                            | CR 36 BR                   | CR 36 B                        | CR 36 BUUR                 | CR 36 BUU                      | 750            | 57.150 ( <sup>1</sup> / <sub>4</sub> ) | 31.750 ( <sup>1</sup> / <sub>4</sub> )   | 22.225 ( <sup>7</sup> / <sub>8</sub> )  | <sup>7</sup> / <sub>8</sub> - 14  | 25.400 ( 1 )                           |

Remarks1. Models with a stud diameter  $d_1$  of 6.35 mm or less have no oil hole. Other models are provided with one oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



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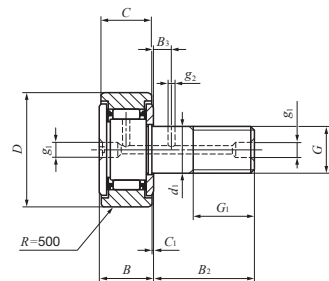
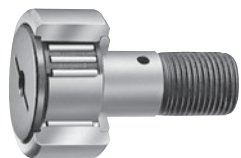
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| Boundary dimensions mm (inch) |                |                |                |                |                |               |              | Mounting<br>dimension<br>f<br>Min.<br>mm (inch) | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|---------------|--------------|-------------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|
| B<br>max                      | B <sub>2</sub> | B <sub>3</sub> | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H             | r            |                                                 |                                        |                                        |                                                    |
| 10.2 (0.40)                   | 12.700 (1/2)   | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                                   | 1.4                                    | 2 520                                  | 2 140                                              |
| 10.9 (0.43)                   | 15.875 (5/8)   | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                                   | 1.4                                    | 2 520                                  | 2 140                                              |
| 11.8 (0.46)                   | 15.875 (5/8)   | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                                  | 3.4                                    | 3 650                                  | 3 670                                              |
| 12.5 (0.49)                   | 19.050 (3/4)   | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                                  | 3.4                                    | 3 650                                  | 3 670                                              |
| 14.2 (0.56)                   | 22.225 (7/8)   | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 13.494 (17/32)                                  | 10.8                                   | 4 420                                  | 5 110                                              |
| 14.2 (0.56)                   | 22.225 (7/8)   | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 15.081 (19/32)                                  | 10.8                                   | 4 790                                  | 5 810                                              |
| 17.3 (0.68)                   | 25.400 (1)     | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.191 (3/64) | 17.859 (45/64)                                  | 17.4                                   | 8 810                                  | 10 800                                             |
| 17.3 (0.68)                   | 25.400 (1)     | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 19.050 (3/4)                                    | 17.4                                   | 9 180                                  | 11 600                                             |
| 20.4 (0.80)                   | 31.750 (1 1/4) | 7.938 (5/16)   | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                                  | 27.7                                   | 14 200                                 | 16 000                                             |
| 20.4 (0.80)                   | 31.750 (1 1/4) | 7.938 (5/16)   | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                                  | 27.7                                   | 14 200                                 | 16 000                                             |
| 23.6 (0.93)                   | 38.100 (1 1/2) | 9.525 (3/8)    | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (1 3/64)                                 | 55.7                                   | 18 600                                 | 24 300                                             |
| 23.6 (0.93)                   | 38.100 (1 1/2) | 9.525 (3/8)    | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (1 3/64)                                 | 55.7                                   | 18 600                                 | 24 300                                             |
| 26.8 (1.06)                   | 44.450 (1 3/4) | 11.112 (7/16)  | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (1 9/32)                                 | 100                                    | 25 100                                 | 38 200                                             |
| 26.8 (1.06)                   | 44.450 (1 3/4) | 11.112 (7/16)  | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (1 9/32)                                 | 100                                    | 25 100                                 | 38 200                                             |
| 33.5 (1.32)                   | 50.800 (2)     | 12.700 (1/2)   | 0.794 (1/32)   | 4.762 (3/16)   | 4.762 (3/16)   | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                                | 162                                    | 32 500                                 | 63 900                                             |
| 33.5 (1.32)                   | 50.800 (2)     | 12.700 (1/2)   | 0.794 (1/32)   | 4.762 (3/16)   | 4.762 (3/16)   | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                                | 162                                    | 32 500                                 | 63 900                                             |

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CAM FOLLOWERS

Inch Series Cam Followers With Cage/With Screwdriver Slot

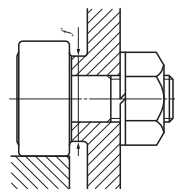
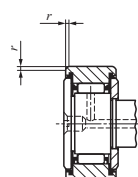
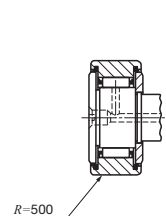
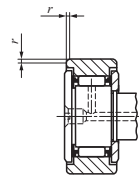


CR ... R

Stud dia. 4.826 – 22.225mm

| Stud<br>dia.<br>mm<br>(inch) | Identification number      |                                |                            |                                | Mass<br>(Ref.) |                  |                  |                       |                 |                       |
|------------------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|----------------|------------------|------------------|-----------------------|-----------------|-----------------------|
|                              | Shield type                |                                | Sealed type                |                                | g              | <i>D</i>         | <i>C</i>         | <i>d</i> <sub>1</sub> | <i>G</i><br>UNF | <i>G</i> <sub>1</sub> |
|                              | With crowned<br>outer ring | With cylindrical<br>outer ring | With crowned<br>outer ring | With cylindrical<br>outer ring |                |                  |                  |                       |                 |                       |
| 4.826                        | CR 8 R                     | CR 8                           | CR 8 UUR                   | CR 8 UU                        | 9              | 12.700 ( 1/2 )   | 8.731 ( 11/32 )  | 4.826                 | No.10-32        | 6.350 ( 1/4 )         |
|                              | CR 8-1 R                   | CR 8-1                         | CR 8-1 UUR                 | CR 8-1 UU                      | 10             | 12.700 ( 1/2 )   | 9.525 ( 3/8 )    | 4.826                 | No.10-32        | 6.350 ( 1/4 )         |
| 6.350<br>( 1/4 )             | CR 10 R                    | CR 10                          | CR 10 UUR                  | CR 10 UU                       | 19             | 15.875 ( 5/8 )   | 10.319 ( 13/32 ) | 6.350 ( 1/4 )         | 1/4 - 28        | 7.938 ( 5/16 )        |
|                              | CR 10-1 R                  | CR 10-1                        | CR 10-1 UUR                | CR 10-1 UU                     | 21             | 15.875 ( 5/8 )   | 11.112 ( 7/16 )  | 6.350 ( 1/4 )         | 1/4 - 28        | 7.938 ( 5/16 )        |
| 9.525<br>( 3/8 )             | CR 12 R                    | CR 12                          | CR 12 UUR                  | CR 12 UU                       | 35             | 19.050 ( 3/4 )   | 12.700 ( 1/2 )   | 9.525 ( 3/8 )         | 3/8 - 24        | 9.525 ( 3/8 )         |
|                              | CR 14 R                    | CR 14                          | CR 14 UUR                  | CR 14 UU                       | 46             | 22.225 ( 7/8 )   | 12.700 ( 1/2 )   | 9.525 ( 3/8 )         | 3/8 - 24        | 9.525 ( 3/8 )         |
| 11.112<br>( 7/16 )           | CR 16 R                    | CR 16                          | CR 16 UUR                  | CR 16 UU                       | 73             | 25.400 ( 1 )     | 15.875 ( 5/8 )   | 11.112 ( 7/16 )       | 7/16 - 20       | 12.700 ( 1/2 )        |
|                              | CR 18 R                    | CR 18                          | CR 18 UUR                  | CR 18 UU                       | 99             | 28.575 ( 1 1/8 ) | 15.875 ( 5/8 )   | 11.112 ( 7/16 )       | 7/16 - 20       | 12.700 ( 1/2 )        |
| 12.700<br>( 1/2 )            | CR 20 R                    | CR 20                          | CR 20 UUR                  | CR 20 UU                       | 132            | 31.750 ( 1 1/4 ) | 19.050 ( 3/4 )   | 12.700 ( 1/2 )        | 1/2 - 20        | 15.875 ( 5/8 )        |
|                              | CR 22 R                    | CR 22                          | CR 22 UUR                  | CR 22 UU                       | 157            | 34.925 ( 1 3/8 ) | 19.050 ( 3/4 )   | 12.700 ( 1/2 )        | 1/2 - 20        | 15.875 ( 5/8 )        |
| 15.875<br>( 5/8 )            | CR 24 R                    | CR 24                          | CR 24 UUR                  | CR 24 UU                       | 225            | 38.100 ( 1 1/2 ) | 22.225 ( 7/8 )   | 15.875 ( 5/8 )        | 5/8 - 18        | 19.050 ( 3/4 )        |
|                              | CR 26 R                    | CR 26                          | CR 26 UUR                  | CR 26 UU                       | 260            | 41.275 ( 1 5/8 ) | 22.225 ( 7/8 )   | 15.875 ( 5/8 )        | 5/8 - 18        | 19.050 ( 3/4 )        |
| 19.050<br>( 3/4 )            | CR 28 R                    | CR 28                          | CR 28 UUR                  | CR 28 UU                       | 365            | 44.450 ( 1 3/4 ) | 25.400 ( 1 )     | 19.050 ( 3/4 )        | 3/4 - 16        | 22.225 ( 7/8 )        |
|                              | CR 30 R                    | CR 30                          | CR 30 UUR                  | CR 30 UU                       | 410            | 47.625 ( 1 7/8 ) | 25.400 ( 1 )     | 19.050 ( 3/4 )        | 3/4 - 16        | 22.225 ( 7/8 )        |
| 22.225<br>( 7/8 )            | CR 32 R                    | CR 32                          | CR 32 UUR                  | CR 32 UU                       | 615            | 50.800 ( 2 )     | 31.750 ( 1 1/4 ) | 22.225 ( 7/8 )        | 7/8 - 14        | 25.400 ( 1 )          |
|                              | CR 36 R                    | CR 36                          | CR 36 UUR                  | CR 36 UU                       | 750            | 57.150 ( 2 1/4 ) | 31.750 ( 1 1/4 ) | 22.225 ( 7/8 )        | 7/8 - 14        | 25.400 ( 1 )          |

Remarks1. Models with a stud diameter  $d_1$  of 6.35 mm or less (marked \*) are provided with an oil hole on the stud head only. Other models are provided with one oil hole each on the head, outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



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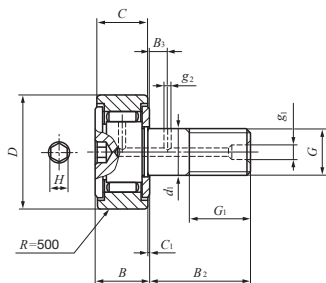
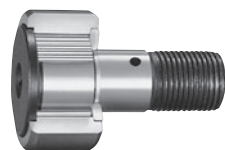
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| Boundary dimensions mm (inch) |                  |                 |                |                |                |                | Mounting dimension<br>$f$<br>Min.<br>mm (inch) | Maximum tightening torque<br>N-m | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|-------------------------------|------------------|-----------------|----------------|----------------|----------------|----------------|------------------------------------------------|----------------------------------|-------------------------------------|-------------------------------------------------|
| $B_{max}$                     | $B_2$            | $B_3$           | $C_1$          | $g_1$          | $g_2$          | $r$            |                                                |                                  |                                     |                                                 |
| 10.2 (0.40)                   | 12.700 ( 1/2 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 8.334 ( 21/64 )                                | 1.4                              | 2 520                               | 2 140                                           |
| 10.9 (0.43)                   | 15.875 ( 5/8 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 8.334 ( 21/64 )                                | 1.4                              | 2 520                               | 2 140                                           |
| 11.8 (0.46)                   | 15.875 ( 5/8 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 11.509 ( 29/64 )                               | 3.4                              | 3 650                               | 3 670                                           |
| 12.5 (0.49)                   | 19.050 ( 3/4 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 11.509 ( 29/64 )                               | 3.4                              | 3 650                               | 3 670                                           |
| 14.2 (0.56)                   | 22.225 ( 7/8 )   | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 0.794 ( 1/32 ) | 13.494 ( 17/32 )                               | 10.8                             | 4 420                               | 5 110                                           |
| 14.2 (0.56)                   | 22.225 ( 7/8 )   | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 0.794 ( 1/32 ) | 15.081 ( 19/32 )                               | 10.8                             | 4 790                               | 5 810                                           |
| 17.3 (0.68)                   | 25.400 ( 1 )     | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.191 ( 3/64 ) | 17.859 ( 45/64 )                               | 17.4                             | 8 810                               | 10 800                                          |
| 17.3 (0.68)                   | 25.400 ( 1 )     | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 19.050 ( 3/4 )                                 | 17.4                             | 9 180                               | 11 600                                          |
| 20.4 (0.80)                   | 31.750 ( 1 1/4 ) | 7.938 ( 5/16 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 21.828 ( 55/64 )                               | 27.7                             | 14 200                              | 16 000                                          |
| 20.4 (0.80)                   | 31.750 ( 1 1/4 ) | 7.938 ( 5/16 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 21.828 ( 55/64 )                               | 27.7                             | 14 200                              | 16 000                                          |
| 23.6 (0.93)                   | 38.100 ( 1 1/2 ) | 9.525 ( 3/8 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 26.196 ( 1 3/64 )                              | 55.7                             | 18 600                              | 24 300                                          |
| 23.6 (0.93)                   | 38.100 ( 1 1/2 ) | 9.525 ( 3/8 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 26.196 ( 1 3/64 )                              | 55.7                             | 18 600                              | 24 300                                          |
| 26.8 (1.06)                   | 44.450 ( 1 3/4 ) | 11.112 ( 7/16 ) | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 32.543 ( 1 9/32 )                              | 100                              | 25 100                              | 38 200                                          |
| 26.8 (1.06)                   | 44.450 ( 1 3/4 ) | 11.112 ( 7/16 ) | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 32.543 ( 1 9/32 )                              | 100                              | 25 100                              | 38 200                                          |
| 33.5 (1.32)                   | 50.800 ( 2 )     | 12.700 ( 1/2 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 4.762 ( 3/16 ) | 1.588 ( 1/16 ) | 37.306 ( 1 15/32 )                             | 162                              | 32 500                              | 63 900                                          |
| 33.5 (1.32)                   | 50.800 ( 2 )     | 12.700 ( 1/2 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 4.762 ( 3/16 ) | 1.588 ( 1/16 ) | 37.306 ( 1 15/32 )                             | 162                              | 32 500                              | 63 900                                          |

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CAM FOLLOWERS

Inch Series Cam Followers Full Complement Type/Stud Head Hex Hole

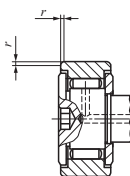


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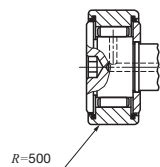
Stud dia. 4.826 – 22.225mm

| Stud<br>dia.<br>mm<br>(inch) | Identification number      |                                |                            |                                |  |     |                  |                  | Mass<br>(Ref.)  |                |                |                |  |  |
|------------------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|--|-----|------------------|------------------|-----------------|----------------|----------------|----------------|--|--|
|                              | Shield type                |                                | Sealed type                |                                |  |     | g                | D                | C               | d <sub>1</sub> | G<br>UNF       | G <sub>1</sub> |  |  |
|                              | With crowned<br>outer ring | With cylindrical<br>outer ring | With crowned<br>outer ring | With cylindrical<br>outer ring |  |     |                  |                  |                 |                |                |                |  |  |
| 4.826                        | CR 8 VBR                   | CR 8 VB                        | CR 8 VBUUR                 | CR 8 VBUU                      |  | 9   | 12.700 ( 1/2 )   | 8.731 ( 11/32 )  | 4.826           | No.10-32       | 6.350 ( 1/4 )  |                |  |  |
|                              | CR 8-1 VBR                 | CR 8-1VB                       | CR 8-1 VBUUR               | CR 8-1 VBUU                    |  | 10  | 12.700 ( 1/2 )   | 9.525 ( 3/8 )    | 4.826           | No.10-32       | 6.350 ( 1/4 )  |                |  |  |
| 6.350<br>( 1/4 )             | CR 10 VBR                  | CR 10 VB                       | CR 10 VBUUR                | CR 10 VBUU                     |  | 19  | 15.875 ( 5/8 )   | 10.319 ( 13/32 ) | 6.350 ( 1/4 )   | 1/4 - 28       | 7.938 ( 5/16 ) |                |  |  |
|                              | CR 10-1 VBR                | CR 10-1VB                      | CR 10-1 VBUUR              | CR 10-1 VBUU                   |  | 21  | 15.875 ( 5/8 )   | 11.112 ( 7/16 )  | 6.350 ( 1/4 )   | 1/4 - 28       | 7.938 ( 5/16 ) |                |  |  |
| 9.525<br>( 3/8 )             | CR 12 VBR                  | CR 12 VB                       | CR 12 VBUUR                | CR 12 VBUU                     |  | 36  | 19.050 ( 3/4 )   | 12.700 ( 1/2 )   | 9.525 ( 3/8 )   | 3/8 - 24       | 9.525 ( 3/8 )  |                |  |  |
|                              | CR 14 VBR                  | CR 14 VB                       | CR 14 VBUUR                | CR 14 VBUU                     |  | 47  | 22.225 ( 7/8 )   | 12.700 ( 1/2 )   | 9.525 ( 3/8 )   | 3/8 - 24       | 9.525 ( 3/8 )  |                |  |  |
| 11.112<br>( 7/16 )           | CR 16 VBR                  | CR 16 VB                       | CR 16 VBUUR                | CR 16 VBUU                     |  | 74  | 25.400 ( 1 )     | 15.875 ( 5/8 )   | 11.112 ( 7/16 ) | 7/16 - 20      | 12.700 ( 1/2 ) |                |  |  |
|                              | CR 18 VBR                  | CR 18 VB                       | CR 18 VBUUR                | CR 18 VBUU                     |  | 101 | 28.575 ( 1 1/8 ) | 15.875 ( 5/8 )   | 11.112 ( 7/16 ) | 7/16 - 20      | 12.700 ( 1/2 ) |                |  |  |
| 12.700<br>( 1/2 )            | CR 20 VBR                  | CR 20 VB                       | CR 20 VBUUR                | CR 20 VBUU                     |  | 137 | 31.750 ( 1 1/4 ) | 19.050 ( 3/4 )   | 12.700 ( 1/2 )  | 1/2 - 20       | 15.875 ( 5/8 ) |                |  |  |
|                              | CR 22 VBR                  | CR 22 VB                       | CR 22 VBUUR                | CR 22 VBUU                     |  | 160 | 34.925 ( 1 3/8 ) | 19.050 ( 3/4 )   | 12.700 ( 1/2 )  | 1/2 - 20       | 15.875 ( 5/8 ) |                |  |  |
| 15.875<br>( 5/8 )            | CR 24 VBR                  | CR 24 VB                       | CR 24 VBUUR                | CR 24 VBUU                     |  | 230 | 38.100 ( 1 1/2 ) | 22.225 ( 7/8 )   | 15.875 ( 5/8 )  | 5/8 - 18       | 19.050 ( 3/4 ) |                |  |  |
|                              | CR 26 VBR                  | CR 26 VB                       | CR 26 VBUUR                | CR 26 VBUU                     |  | 265 | 41.275 ( 1 5/8 ) | 22.225 ( 7/8 )   | 15.875 ( 5/8 )  | 5/8 - 18       | 19.050 ( 3/4 ) |                |  |  |
| 19.050<br>( 3/4 )            | CR 28 VBR                  | CR 28 VB                       | CR 28 VBUUR                | CR 28 VBUU                     |  | 372 | 44.450 ( 1 3/4 ) | 25.400 ( 1 )     | 19.050 ( 3/4 )  | 3/4 - 16       | 22.225 ( 7/8 ) |                |  |  |
|                              | CR 30 VBR                  | CR 30 VB                       | CR 30 VBUUR                | CR 30 VBUU                     |  | 418 | 47.625 ( 1 7/8 ) | 25.400 ( 1 )     | 19.050 ( 3/4 )  | 3/4 - 16       | 22.225 ( 7/8 ) |                |  |  |
| 22.225<br>( 7/8 )            | CR 32 VBR                  | CR 32 VB                       | CR 32 VBUUR                | CR 32 VBUU                     |  | 627 | 50.800 ( 2 )     | 31.750 ( 1 1/4 ) | 22.225 ( 7/8 )  | 7/8 - 14       | 25.400 ( 1 )   |                |  |  |
|                              | CR 36 VBR                  | CR 36 VB                       | CR 36 VBUUR                | CR 36 VBUU                     |  | 759 | 57.150 ( 2 1/4 ) | 31.750 ( 1 1/4 ) | 22.225 ( 7/8 )  | 7/8 - 14       | 25.400 ( 1 )   |                |  |  |

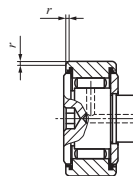
Remarks1. Models with a stud diameter  $d_1$  of 6.35 mm or less have no oil hole. Other models are provided with one oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



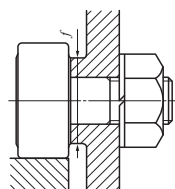
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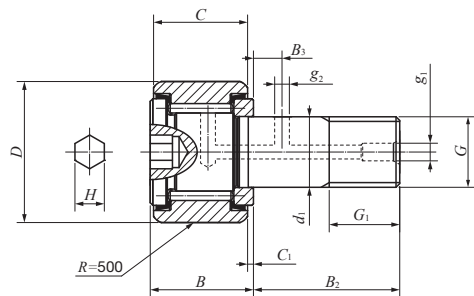


| Boundary dimensions mm(inch) |                |               |              |              |              |               |              | Mounting<br>dimension<br>$f$<br>Min.<br>mm(inch) | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|------------------------------|----------------|---------------|--------------|--------------|--------------|---------------|--------------|--------------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|
| $B_{max}$                    | $B_2$          | $B_3$         | $C_1$        | $g_1$        | $g_2$        | $H$           | $r$          |                                                  |                                        |                                        |                                                    |
| 10.2 (0.40)                  | 12.700 (1/2)   | — (—)         | 0.794 (1/32) | — (—)        | — (—)        | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                                    | 1.4                                    | 4 260                                  | 4 750                                              |
| 10.9 (0.43)                  | 15.875 (5/8)   | — (—)         | 0.794 (1/32) | — (—)        | — (—)        | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                                    | 1.4                                    | 4 710                                  | 5 410                                              |
| 11.8 (0.46)                  | 15.875 (5/8)   | — (—)         | 0.794 (1/32) | — (—)        | — (—)        | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                                   | 3.4                                    | 5 830                                  | 7 660                                              |
| 12.5 (0.49)                  | 19.050 (3/4)   | — (—)         | 0.794 (1/32) | — (—)        | — (—)        | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                                   | 3.4                                    | 6 340                                  | 8 530                                              |
| 14.2 (0.56)                  | 22.225 (7/8)   | 6.350 (1/4)   | 0.794 (1/32) | 4.762 (3/16) | 2.381 (3/32) | 4.762 (3/16)  | 0.794 (1/32) | 13.494 (17/32)                                   | 10.8                                   | 8 710                                  | 12 300                                             |
| 14.2 (0.56)                  | 22.225 (7/8)   | 6.350 (1/4)   | 0.794 (1/32) | 4.762 (3/16) | 2.381 (3/32) | 4.762 (3/16)  | 0.794 (1/32) | 15.081 (19/32)                                   | 10.8                                   | 8 710                                  | 12 300                                             |
| 17.3 (0.68)                  | 25.400 (1)     | 6.350 (1/4)   | 0.794 (1/32) | 4.762 (3/16) | 3.175 (1/8)  | 6.350 (1/4)   | 1.191 (3/64) | 17.859 (45/64)                                   | 17.4                                   | 13 100                                 | 22 700                                             |
| 17.3 (0.68)                  | 25.400 (1)     | 6.350 (1/4)   | 0.794 (1/32) | 4.762 (3/16) | 3.175 (1/8)  | 6.350 (1/4)   | 1.588 (1/16) | 19.050 (3/4)                                     | 17.4                                   | 13 100                                 | 22 700                                             |
| 20.4 (0.80)                  | 31.750 (1 1/4) | 7.938 (5/16)  | 0.794 (1/32) | 4.762 (3/16) | 3.175 (1/8)  | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                                   | 27.7                                   | 23 600                                 | 31 700                                             |
| 20.4 (0.80)                  | 31.750 (1 1/4) | 7.938 (5/16)  | 0.794 (1/32) | 4.762 (3/16) | 3.175 (1/8)  | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                                   | 27.7                                   | 23 600                                 | 31 700                                             |
| 23.6 (0.93)                  | 38.100 (1 1/2) | 9.525 (3/8)   | 0.794 (1/32) | 4.762 (3/16) | 3.969 (5/32) | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (1 3/64)                                  | 55.7                                   | 28 200                                 | 40 100                                             |
| 23.6 (0.93)                  | 38.100 (1 1/2) | 9.525 (3/8)   | 0.794 (1/32) | 4.762 (3/16) | 3.969 (5/32) | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (1 3/64)                                  | 55.7                                   | 28 200                                 | 40 100                                             |
| 26.8 (1.06)                  | 44.450 (1 3/4) | 11.112 (7/16) | 0.794 (1/32) | 4.762 (3/16) | 3.969 (5/32) | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (1 9/32)                                  | 100                                    | 35 300                                 | 55 600                                             |
| 26.8 (1.06)                  | 44.450 (1 3/4) | 11.112 (7/16) | 0.794 (1/32) | 4.762 (3/16) | 3.969 (5/32) | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (1 9/32)                                  | 100                                    | 35 300                                 | 55 600                                             |
| 33.5 (1.32)                  | 50.800 (2)     | 12.700 (1/2)  | 0.794 (1/32) | 4.762 (3/16) | 4.762 (3/16) | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                                 | 162                                    | 45 700                                 | 80 600                                             |
| 33.5 (1.32)                  | 50.800 (2)     | 12.700 (1/2)  | 0.794 (1/32) | 4.762 (3/16) | 4.762 (3/16) | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                                 | 162                                    | 45 700                                 | 80 600                                             |

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CAM FOLLOWERS

Inch Series Cam Followers Full Complement Type/Stud Head Hex Hole

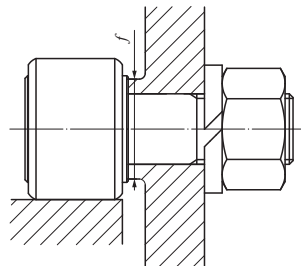
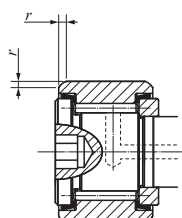


CR···VBSR

Stud dia. 4.826 – 22.225mm

| Stud dia.<br>mm<br>(inch)    | Identification number              |                             | Mass<br>(Ref.)<br><br>g |                            |                            |                           |                    |                          |                 |                            |  |
|------------------------------|------------------------------------|-----------------------------|-------------------------|----------------------------|----------------------------|---------------------------|--------------------|--------------------------|-----------------|----------------------------|--|
|                              | Sealed type with ThrustDisk Seals™ |                             |                         | <i>D</i>                   | <i>C</i>                   | <i>d</i> <sub>1</sub>     | <i>G</i><br>UNF    | <i>G</i> <sub>1</sub>    | <i>B</i><br>max | <i>B</i> <sub>2</sub>      |  |
|                              | With crowned outer ring            | With cylindrical outer ring |                         |                            |                            |                           |                    |                          |                 |                            |  |
| 4.826                        | CR 8 VBSR                          | CR 8 VBS                    | 9                       | 12.700 ( $\frac{1}{2}$ )   | 8.731 ( $\frac{11}{32}$ )  | 4.826                     | No.10-32           | 6.350 ( $\frac{1}{4}$ )  | 10.2(0.40)      | 12.700 ( $\frac{1}{2}$ )   |  |
|                              | CR 8-1 VBSR                        | CR 8-1 VBS                  | 10                      | 12.700 ( $\frac{1}{2}$ )   | 9.525 ( $\frac{3}{8}$ )    | 4.826                     | No.10-32           | 6.350 ( $\frac{1}{4}$ )  | 10.9(0.43)      | 15.875 ( $\frac{5}{8}$ )   |  |
| 6.350<br>( $\frac{1}{4}$ )   | CR 10 VBSR                         | CR 10 VBS                   | 19                      | 15.875 ( $\frac{5}{8}$ )   | 10.319 ( $\frac{13}{32}$ ) | 6.350 ( $\frac{1}{4}$ )   | $\frac{1}{4}$ -28  | 7.938 ( $\frac{5}{16}$ ) | 11.8(0.46)      | 15.875 ( $\frac{5}{8}$ )   |  |
|                              | CR 10-1 VBSR                       | CR 10-1 VBS                 | 21                      | 15.875 ( $\frac{5}{8}$ )   | 11.112 ( $\frac{7}{16}$ )  | 6.350 ( $\frac{1}{4}$ )   | $\frac{1}{4}$ -28  | 7.938 ( $\frac{5}{16}$ ) | 12.5(0.49)      | 19.050 ( $\frac{3}{4}$ )   |  |
| 9.525<br>( $\frac{3}{8}$ )   | CR 12 VBSR                         | CR 12 VBS                   | 34                      | 19.050 ( $\frac{3}{4}$ )   | 12.700 ( $\frac{1}{2}$ )   | 9.525 ( $\frac{3}{8}$ )   | $\frac{3}{8}$ -24  | 9.525 ( $\frac{3}{8}$ )  | 14.2(0.56)      | 22.225 ( $\frac{7}{8}$ )   |  |
|                              | CR 14 VBSR                         | CR 14 VBS                   | 45                      | 22.225 ( $\frac{7}{8}$ )   | 12.700 ( $\frac{1}{2}$ )   | 9.525 ( $\frac{3}{8}$ )   | $\frac{3}{8}$ -24  | 9.525 ( $\frac{3}{8}$ )  | 14.2(0.56)      | 22.225 ( $\frac{7}{8}$ )   |  |
| 11.112<br>( $\frac{7}{16}$ ) | CR 16 VBSR                         | CR 16 VBS                   | 73                      | 25.400 ( 1 )               | 15.875 ( $\frac{5}{8}$ )   | 11.112 ( $\frac{7}{16}$ ) | $\frac{7}{16}$ -20 | 12.700 ( $\frac{1}{2}$ ) | 17.3(0.68)      | 25.400 ( 1 )               |  |
|                              | CR 18 VBSR                         | CR 18 VBS                   | 100                     | 28.575 ( 1 $\frac{1}{8}$ ) | 15.875 ( $\frac{5}{8}$ )   | 11.112 ( $\frac{7}{16}$ ) | $\frac{7}{16}$ -20 | 12.700 ( $\frac{1}{2}$ ) | 17.3(0.68)      | 25.400 ( 1 )               |  |
| 12.700<br>( $\frac{1}{2}$ )  | CR 20 VBSR                         | CR 20 VBS                   | 136                     | 31.750 ( 1 $\frac{1}{4}$ ) | 19.050 ( $\frac{3}{4}$ )   | 12.700 ( $\frac{1}{2}$ )  | $\frac{1}{2}$ -20  | 15.875 ( $\frac{5}{8}$ ) | 20.4(0.80)      | 31.750 ( 1 $\frac{1}{4}$ ) |  |
|                              | CR 22 VBSR                         | CR 22 VBS                   | 159                     | 34.925 ( 1 $\frac{3}{8}$ ) | 19.050 ( $\frac{3}{4}$ )   | 12.700 ( $\frac{1}{2}$ )  | $\frac{1}{2}$ -20  | 15.875 ( $\frac{5}{8}$ ) | 20.4(0.80)      | 31.750 ( 1 $\frac{1}{4}$ ) |  |
| 15.875<br>( $\frac{5}{8}$ )  | CR 24 VBSR                         | CR 24 VBS                   | 230                     | 38.100 ( 1 $\frac{1}{2}$ ) | 22.225 ( $\frac{7}{8}$ )   | 15.875 ( $\frac{5}{8}$ )  | $\frac{5}{8}$ -18  | 19.050 ( $\frac{3}{4}$ ) | 23.6(0.93)      | 38.100 ( 1 $\frac{1}{2}$ ) |  |
|                              | CR 26 VBSR                         | CR 26 VBS                   | 265                     | 41.275 ( 1 $\frac{5}{8}$ ) | 22.225 ( $\frac{7}{8}$ )   | 15.875 ( $\frac{5}{8}$ )  | $\frac{5}{8}$ -18  | 19.050 ( $\frac{3}{4}$ ) | 23.6(0.93)      | 38.100 ( 1 $\frac{1}{2}$ ) |  |
| 19.050<br>( $\frac{3}{4}$ )  | CR 28 VBSR                         | CR 28 VBS                   | 368                     | 44.450 ( 1 $\frac{3}{4}$ ) | 25.400 ( 1 )               | 19.050 ( $\frac{3}{4}$ )  | $\frac{3}{4}$ -16  | 22.225 ( $\frac{7}{8}$ ) | 26.8(1.06)      | 44.450 ( 1 $\frac{3}{4}$ ) |  |
|                              | CR 30 VBSR                         | CR 30 VBS                   | 413                     | 47.625 ( 1 $\frac{7}{8}$ ) | 25.400 ( 1 )               | 19.050 ( $\frac{3}{4}$ )  | $\frac{3}{4}$ -16  | 22.225 ( $\frac{7}{8}$ ) | 26.8(1.06)      | 44.450 ( 1 $\frac{3}{4}$ ) |  |
| 22.225<br>( $\frac{7}{8}$ )  | CR 32 VBSR                         | CR 32 VBS                   | 620                     | 50.800 ( 2 )               | 31.750 ( 1 $\frac{1}{4}$ ) | 22.225 ( $\frac{7}{8}$ )  | $\frac{7}{8}$ -14  | 25.400 ( 1 )             | 33.5(1.32)      | 50.800 ( 2 )               |  |
|                              | CR 36 VBSR                         | CR 36 VBS                   | 753                     | 57.150 ( 2 $\frac{1}{4}$ ) | 31.750 ( 1 $\frac{1}{4}$ ) | 22.225 ( $\frac{7}{8}$ )  | $\frac{7}{8}$ -14  | 25.400 ( 1 )             | 33.5(1.32)      | 50.800 ( 2 )               |  |

Remarks1. Models with a stud diameter  $d_1$  of 6.35 mm or less have no oil hole. Other models are provided with one oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



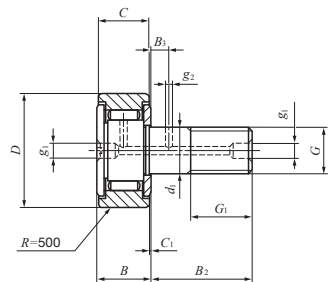
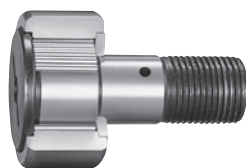
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| Boundary dimensions mm(inch) |                |                |                |               |              | Mounting dimension<br>f<br>Min.<br>mm(inch) | Maximum tightening torque<br>N-m | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|------------------------------|----------------|----------------|----------------|---------------|--------------|---------------------------------------------|----------------------------------|-------------------------------------|-------------------------------------------------|
| B <sub>3</sub>               | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H             | r            |                                             |                                  |                                     |                                                 |
| — (—)                        | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                               | 1.4                              | 3 790                               | 4 100                                           |
| — (—)                        | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                               | 1.4                              | 4 260                               | 4 750                                           |
| — (—)                        | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                              | 3.4                              | 5 310                               | 6 780                                           |
| — (—)                        | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.509 (29/64)                              | 3.4                              | 5 830                               | 7 660                                           |
| 6.350 (1/4)                  | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 13.494 (17/32)                              | 10.8                             | 7 400                               | 11 100                                          |
| 6.350 (1/4)                  | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 15.081 (19/32)                              | 10.8                             | 7 400                               | 11 100                                          |
| 6.350 (1/4)                  | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.191 (3/64) | 17.859 (45/64)                              | 17.4                             | 12,000                              | 20,300                                          |
| 6.350 (1/4)                  | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 19.050 (3/4)                                | 17.4                             | 12,000                              | 20,300                                          |
| 7.938 (5/16)                 | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                              | 27.7                             | 22,000                              | 29,000                                          |
| 7.938 (5/16)                 | 0.794 (1/32)   | 4.762 (3/16)   | 3.175 (1/8)    | 6.350 (1/4)   | 1.588 (1/16) | 21.828 (55/64)                              | 27.7                             | 22,000                              | 29,000                                          |
| 9.525 (3/8)                  | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (13/64)                              | 55.7                             | 26,400                              | 36,900                                          |
| 9.525 (3/8)                  | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.196 (13/64)                              | 55.7                             | 26,400                              | 36,900                                          |
| 11.112 (7/16)                | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (13/32)                              | 100                              | 32,200                              | 49,500                                          |
| 11.112 (7/16)                | 0.794 (1/32)   | 4.762 (3/16)   | 3.969 (5/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.543 (13/32)                              | 100                              | 32,200                              | 49,500                                          |
| 12.700 (1/2)                 | 0.794 (1/32)   | 4.762 (3/16)   | 4.762 (3/16)   | 11.112 (7/16) | 1.588 (1/16) | 37.306 (115/32)                             | 162                              | 42,600                              | 73,700                                          |
| 12.700 (1/2)                 | 0.794 (1/32)   | 4.762 (3/16)   | 4.762 (3/16)   | 11.112 (7/16) | 1.588 (1/16) | 37.306 (115/32)                             | 162                              | 42,600                              | 73,700                                          |

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CAM FOLLOWERS

Inch Series Cam Followers Full Complement Type/With Screwdriver Slot

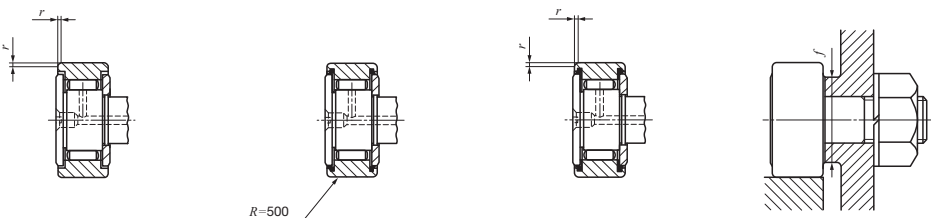


CR...VR

Stud dia. 4.826 – 31.750mm

| Stud<br>dia.<br>mm<br>(inch) | Identification number      |                                |                            |                                | Mass<br>(Ref.) |                 |                 |                       |                 |                       |
|------------------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|----------------|-----------------|-----------------|-----------------------|-----------------|-----------------------|
|                              | Shield type                |                                | Sealed type                |                                | g              | <i>D</i>        | <i>C</i>        | <i>d</i> <sub>1</sub> | <i>G</i><br>UNF | <i>G</i> <sub>1</sub> |
|                              | With crowned<br>outer ring | With cylindrical<br>outer ring | With crowned<br>outer ring | With cylindrical<br>outer ring |                |                 |                 |                       |                 |                       |
| 4.826                        | CR 8 VR                    | CR 8 V                         | CR 8 VUUR                  | CR 8 VUU                       | 9              | 12.700( 1/2 )   | 8.731( 11/32 )  | 4.826                 | No.10-32        | 6.350( 1/4 )          |
|                              | CR 8-1 VR                  | CR 8-1 V                       | CR 8-1 VUUR                | CR 8-1 VUU                     | 10             | 12.700( 1/2 )   | 9.525( 3/8 )    | 4.826                 | No.10-32        | 6.350( 1/4 )          |
| 6.350<br>( 1/4 )             | CR 10 VR                   | CR 10 V                        | CR 10 VUUR                 | CR 10 VUU                      | 19             | 15.875( 5/8 )   | 10.319( 13/32 ) | 6.350( 1/4 )          | 1/4 - 28        | 7.938( 5/16 )         |
|                              | CR 10-1 VR                 | CR 10-1 V                      | CR 10-1 VUUR               | CR 10-1 VUU                    | 21             | 15.875( 5/8 )   | 11.112( 7/16 )  | 6.350( 1/4 )          | 1/4 - 28        | 7.938( 5/16 )         |
| 9.525<br>( 3/8 )             | CR 12 VR                   | CR 12 V                        | CR 12 VUUR                 | CR 12 VUU                      | 36             | 19.050( 3/4 )   | 12.700( 1/2 )   | 9.525( 3/8 )          | 3/8 - 24        | 9.525( 3/8 )          |
|                              | CR 14 VR                   | CR 14 V                        | CR 14 VUUR                 | CR 14 VUU                      | 47             | 22.225( 7/8 )   | 12.700( 1/2 )   | 9.525( 3/8 )          | 3/8 - 24        | 9.525( 3/8 )          |
| 11.112<br>( 7/16 )           | CR 16 VR                   | CR 16 V                        | CR 16 VUUR                 | CR 16 VUU                      | 74             | 25.400( 1 )     | 15.875( 5/8 )   | 11.112( 7/16 )        | 7/16 - 20       | 12.700( 1/2 )         |
|                              | CR 18 VR                   | CR 18 V                        | CR 18 VUUR                 | CR 18 VUU                      | 101            | 28.575( 1 1/8 ) | 15.875( 5/8 )   | 11.112( 7/16 )        | 7/16 - 20       | 12.700( 1/2 )         |
| 12.700<br>( 1/2 )            | CR 20 VR                   | CR 20 V                        | CR 20 VUUR                 | CR 20 VUU                      | 137            | 31.750( 1 1/4 ) | 19.050( 3/4 )   | 12.700( 1/2 )         | 1/2 - 20        | 15.875( 5/8 )         |
|                              | CR 22 VR                   | CR 22 V                        | CR 22 VUUR                 | CR 22 VUU                      | 160            | 34.925( 1 3/8 ) | 19.050( 3/4 )   | 12.700( 1/2 )         | 1/2 - 20        | 15.875( 5/8 )         |
| 15.875<br>( 5/8 )            | CR 24 VR                   | CR 24 V                        | CR 24 VUUR                 | CR 24 VUU                      | 230            | 38.100( 1 1/2 ) | 22.225( 7/8 )   | 15.875( 5/8 )         | 5/8 - 18        | 19.050( 3/4 )         |
|                              | CR 26 VR                   | CR 26 V                        | CR 26 VUUR                 | CR 26 VUU                      | 265            | 41.275( 1 5/8 ) | 22.225( 7/8 )   | 15.875( 5/8 )         | 5/8 - 18        | 19.050( 3/4 )         |
| 19.050<br>( 3/4 )            | CR 28 VR                   | CR 28 V                        | CR 28 VUUR                 | CR 28 VUU                      | 372            | 44.450( 1 3/4 ) | 25.400( 1 )     | 19.050( 3/4 )         | 3/4 - 16        | 22.225( 7/8 )         |
|                              | CR 30 VR                   | CR 30 V                        | CR 30 VUUR                 | CR 30 VUU                      | 418            | 47.625( 1 7/8 ) | 25.400( 1 )     | 19.050( 3/4 )         | 3/4 - 16        | 22.225( 7/8 )         |
| 22.225<br>( 7/8 )            | CR 32 VR                   | CR 32 V                        | CR 32 VUUR                 | CR 32 VUU                      | 627            | 50.800( 2 )     | 31.750( 1 1/4 ) | 22.225( 7/8 )         | 7/8 - 14        | 25.400( 1 )           |
|                              | CR 36 VR                   | CR 36 V                        | CR 36 VUUR                 | CR 36 VUU                      | 759            | 57.150( 2 1/4 ) | 31.750( 1 1/4 ) | 22.225( 7/8 )         | 7/8 - 14        | 25.400( 1 )           |
| 31.750<br>( 1 1/4 )          | —                          | —                              | —                          | CR 48 VUU                      | 1 960          | 76.200( 3 )     | 44.450( 1 3/4 ) | 31.750( 1 1/4 )       | 1 1/4 - 12      | 31.750( 1 1/4 )       |

Remarks1. Models with a stud diameter  $d_1$  of 6.35 mm or less (marked \*) are provided with an oil hole on the stud head only. Other models are provided with one oil hole each on the head, outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



CR...V

CR...VUUR

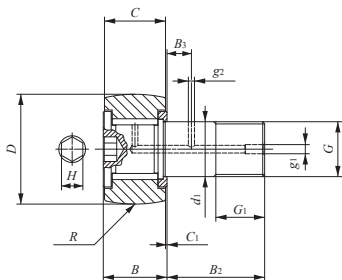
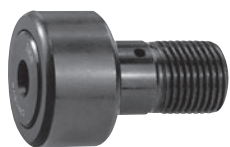
CR...VUU

| Boundary dimensions mm(inch) |                  |                 |                |                |                |                | Mounting<br>dimension<br>f<br>Min.<br>mm(inch) | Maximum<br>tightening<br>torque<br>N·m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|------------------------------|------------------|-----------------|----------------|----------------|----------------|----------------|------------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|
| B<br>max                     | B <sub>2</sub>   | B <sub>3</sub>  | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | r              |                                                |                                        |                                        |                                                    |
| 10.2 (0.40)                  | 12.700 ( 1/2 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 8.334 ( 21/64 )                                | 1.4                                    | 4 260                                  | 4 750                                              |
| 10.9 (0.43)                  | 15.875 ( 5/8 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 8.334 ( 21/64 )                                | 1.4                                    | 4 710                                  | 5 410                                              |
| 11.8 (0.46)                  | 15.875 ( 5/8 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 11.509 ( 29/64 )                               | 3.4                                    | 5 830                                  | 7 660                                              |
| 12.5 (0.49)                  | 19.050 ( 3/4 )   | — ( — )         | 0.794 ( 1/32 ) | *3.175 ( 1/8 ) | — ( — )        | 0.397 ( 1/64 ) | 11.509 ( 29/64 )                               | 3.4                                    | 6 340                                  | 8 530                                              |
| 14.2 (0.56)                  | 22.225 ( 7/8 )   | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 0.794 ( 1/32 ) | 13.494 ( 17/32 )                               | 10.8                                   | 8 710                                  | 12 300                                             |
| 14.2 (0.56)                  | 22.225 ( 7/8 )   | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 0.794 ( 1/32 ) | 15.081 ( 19/32 )                               | 10.8                                   | 8 710                                  | 12 300                                             |
| 17.3 (0.68)                  | 25.400 ( 1 )     | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.191 ( 3/64 ) | 17.859 ( 45/64 )                               | 17.4                                   | 13 100                                 | 22 700                                             |
| 17.3 (0.68)                  | 25.400 ( 1 )     | 6.350 ( 1/4 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 19.050 ( 3/4 )                                 | 17.4                                   | 13 100                                 | 22 700                                             |
| 20.4 (0.80)                  | 31.750 ( 1 1/4 ) | 7.938 ( 5/16 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 21.828 ( 55/64 )                               | 27.7                                   | 23 600                                 | 31 700                                             |
| 20.4 (0.80)                  | 31.750 ( 1 1/4 ) | 7.938 ( 5/16 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 1.588 ( 1/16 ) | 21.828 ( 55/64 )                               | 27.7                                   | 23 600                                 | 31 700                                             |
| 23.6 (0.93)                  | 38.100 ( 1 1/2 ) | 9.525 ( 3/8 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 26.196 ( 1 3/64 )                              | 55.7                                   | 28 200                                 | 40 100                                             |
| 23.6 (0.93)                  | 38.100 ( 1 1/2 ) | 9.525 ( 3/8 )   | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 26.196 ( 1 3/64 )                              | 55.7                                   | 28 200                                 | 40 100                                             |
| 26.8 (1.06)                  | 44.450 ( 1 3/4 ) | 11.112 ( 7/16 ) | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 32.543 ( 1 9/32 )                              | 100                                    | 35 300                                 | 55 600                                             |
| 26.8 (1.06)                  | 44.450 ( 1 3/4 ) | 11.112 ( 7/16 ) | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 3.969 ( 5/32 ) | 1.588 ( 1/16 ) | 32.543 ( 1 9/32 )                              | 100                                    | 35 300                                 | 55 600                                             |
| 33.5 (1.32)                  | 50.800 ( 2 )     | 12.700 ( 1/2 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 4.762 ( 3/16 ) | 1.588 ( 1/16 ) | 37.306 ( 1 15/32 )                             | 162                                    | 45 700                                 | 80 600                                             |
| 33.5 (1.32)                  | 50.800 ( 2 )     | 12.700 ( 1/2 )  | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 4.762 ( 3/16 ) | 1.588 ( 1/16 ) | 37.306 ( 1 15/32 )                             | 162                                    | 45 700                                 | 80 600                                             |
| 46.4 (1.83)                  | 63.500 ( 2 1/2 ) | 15.875 ( 5/8 )  | 1.588 ( 1/16 ) | 6.350 ( 1/4 )  | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 51.991 ( 2 3/64 )                              | 500                                    | 77 600                                 | 172 000                                            |

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CAM FOLLOWERS

Inch Series Heavy Duty Cam Followers **Full Complement Type/Stud Head Hex Hole**

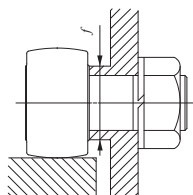
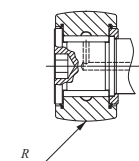


CRH ... VBR

Stud dia. 6.350 — 50.800mm

| Stud dia.<br>mm<br>(inch) | Identification number                     |                                           | Mass<br>(Ref.)<br><br>g | Boundary dimensions mm (inch) |                  |                  |              |                  |               |
|---------------------------|-------------------------------------------|-------------------------------------------|-------------------------|-------------------------------|------------------|------------------|--------------|------------------|---------------|
|                           | Shield type<br>With crowned<br>outer ring | Sealed type<br>With crowned<br>outer ring |                         | D                             | C                | d <sub>1</sub>   | G<br>UNF     | G <sub>1</sub>   | B<br>max      |
| 6.350<br>(1/4)            | CRH 8-1 VBR                               | CRH 8-1 VBUUR                             | 12                      | 12.700 ( 1/2 )                | 9.525 ( 3/8 )    | 6.350 ( 1/4 )    | 1/4 - 28     | 6.350 ( 1/4 )    | 11.1 ( 0.44 ) |
|                           | CRH 9 VBR                                 | CRH 9 VBUUR                               | 15                      | 14.288 ( 9/16 )               | 9.525 ( 3/8 )    | 6.350 ( 1/4 )    | 1/4 - 28     | 6.350 ( 1/4 )    | 11.1 ( 0.44 ) |
| 7.938<br>(5/16)           | CRH 10-1 VBR                              | CRH 10-1 VBUUR                            | 23                      | 15.875 ( 5/8 )                | 11.112 ( 7/16 )  | 7.938 ( 5/16 )   | 5/16 - 24    | 7.938 ( 5/16 )   | 12.8 ( 0.50 ) |
|                           | CRH 11 VBR                                | CRH 11 VBUUR                              | 27                      | 17.462 ( 11/16 )              | 11.112 ( 7/16 )  | 7.938 ( 5/16 )   | 5/16 - 24    | 7.938 ( 5/16 )   | 12.8 ( 0.50 ) |
| 11.112<br>(7/16)          | CRH 12 VBR                                | CRH 12 VBUUR                              | 39                      | 19.050 ( 3/4 )                | 12.700 ( 1/2 )   | 11.112 ( 7/16 )  | 7/16 - 20    | 9.525 ( 3/8 )    | 14.6 ( 0.57 ) |
|                           | CRH 14 VBR                                | CRH 14 VBUUR                              | 49                      | 22.225 ( 7/8 )                | 12.700 ( 1/2 )   | 11.112 ( 7/16 )  | 7/16 - 20    | 9.525 ( 3/8 )    | 14.6 ( 0.57 ) |
| 15.875<br>(5/8)           | CRH 16 VBR                                | CRH 16 VBUUR                              | 93                      | 25.400 ( 1 )                  | 15.875 ( 5/8 )   | 15.875 ( 5/8 )   | 5/8 - 18     | 12.700 ( 1/2 )   | 17.9 ( 0.70 ) |
|                           | CRH 18 VBR                                | CRH 18 VBUUR                              | 109                     | 28.575 ( 1 1/8 )              | 15.875 ( 5/8 )   | 15.875 ( 5/8 )   | 5/8 - 18     | 12.700 ( 1/2 )   | 17.9 ( 0.70 ) |
| 19.050<br>(3/4)           | CRH 20 VBR                                | CRH 20 VBUUR                              | 176                     | 31.750 ( 1 1/4 )              | 19.050 ( 3/4 )   | 19.050 ( 3/4 )   | 3/4 - 16     | 15.875 ( 5/8 )   | 21.0 ( 0.83 ) |
|                           | CRH 22 VBR                                | CRH 22 VBUUR                              | 200                     | 34.925 ( 1 3/8 )              | 19.050 ( 3/4 )   | 19.050 ( 3/4 )   | 3/4 - 16     | 15.875 ( 5/8 )   | 21.0 ( 0.83 ) |
| 22.225<br>(7/8)           | CRH 24 VBR                                | CRH 24 VBUUR                              | 296                     | 38.100 ( 1 1/2 )              | 22.225 ( 7/8 )   | 22.225 ( 7/8 )   | 7/8 - 14     | 19.050 ( 3/4 )   | 24.3 ( 0.96 ) |
|                           | CRH 26 VBR                                | CRH 26 VBUUR                              | 329                     | 41.275 ( 1 5/8 )              | 22.225 ( 7/8 )   | 22.225 ( 7/8 )   | 7/8 - 14     | 19.050 ( 3/4 )   | 24.3 ( 0.96 ) |
| 25.400<br>( 1 )           | CRH 28 VBR                                | CRH 28 VBUUR                              | 463                     | 44.450 ( 1 3/4 )              | 25.400 ( 1 )     | 25.400 ( 1 )     | 1 - 14 UNS   | 22.225 ( 7/8 )   | 27.4 ( 1.08 ) |
|                           | CRH 30 VBR                                | CRH 30 VBUUR                              | 508                     | 47.625 ( 1 7/8 )              | 25.400 ( 1 )     | 25.400 ( 1 )     | 1 - 14 UNS   | 22.225 ( 7/8 )   | 27.4 ( 1.08 ) |
| 28.575<br>(1 1/8)         | CRH 32 VBR                                | CRH 32 VBUUR                              | 722                     | 50.800 ( 2 )                  | 31.750 ( 1 1/4 ) | 28.575 ( 1 1/8 ) | 1 1/8 - 12   | 25.400 ( 1 )     | 34.2 ( 1.35 ) |
|                           | CRH 36 VBR                                | CRH 36 VBUUR                              | 858                     | 57.150 ( 2 1/4 )              | 31.750 ( 1 1/4 ) | 28.575 ( 1 1/8 ) | 1 1/8 - 12   | 25.400 ( 1 )     | 34.2 ( 1.35 ) |
| 31.750<br>(1 1/4)         | CRH 40 VBR                                | CRH 40 VBUUR                              | 1 260                   | 63.500 ( 2 1/2 )              | 38.100 ( 1 1/2 ) | 31.750 ( 1 1/4 ) | 1 1/4 - 12   | 28.575 ( 1 1/8 ) | 40.0 ( 1.57 ) |
|                           | CRH 44 VBR                                | CRH 44 VBUUR                              | 1 460                   | 69.850 ( 2 3/4 )              | 38.100 ( 1 1/2 ) | 31.750 ( 1 1/4 ) | 1 1/4 - 12   | 28.575 ( 1 1/8 ) | 40.0 ( 1.57 ) |
| 38.100<br>(1 1/2)         | CRH 48 VBR                                | CRH 48 VBUUR                              | 2 100                   | 76.200 ( 3 )                  | 44.450 ( 1 3/4 ) | 38.100 ( 1 1/2 ) | 1 1/2 - 12   | 31.750 ( 1 1/4 ) | 46.4 ( 1.83 ) |
|                           | CRH 52 VBR                                | CRH 52 VBUUR                              | 2 380                   | 82.550 ( 3 1/4 )              | 44.450 ( 1 3/4 ) | 38.100 ( 1 1/2 ) | 1 1/2 - 12   | 31.750 ( 1 1/4 ) | 46.4 ( 1.83 ) |
| 44.450<br>(1 3/4)         | CRH 56 VBR                                | CRH 56 VBUUR                              | 3 240                   | 88.900 ( 3 1/2 )              | 50.800 ( 2 )     | 44.450 ( 1 3/4 ) | 1 3/4 - 12UN | 34.925 ( 1 3/8 ) | 52.8 ( 2.08 ) |
| 50.800<br>( 2 )           | CRH 64 VBR                                | CRH 64 VBUUR                              | 4 960                   | 101.600 ( 4 )                 | 57.150 ( 2 1/4 ) | 50.800 ( 2 )     | 2 - 12 UN    | 38.100 ( 1 1/2 ) | 59.4 ( 2.34 ) |

Remarks1. Models with a stud diameter  $d_1$  of 7.938 mm or less have no oil hole. Other models are provided with one oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



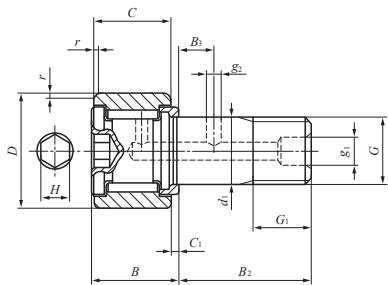
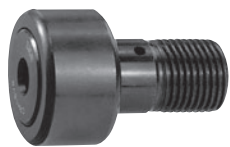
CRH ... VBUUR

| Boundary dimensions mm (inch) |                  |                |                |                |                 |            | Mounting dimension<br>f<br>Min.<br>mm (inch) | Maximum<br>tightening<br>torque<br>N-m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|-------------------------------|------------------|----------------|----------------|----------------|-----------------|------------|----------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|
| B <sub>2</sub>                | B <sub>3</sub>   | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H               | R          |                                              |                                        |                                        |                                                    |
| 15.875 ( 5/8 )                | — ( — )          | 0.794 ( 1/32 ) | — ( — )        | — ( — )        | 3.175 ( 1/8 )   | 180 ( 7 )  | 8.334 ( 21/64 )                              | 3.4                                    | 4 710                                  | 5 410                                              |
| 15.875 ( 5/8 )                | — ( — )          | 0.794 ( 1/32 ) | — ( — )        | — ( — )        | 3.175 ( 1/8 )   | 180 ( 7 )  | 8.334 ( 21/64 )                              | 3.4                                    | 4 710                                  | 5 410                                              |
| 19.050 ( 3/4 )                | — ( — )          | 0.794 ( 1/32 ) | — ( — )        | — ( — )        | 3.175 ( 1/8 )   | 200 ( 8 )  | 11.112 ( 7/16 )                              | 6.8                                    | 6 340                                  | 8 530                                              |
| 19.050 ( 3/4 )                | — ( — )          | 0.794 ( 1/32 ) | — ( — )        | — ( — )        | 3.175 ( 1/8 )   | 200 ( 8 )  | 11.112 ( 7/16 )                              | 6.8                                    | 6 340                                  | 8 530                                              |
| 22.225 ( 7/8 )                | 6.350 ( 1/4 )    | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 4.762 ( 3/16 )  | 250 ( 10 ) | 13.494 ( 17/32 )                             | 17.6                                   | 8 710                                  | 12 300                                             |
| 22.225 ( 7/8 )                | 6.350 ( 1/4 )    | 0.794 ( 1/32 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 4.762 ( 3/16 )  | 250 ( 10 ) | 13.494 ( 17/32 )                             | 17.6                                   | 8 710                                  | 12 300                                             |
| 25.400 ( 1 )                  | 6.350 ( 1/4 )    | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 6.350 ( 1/4 )   | 300 ( 12 ) | 18.256 ( 23/32 )                             | 57.8                                   | 13 100                                 | 22 700                                             |
| 25.400 ( 1 )                  | 6.350 ( 1/4 )    | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 6.350 ( 1/4 )   | 300 ( 12 ) | 18.256 ( 23/32 )                             | 57.8                                   | 13 100                                 | 22 700                                             |
| 31.750 ( 1 1/4 )              | 7.938 ( 5/16 )   | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 6.350 ( 1/4 )   | 360 ( 14 ) | 24.209 ( 61/64 )                             | 103                                    | 23 600                                 | 31 700                                             |
| 31.750 ( 1 1/4 )              | 7.938 ( 5/16 )   | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 6.350 ( 1/4 )   | 360 ( 14 ) | 24.209 ( 61/64 )                             | 103                                    | 23 600                                 | 31 700                                             |
| 38.100 ( 1 1/2 )              | 9.525 ( 3/8 )    | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 7.938 ( 5/16 )  | 500 ( 20 ) | 26.988 ( 1 1/16 )                            | 162                                    | 28 200                                 | 40 100                                             |
| 38.100 ( 1 1/2 )              | 9.525 ( 3/8 )    | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 7.938 ( 5/16 )  | 500 ( 20 ) | 26.988 ( 1 1/16 )                            | 162                                    | 28 200                                 | 40 100                                             |
| 44.450 ( 1 3/4 )              | 11.112 ( 7/16 )  | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 7.938 ( 5/16 )  | 500 ( 20 ) | 32.941 ( 1 19/64 )                           | 258                                    | 35 300                                 | 55 600                                             |
| 44.450 ( 1 3/4 )              | 11.112 ( 7/16 )  | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 2.381 ( 3/32 ) | 7.938 ( 5/16 )  | 500 ( 20 ) | 32.941 ( 1 19/64 )                           | 258                                    | 35 300                                 | 55 600                                             |
| 50.800 ( 2 )                  | 12.700 ( 1/2 )   | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 11.112 ( 7/16 ) | 600 ( 24 ) | 37.306 ( 1 15/32 )                           | 356                                    | 45 700                                 | 80 600                                             |
| 50.800 ( 2 )                  | 12.700 ( 1/2 )   | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 11.112 ( 7/16 ) | 600 ( 24 ) | 37.306 ( 1 15/32 )                           | 356                                    | 45 700                                 | 80 600                                             |
| 57.150 ( 2 1/4 )              | 14.288 ( 9/16 )  | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 12.700 ( 1/2 )  | 760 ( 30 ) | 40.878 ( 1 39/64 )                           | 500                                    | 61 400                                 | 116 000                                            |
| 57.150 ( 2 1/4 )              | 14.288 ( 9/16 )  | 1.588 ( 1/16 ) | 4.762 ( 3/16 ) | 3.175 ( 1/8 )  | 12.700 ( 1/2 )  | 760 ( 30 ) | 40.878 ( 1 39/64 )                           | 500                                    | 61 400                                 | 116 000                                            |
| 63.500 ( 2 1/2 )              | 15.875 ( 5/8 )   | 1.588 ( 1/16 ) | 6.350 ( 1/4 )  | 3.175 ( 1/8 )  | 19.050 ( 3/4 )  | 760 ( 30 ) | 51.991 ( 2 3/64 )                            | 892                                    | 77 600                                 | 172 000                                            |
| 63.500 ( 2 1/2 )              | 15.875 ( 5/8 )   | 1.588 ( 1/16 ) | 6.350 ( 1/4 )  | 3.175 ( 1/8 )  | 19.050 ( 3/4 )  | 760 ( 30 ) | 51.991 ( 2 3/64 )                            | 892                                    | 77 600                                 | 172 000                                            |
| 69.850 ( 2 3/4 )              | 17.462 ( 11/16 ) | 1.588 ( 1/16 ) | 6.350 ( 1/4 )  | 3.175 ( 1/8 )  | 19.050 ( 3/4 )  | 760 ( 30 ) | 59.928 ( 2 23/64 )                           | 1450                                   | 111 000                                | 239 000                                            |
| 88.900 ( 3 1/2 )              | 19.050 ( 3/4 )   | 1.588 ( 1/16 ) | 6.350 ( 1/4 )  | 3.175 ( 1/8 )  | 19.050 ( 3/4 )  | 760 ( 30 ) | 64.691 ( 2 35/64 )                           | 2190                                   | 142 000                                | 317 000                                            |

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CAM FOLLOWERS

Inch Series Heavy Duty Cam Followers Full Complement Type/Stud Head Hex Hole

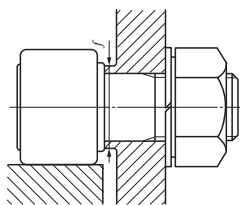
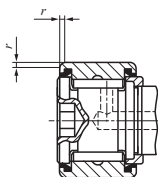


CRH...VB

Stud dia. 6.350 – 50.800mm

| Stud dia.<br>mm<br>(inch) | Identification number                         |                                               | Mass<br>(Ref.)<br><br>g |                |                |                |              |                |             |
|---------------------------|-----------------------------------------------|-----------------------------------------------|-------------------------|----------------|----------------|----------------|--------------|----------------|-------------|
|                           | Shield type<br>With cylindrical<br>outer ring | Sealed type<br>With cylindrical<br>outer ring |                         | D              | C              | d <sub>1</sub> | G<br>UNF     | G <sub>1</sub> | B<br>max    |
| 6.350<br>(1/4)            | CRH 8-1 VB                                    | CRH 8-1 VBUU                                  | 12                      | 12.700 (1/2)   | 9.525 (3/8)    | 6.350 (1/4)    | 1/4 - 28     | 6.350 (1/4)    | 11.1 (0.44) |
|                           | CRH 9 VB                                      | CRH 9 VBUU                                    | 15                      | 14.288 (9/16)  | 9.525 (3/8)    | 6.350 (1/4)    | 1/4 - 28     | 6.350 (1/4)    | 11.1 (0.44) |
| 7.938<br>(5/16)           | CRH 10-1 VB                                   | CRH 10-1 VBUU                                 | 23                      | 15.875 (5/8)   | 11.112 (7/16)  | 7.938 (5/16)   | 5/16 - 24    | 7.938 (5/16)   | 12.8 (0.50) |
|                           | CRH 11 VB                                     | CRH 11 VBUU                                   | 27                      | 17.462 (11/16) | 11.112 (7/16)  | 7.938 (5/16)   | 5/16 - 24    | 7.938 (5/16)   | 12.8 (0.50) |
| 11.112<br>(7/16)          | CRH 12 VB                                     | CRH 12 VBUU                                   | 39                      | 19.050 (3/4)   | 12.700 (1/2)   | 11.112 (7/16)  | 7/16 - 20    | 9.525 (3/8)    | 14.6 (0.57) |
|                           | CRH 14 VB                                     | CRH 14 VBUU                                   | 49                      | 22.225 (7/8)   | 12.700 (1/2)   | 11.112 (7/16)  | 7/16 - 20    | 9.525 (3/8)    | 14.6 (0.57) |
| 15.875<br>(5/8)           | CRH 16 VB                                     | CRH 16 VBUU                                   | 93                      | 25.400 (1)     | 15.875 (5/8)   | 15.875 (5/8)   | 5/8 - 18     | 12.700 (1/2)   | 17.9 (0.70) |
|                           | CRH 18 VB                                     | CRH 18 VBUU                                   | 109                     | 28.575 (1 1/8) | 15.875 (5/8)   | 15.875 (5/8)   | 5/8 - 18     | 12.700 (1/2)   | 17.9 (0.70) |
| 19.050<br>(3/4)           | CRH 20 VB                                     | CRH 20 VBUU                                   | 176                     | 31.750 (1 1/4) | 19.050 (3/4)   | 19.050 (3/4)   | 3/4 - 16     | 15.875 (5/8)   | 21.0 (0.83) |
|                           | CRH 22 VB                                     | CRH 22 VBUU                                   | 200                     | 34.925 (1 3/8) | 19.050 (3/4)   | 19.050 (3/4)   | 3/4 - 16     | 15.875 (5/8)   | 21.0 (0.83) |
| 22.225<br>(7/8)           | CRH 24 VB                                     | CRH 24 VBUU                                   | 296                     | 38.100 (1 1/2) | 22.225 (7/8)   | 22.225 (7/8)   | 7/8 - 14     | 19.050 (3/4)   | 24.3 (0.96) |
|                           | CRH 26 VB                                     | CRH 26 VBUU                                   | 329                     | 41.275 (1 5/8) | 22.225 (7/8)   | 22.225 (7/8)   | 7/8 - 14     | 19.050 (3/4)   | 24.3 (0.96) |
| 25.400<br>(1)             | CRH 28 VB                                     | CRH 28 VBUU                                   | 463                     | 44.450 (1 3/4) | 25.400 (1)     | 25.400 (1)     | 1 - 14 UNS   | 22.225 (7/8)   | 27.4 (1.08) |
|                           | CRH 30 VB                                     | CRH 30 VBUU                                   | 508                     | 47.625 (1 7/8) | 25.400 (1)     | 25.400 (1)     | 1 - 14 UNS   | 22.225 (7/8)   | 27.4 (1.08) |
| 28.575<br>(1 1/8)         | CRH 32 VB                                     | CRH 32 VBUU                                   | 722                     | 50.800 (2)     | 31.750 (1 1/4) | 28.575 (1 1/8) | 1 1/8 - 12   | 25.400 (1)     | 34.2 (1.35) |
|                           | CRH 36 VB                                     | CRH 36 VBUU                                   | 858                     | 57.150 (2 1/4) | 31.750 (1 1/4) | 28.575 (1 1/8) | 1 1/8 - 12   | 25.400 (1)     | 34.2 (1.35) |
| 31.750<br>(1 1/4)         | CRH 40 VB                                     | CRH 40 VBUU                                   | 1 260                   | 63.500 (2 1/2) | 38.100 (1 1/2) | 31.750 (1 1/4) | 1 1/4 - 12   | 28.575 (1 1/8) | 40.0 (1.57) |
|                           | CRH 44 VB                                     | CRH 44 VBUU                                   | 1 460                   | 69.850 (2 3/4) | 38.100 (1 1/2) | 31.750 (1 1/4) | 1 1/4 - 12   | 28.575 (1 1/8) | 40.0 (1.57) |
| 38.100<br>(1 1/2)         | CRH 48 VB                                     | CRH 48 VBUU                                   | 2 100                   | 76.200 (3)     | 44.450 (1 3/4) | 38.100 (1 1/2) | 1 1/2 - 12   | 31.750 (1 1/4) | 46.4 (1.83) |
|                           | CRH 52 VB                                     | CRH 52 VBUU                                   | 2 380                   | 82.550 (3 1/4) | 44.450 (1 3/4) | 38.100 (1 1/2) | 1 1/2 - 12   | 31.750 (1 1/4) | 46.4 (1.83) |
| 44.450<br>(1 3/4)         | CRH 56 VB                                     | CRH 56 VBUU                                   | 3 240                   | 88.900 (3 1/2) | 50.800 (2)     | 44.450 (1 3/4) | 1 3/4 - 12UN | 34.925 (1 3/8) | 52.8 (2.08) |
| 50.800<br>(2)             | CRH 64 VB                                     | CRH 64 VBUU                                   | 4 960                   | 101.600 (4)    | 57.150 (2 1/4) | 50.800 (2)     | 2 - 12 UN    | 38.100 (1 1/2) | 59.4 (2.34) |

Remarks1. Models with a stud diameter  $d_1$  of 7.938 mm or less have no oil hole. Other models are provided with one oil hole each on the outside surface and end surface of the stud.  
2. Provided with prepacked grease.  
3. For the maximum allowable static load, please contact IKO.



CRH...VBUU

| Boundary dimensions mm(inch) |                |                |                |                |               |              | Mounting dimension<br>f<br>Min.<br>mm(inch) | Maximum<br>tightening<br>torque<br>N-m | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|------------------------------|----------------|----------------|----------------|----------------|---------------|--------------|---------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------|
| B <sub>2</sub>               | B <sub>3</sub> | C <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> | H             | r            |                                             |                                        |                                        |                                                    |
| 15.875 (5/8)                 | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                               | 3.4                                    | 4 710                                  | 5 410                                              |
| 15.875 (5/8)                 | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 8.334 (21/64)                               | 3.4                                    | 4 710                                  | 5 410                                              |
| 19.050 (3/4)                 | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.112 (7/16)                               | 6.8                                    | 6 340                                  | 8 530                                              |
| 19.050 (3/4)                 | — (—)          | 0.794 (1/32)   | — (—)          | — (—)          | 3.175 (1/8)   | 0.397 (1/64) | 11.112 (7/16)                               | 6.8                                    | 6 340                                  | 8 530                                              |
| 22.225 (7/8)                 | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 13.494 (17/32)                              | 17.6                                   | 8 710                                  | 12 300                                             |
| 22.225 (7/8)                 | 6.350 (1/4)    | 0.794 (1/32)   | 4.762 (3/16)   | 2.381 (3/32)   | 4.762 (3/16)  | 0.794 (1/32) | 13.494 (17/32)                              | 17.6                                   | 8 710                                  | 12 300                                             |
| 25.400 (1)                   | 6.350 (1/4)    | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 6.350 (1/4)   | 1.191 (3/64) | 18.256 (23/32)                              | 57.8                                   | 13 100                                 | 22 700                                             |
| 25.400 (1)                   | 6.350 (1/4)    | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 6.350 (1/4)   | 1.588 (1/16) | 18.256 (23/32)                              | 57.8                                   | 13 100                                 | 22 700                                             |
| 31.750 (1 1/4)               | 7.938 (5/16)   | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 6.350 (1/4)   | 1.588 (1/16) | 24.209 (61/64)                              | 103                                    | 23 600                                 | 31 700                                             |
| 31.750 (1 1/4)               | 7.938 (5/16)   | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 6.350 (1/4)   | 1.588 (1/16) | 24.209 (61/64)                              | 103                                    | 23 600                                 | 31 700                                             |
| 38.100 (1 1/2)               | 9.525 (3/8)    | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.988 (1 1/16)                             | 162                                    | 28 200                                 | 40 100                                             |
| 38.100 (1 1/2)               | 9.525 (3/8)    | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 7.938 (5/16)  | 1.588 (1/16) | 26.988 (1 1/16)                             | 162                                    | 28 200                                 | 40 100                                             |
| 44.450 (1 3/4)               | 11.112 (7/16)  | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.941 (1 19/64)                            | 258                                    | 35 300                                 | 55 600                                             |
| 44.450 (1 3/4)               | 11.112 (7/16)  | 1.588 (1/16)   | 4.762 (3/16)   | 2.381 (3/32)   | 7.938 (5/16)  | 1.588 (1/16) | 32.941 (1 19/64)                            | 258                                    | 35 300                                 | 55 600                                             |
| 50.800 (2)                   | 12.700 (1/2)   | 1.588 (1/16)   | 4.762 (3/16)   | 3.175 (1/8)    | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                            | 356                                    | 45 700                                 | 80 600                                             |
| 50.800 (2)                   | 12.700 (1/2)   | 1.588 (1/16)   | 4.762 (3/16)   | 3.175 (1/8)    | 11.112 (7/16) | 1.588 (1/16) | 37.306 (1 15/32)                            | 356                                    | 45 700                                 | 80 600                                             |
| 57.150 (2 1/4)               | 14.288 (9/16)  | 1.588 (1/16)   | 4.762 (3/16)   | 3.175 (1/8)    | 12.700 (1/2)  | 2.381 (3/32) | 40.878 (1 39/64)                            | 500                                    | 61 400                                 | 116 000                                            |
| 57.150 (2 1/4)               | 14.288 (9/16)  | 1.588 (1/16)   | 4.762 (3/16)   | 3.175 (1/8)    | 12.700 (1/2)  | 2.381 (3/32) | 40.878 (1 39/64)                            | 500                                    | 61 400                                 | 116 000                                            |
| 63.500 (2 1/2)               | 15.875 (5/8)   | 1.588 (1/16)   | 6.350 (1/4)    | 3.175 (1/8)    | 19.050 (3/4)  | 2.381 (3/32) | 51.991 (2 3/64)                             | 892                                    | 77 600                                 | 172 000                                            |
| 63.500 (2 1/2)               | 15.875 (5/8)   | 1.588 (1/16)   | 6.350 (1/4)    | 3.175 (1/8)    | 19.050 (3/4)  | 2.381 (3/32) | 51.991 (2 3/64)                             | 892                                    | 77 600                                 | 172 000                                            |
| 69.850 (2 3/4)               | 17.462 (11/16) | 1.588 (1/16)   | 6.350 (1/4)    | 3.175 (1/8)    | 19.050 (3/4)  | 2.381 (3/32) | 59.928 (2 23/64)                            | 1 450                                  | 111 000                                | 239 000                                            |
| 88.900 (3 1/2)               | 19.050 (3/4)   | 1.588 (1/16)   | 6.350 (1/4)    | 3.175 (1/8)    | 19.050 (3/4)  | 2.381 (3/32) | 64.691 (2 35/64)                            | 2 190                                  | 142 000                                | 317 000                                            |

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# ROLLER FOLLOWERS

- Separable Roller Followers
- Non-separable Roller Followers
- High carbon steel made
- Stainless steel made
- C-Lube Roller Followers
- Cylindrical Roller Followers



## Structure and Features

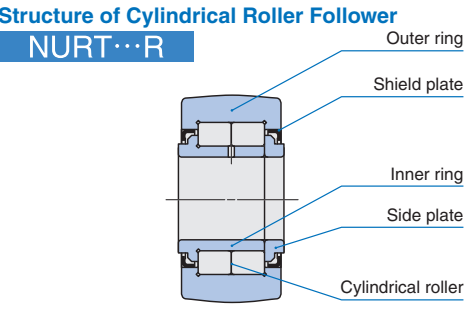
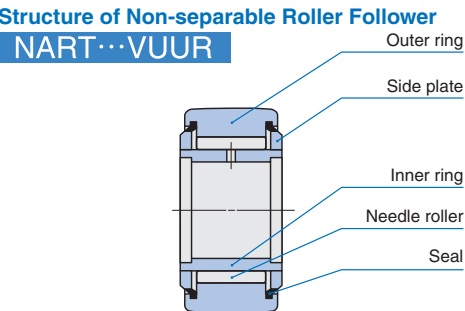
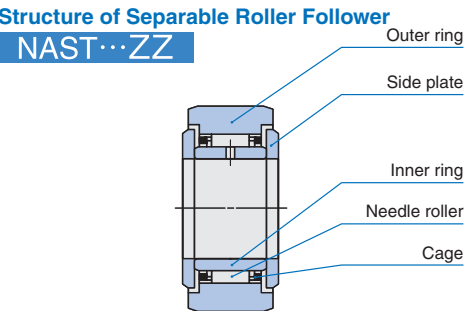
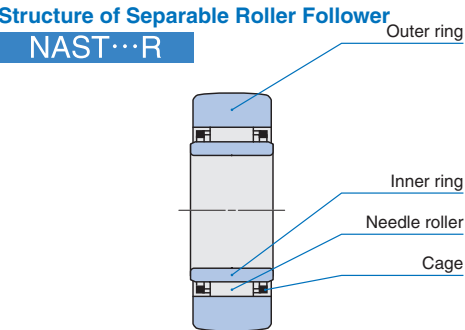
IKO Roller Followers are bearings designed for outer ring rotation, in which needle rollers are incorporated in a thick walled outer ring. Both crowned and cylindrical outer rings are available. The outer rings run directly on mating cam guide surfaces, and the crowned outer ring is effective in relieving the edge load caused by mounting errors. The cylindrical outer ring, on the other hand, has a large contact area with the mating cam guide surface and is suitable for applications involving large loads or low cam guide surface hardness.

In Roller Followers, there are two types of bearings available, the caged type and the full complement type. The caged type is useful for applications at high-speed rotation. The full complement type, on the other hand, is suitable for heavy-load applications at low-speed rotation or oscillating motions.

Roller Followers include separable and non-separable types. Also, in addition to the open type, shield type and sealed type are available. The clearances between the side plates and outer ring of the shield type are narrow, and form labyrinths. In the sealed type, special synthetic rubber seals are assembled in these clearances, and they are effective in preventing penetration of dust and dirt.

These bearings are available in a variety of types to suit almost any kind of application. They are widely used for cam mechanisms and for linear motions of conveying equipment.

### Structures of Roller Followers



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NAST  
NART  
NURT  
CRY

Types

In Roller Followers, types shown in Table 1 are available.

Table 1 Type of Roller Followers

| Type                                 |                                                        |                        |             | With cage               |                        | Full complement type |                        |
|--------------------------------------|--------------------------------------------------------|------------------------|-------------|-------------------------|------------------------|----------------------|------------------------|
|                                      |                                                        |                        |             | Crowned outer ring      | Cylindrical outer ring | Crowned outer ring   | Cylindrical outer ring |
| Metric series                        | Separable Roller Followers<br>RNAS <sup>1</sup> , NAST | Without inner ring     | Open type   | RNAS <sup>1</sup> ... R | RNAS <sup>1</sup>      | —                    | —                      |
|                                      |                                                        | With inner ring        | Open type   | NAST ... R              | NAST                   | —                    | —                      |
|                                      |                                                        |                        | Shield type | NAST ... ZZ R           | NAST ... ZZ            | —                    | —                      |
|                                      |                                                        |                        | Sealed type | NAST ... ZZUUR          | NAST ... ZZUU          | —                    | —                      |
|                                      | Non-separable Roller Followers<br>NART                 | High carbon steel made | Shield type | NART ... R              | —                      | NART ... V R         | —                      |
|                                      |                                                        |                        | Sealed type | NART ... UU R           | —                      | NART ... VUUR        | —                      |
|                                      |                                                        | Stainless steel made   | Shield type | NART ... F R            | —                      | —                    | —                      |
|                                      |                                                        |                        | Sealed type | NART ... FUU R          | —                      | —                    | —                      |
|                                      | C-Lube Roller Followers<br>NART ... /SG                |                        | Sealed type | NART ... UUR/SG         | —                      | —                    | —                      |
| Cylindrical Roller Followers<br>NURT |                                                        | Shield type            | —           | —                       | NURT ... R             | NURT                 |                        |
| Inch series                          | Non-separable Roller Followers<br>CRY                  |                        | Shield type | —                       | —                      | CRY ... V R          | CRY ... V              |
|                                      |                                                        |                        | Sealed type | —                       | —                      | CRY ... VUUR         | CRY ... VUU            |

Separable Roller Followers

These bearings are assembled by combining an outer ring, inner ring and Needle Roller Cage, which can be separated from one another. Thus, handling is easy. Oil lubrication is also easy, making them suitable for high-speed rotations. There are two types: type without inner ring RNAS<sup>1</sup> and type with inner ring NAST. The type with inner ring includes open type, shield type, and sealed type.

Non-separable Roller Followers

These non-separable type bearings have side plates fixed on both sides of the inner ring, and include the caged type and the full complement type. Both shield type and sealed type are available. As well, these bearings also offer a highly corrosion-resistant stainless steel specification, of which the products are suitable for applications where rust prevention oil is not preferred, such as in cleanroom environments. Inch series Non-separable Roller Followers are full complement type bearings with black oxide surface treatment.

C-Lube Roller Followers

These Roller Followers are lubricated with C-Lube, an IKO original thermosetting solid-type lubricant which fills the inner space of the bearing. C-Lube is lubricant made of a lot of lubricant and fine particles of super-high molecular polyolefin that are solidified by heat treatment. As the bearing rotates, the lubricant oozes out onto the raceway in proper quantities, maintaining the lubrication performance for a long period of time.

Cylindrical Roller Followers

These bearings are full complement type bearings incorporating double rows of full complement cylindrical rollers in the outer ring, and can withstand large radial loads. Additionally, the outer ring is guided by the outer ring shoulder and the end face of cylindrical rollers to the axial direction.

Identification Number

Some examples of the identification number of Roller Followers are shown below.

Examples of identification number

Example 1

Example 2

Example 3

Example 4

NAST 10 ZZUU R

NART 10 V UU R

NART 15 UU R /SG

NART 12 F UU R

| Model code    |                   |                                              |
|---------------|-------------------|----------------------------------------------|
| Metric series | RNAS <sup>1</sup> | Separable Roller Follower Without inner ring |
|               | NAST              | Separable Roller Follower With inner ring    |
|               | NART              | Non-separable Roller Follower                |
|               | NART.../SG        | C-Lube Roller Follower                       |
| Inch series   | NURT              | Cylindrical Roller Follower                  |
|               | CRY               | Non-separable Roller Follower                |

Size

The size indicates the bore diameter of the inner ring. (unit: mm)  
In the inch series, the outer diameter of the outer ring is indicated in units of 1/16 inch.

| Type of material |                        |
|------------------|------------------------|
| No symbol        | High carbon steel made |
| F(')             | Stainless steel made   |

| Roller guide method |                      |
|---------------------|----------------------|
| No symbol           | With cage            |
| V                   | Full complement type |

| Seal structure (Separable Roller Follower) |             |
|--------------------------------------------|-------------|
| No symbol                                  | Open type   |
| ZZ                                         | Shield type |
| ZZUU                                       | Sealed type |

| Seal structure (Other Roller Follower) |             |
|----------------------------------------|-------------|
| No symbol                              | Shield type |
| UU                                     | Sealed type |

| Shape of outer ring outside surface |                             |
|-------------------------------------|-----------------------------|
| R                                   | With crowned outer ring     |
| No symbol                           | With cylindrical outer ring |

Note(1) Applicable to Non-separable Roller Followers only

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NURT  
CRY



Track Capacity

Track capacity is defined as the load that can be continuously applied on a Roller Follower placed on a steel cam guide surface without causing deformation and indentation on the cam guide surface when the outer ring of the Roller Follower makes contact with the mating cam guide surface (plane). The track capacities shown in Tables 8.1 and 8.2 are applicable when the hardness of the mating cam guide surface is 40HRC

(Tensile strength 1250N/mm<sup>2</sup>). When the hardness of the mating cam guide surface differs from 40HRC, the track capacity is obtained by multiplying the value by the track capacity factor shown in Table 9. If lubrication between the outer ring and the mating cam guide surface is insufficient, seizure and/or wear may occur depending on the application. Therefore, pay attention to lubrication and surface roughness of the mating cam guide especially in the case of high-speed rotation such as for cam mechanisms.

Table 8.1 Track capacity (Metric series) unit: N

| Roller Followers with crowned outer ring |                                               |                              |                | Roller Followers with cylindrical outer ring |                |                                      |                |                       |                |
|------------------------------------------|-----------------------------------------------|------------------------------|----------------|----------------------------------------------|----------------|--------------------------------------|----------------|-----------------------|----------------|
| Identification number <sup>(1)</sup>     |                                               |                              | Track capacity | Identification number                        | Track capacity | Identification number <sup>(2)</sup> | Track capacity | Identification number | Track capacity |
| Separable Roller Followers               | Non-separable <sup>(3)</sup> Roller Followers | Cylindrical Roller Followers |                |                                              |                |                                      |                |                       |                |
| RNAST 5R                                 | NART 5R                                       | —                            | 1 040          | RNAST 5                                      | 2 310          | —                                    | —              | —                     | —              |
| (R)NAST 6R                               | NART 6R                                       | —                            | 1 330          | (R)NAST 6                                    | 3 550          | NAST 6ZZ                             | 3 550          | —                     | —              |
| (R)NAST 8R                               | NART 8R                                       | —                            | 1 850          | (R)NAST 8                                    | 3 980          | NAST 8ZZ                             | 4 490          | —                     | —              |
| (R)NAST10R                               | NART10R                                       | —                            | 2 470          | (R)NAST10                                    | 5 610          | NAST10ZZ                             | 6 890          | —                     | —              |
| (R)NAST12R                               | NART12R                                       | —                            | 2 710          | (R)NAST12                                    | 5 990          | NAST12ZZ                             | 7 350          | —                     | —              |
| (R)NAST15R                               | NART15R                                       | NURT15 R                     | 3 060          | (R)NAST15                                    | 6 550          | NAST15ZZ                             | 8 030          | NURT15                | 11 500         |
| —                                        | —                                             | NURT15-1R                    | 3 910          | —                                            | —              | —                                    | —              | NURT15-1              | 13 700         |
| (R)NAST17R                               | NART17R                                       | NURT17 R                     | 3 660          | (R)NAST17                                    | 10 900         | NAST17ZZ                             | 11 700         | NURT17                | 13 600         |
| —                                        | —                                             | NURT17-1R                    | 4 530          | —                                            | —              | —                                    | —              | NURT17-1              | 16 000         |
| (R)NAST20R                               | NART20R                                       | NURT20 R                     | 4 530          | (R)NAST20                                    | 12 800         | NAST20ZZ                             | 13 800         | NURT20                | 20 000         |
| —                                        | —                                             | NURT20-1R                    | 5 190          | —                                            | —              | —                                    | —              | NURT20-1              | 22 100         |
| (R)NAST25R                               | NART25R                                       | NURT25 R                     | 5 190          | (R)NAST25                                    | 14 100         | NAST25ZZ                             | 15 300         | NURT25                | 22 100         |
| —                                        | —                                             | NURT25-1R                    | 6 580          | —                                            | —              | —                                    | —              | NURT25-1              | 26 400         |
| (R)NAST30R                               | NART30R                                       | NURT30 R                     | 6 580          | (R)NAST30                                    | 22 100         | NAST30ZZ                             | 22 100         | NURT30                | 31 600         |
| —                                        | —                                             | NURT30-1R                    | 8 020          | —                                            | —              | —                                    | —              | NURT30-1              | 36 700         |
| (R)NAST35R                               | NART35R                                       | NURT35 R                     | 8 020          | (R)NAST35                                    | 25 700         | NAST35ZZ                             | 25 700         | NURT35                | 36 700         |
| —                                        | —                                             | NURT35-1R                    | 9 220          | —                                            | —              | —                                    | —              | NURT35-1              | 40 800         |
| (R)NAST40R                               | NART40R                                       | NURT40 R                     | 9 220          | (R)NAST40                                    | 26 900         | NAST40ZZ                             | 30 300         | NURT40                | 44 200         |
| —                                        | —                                             | NURT40-1R                    | 10 800         | —                                            | —              | —                                    | —              | NURT40-1              | 49 700         |
| (R)NAST45R                               | NART45R                                       | NURT45 R                     | 9 990          | (R)NAST45                                    | 28 500         | NAST45ZZ                             | 32 200         | NURT45                | 47 000         |
| —                                        | —                                             | NURT45-1R                    | 12 400         | —                                            | —              | —                                    | —              | NURT45-1              | 55 300         |
| (R)NAST50R                               | NART50R                                       | NURT50 R                     | 10 800         | (R)NAST50                                    | 30 200         | NAST50ZZ                             | 34 000         | NURT50                | 49 700         |
| —                                        | —                                             | NURT50-1R                    | 14 000         | —                                            | —              | —                                    | —              | NURT50-1              | 60 800         |

Notes<sup>(1)</sup> Also applicable to the full complement type, shield type, and sealed type. <sup>(2)</sup> Also applicable to the sealed type. <sup>(3)</sup> Also applicable to C-Lube Roller Followers.

Table 8.2 Track capacity (Inch series) unit: N

| Crowned outer ring                   |                | Cylindrical outer ring               |                |
|--------------------------------------|----------------|--------------------------------------|----------------|
| Identification number <sup>(1)</sup> | Track capacity | Identification number <sup>(1)</sup> | Track capacity |
| CRY12R                               | 853            | CRY12                                | 4 490          |
| CRY14R                               | 1 050          | CRY14                                | 5 240          |
| CRY16R                               | 1 420          | CRY16                                | 7 270          |
| CRY18R                               | 1 660          | CRY18                                | 7 700          |
| CRY20R                               | 2 160          | CRY20                                | 10 700         |
| CRY22R                               | 2 450          | CRY22                                | 11 800         |
| CRY24R                               | 3 410          | CRY24                                | 15 400         |
| CRY26R                               | 3 820          | CRY26                                | 16 700         |
| CRY28R                               | 4 210          | CRY28                                | 21 000         |
| CRY30R                               | 4 610          | CRY30                                | 22 500         |
| CRY32R                               | 5 690          | CRY32                                | 30 800         |
| CRY36R                               | 6 640          | CRY36                                | 34 700         |
| CRY40R                               | 8 970          | CRY40                                | 44 900         |
| CRY44R                               | 10 200         | CRY44                                | 49 400         |
| CRY48R                               | 11 400         | CRY48                                | 64 300         |
| CRY52R                               | 12 700         | CRY52                                | 69 600         |
| CRY56R                               | 14 100         | CRY56                                | 87 000         |
| CRY64R                               | 16 800         | CRY64                                | 113 000        |

Note<sup>(1)</sup> Also applicable to the sealed type.

Table 9 Track capacity factor

| Hardness<br>HRC | Tensile strength<br>N/mm <sup>2</sup> | Track capacity factor |                        |
|-----------------|---------------------------------------|-----------------------|------------------------|
|                 |                                       | Crowned outer ring    | Cylindrical outer ring |
| 20              | 760                                   | 0.22                  | 0.37                   |
| 25              | 840                                   | 0.31                  | 0.46                   |
| 30              | 950                                   | 0.45                  | 0.58                   |
| 35              | 1 080                                 | 0.65                  | 0.75                   |
| 38              | 1 180                                 | 0.85                  | 0.89                   |
| 40              | 1 250                                 | 1.00                  | 1.00                   |
| 42              | 1 340                                 | 1.23                  | 1.15                   |
| 44              | 1 435                                 | 1.52                  | 1.32                   |
| 46              | 1 530                                 | 1.85                  | 1.51                   |
| 48              | 1 635                                 | 2.27                  | 1.73                   |
| 50              | 1 760                                 | 2.80                  | 1.99                   |
| 52              | 1 880                                 | 3.46                  | 2.29                   |
| 54              | 2 015                                 | 4.21                  | 2.61                   |
| 56              | 2 150                                 | 5.13                  | 2.97                   |
| 58              | 2 290                                 | 6.26                  | 3.39                   |

Allowable Rotational Speed

The allowable rotational speed of Roller Followers is affected by mounting and operating conditions. For *dn* values with only pure radial load applied, use the maximum values in Table 10 or less as a guideline. Under actual operating conditions, use the recommended *dn* values in Table 10 as a guideline in consideration of the effect of axial loads. For use with oscillating rotation, use a C-Lube Roller Follower *dn* value of 8,000 or less as a guideline. For use with one-way or continuous rotation, please consult IKO.

Table 10 *dn* values of Roller Followers<sup>(1)</sup>

| Type                        | Grease  |             | Oil     |             |
|-----------------------------|---------|-------------|---------|-------------|
|                             | Maximum | Recommended | Maximum | Recommended |
| Caged type                  | 84 000  | 8 400       | 140 000 | 14 000      |
| Full complement type        | 42 000  | 4 200       | 70 000  | 7 000       |
| Cylindrical Roller Follower | 72 000  | 7 200       | 120 000 | 12 000      |
| C-Lube Roller Followers     | 8 000   |             | 8 000   |             |

Note<sup>(1)</sup> *dn* value = *d* × *n*  
where, *d* : Bore diameter of bearing mm  
*n* : Rotational speed min<sup>-1</sup>

Lubrication

In Sealed Type Roller Followers, Heavy Duty Type Roller Followers and Inch series Roller Followers, ALVANIA GREASE S2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease. For Roller Followers without prepacked grease, grease or oil should be supplied through the oil hole of the inner ring for use. If they are used without lubrication, wear of rolling contact surfaces may take place, leading to a short bearing life.

Oil Hole

Open Type Separable Roller Followers have no oil hole. Inner rings of other types of Metric series Roller Followers have an oil hole. Inch series inner rings have an oil groove and an oil hole.

Mounting

- ① In case of shield and sealed types, match the side surface correctly to the mating seating surface indicated by the dimension *a* shown in the dimension table, and fix them. (See Fig. 1.)
- ② When mounting Roller Followers, pay special attention to avoid locating the oil hole of the inner ring within the loading zone. This may lead to a short bearing life. (See Fig. 2.)
- ③ When mounting Sealed Type Separable Roller Followers, do not cause the side plates to come off. If they come off, set them again in place taking care to avoid damaging the seal lips.

- ④ In case of Roller Followers without an inner ring, the shaft requires heat treatment and grinding finish. The recommended surface hardness of the shaft is 58 ~ 64HRC, and the recommended roughness of the shaft is 0.2 μm *R<sub>a</sub>* or less. Also, the outer ring and cage are guided by side surfaces of the mounting parts. Therefore, it is recommended that the side surfaces of the mounting parts be finished by grinding or at least by machining. (See Fig. 3.)
- ⑤ In Non-separable Roller Followers, the side plates are press-fitted. Therefore, when mounting the Roller Followers, do not push the side plates/outer rings. Pushing on the side plates or outer rings may cause unsatisfactory product performance.

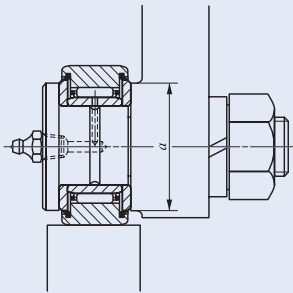


Fig. 1 Mating seating dimension "a"

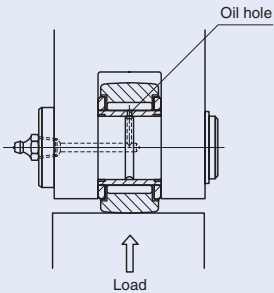


Fig. 2 Position of oil hole and load direction

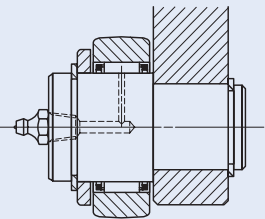
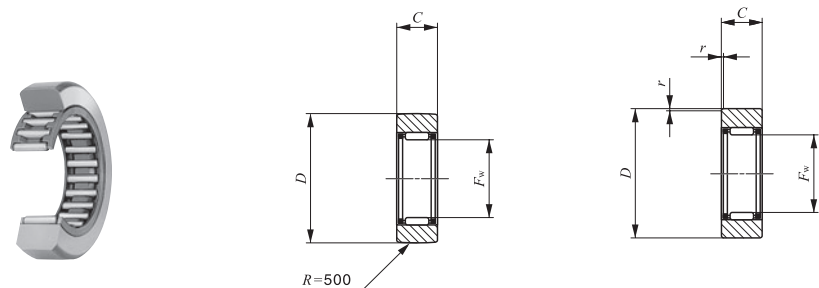


Fig. 3 Mounting example of Roller Follower without inner ring

1N=0.102kgf=0.2248lbs.  
1mm=0.03937inch

ROLLER FOLLOWERS

Separable Roller Followers, Open Type With Cage/Without Inner Ring



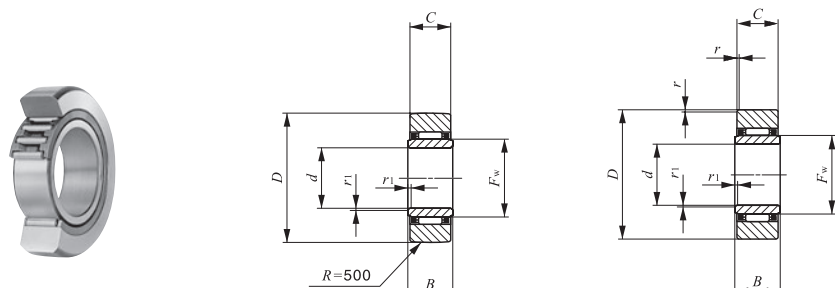
Shaft dia. 7 – 60mm

RNAS...R RNAST

| Shaft<br>dia.<br><br>mm | Identification number |                        | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |     |      |                   | Basic dynamic<br>load rating<br><br>$C$<br><br>N | Basic static<br>load rating<br><br>$C_0$<br><br>N |
|-------------------------|-----------------------|------------------------|-------------------------|---------------------------|-----|------|-------------------|--------------------------------------------------|---------------------------------------------------|
|                         | Open type             |                        |                         | $F_w$                     | $D$ | $C$  | $r_{s\min}^{(1)}$ |                                                  |                                                   |
|                         | Crowned outer ring    | Cylindrical outer ring |                         |                           |     |      |                   |                                                  |                                                   |
| 7                       | RNAST 5 R             | RNAST 5                | 8.9                     | 7                         | 16  | 7.8  | 0.3               | 2 710                                            | 2 390                                             |
| 10                      | RNAST 6 R             | RNAST 6                | 13.9                    | 10                        | 19  | 9.8  | 0.3               | 4 160                                            | 4 550                                             |
| 12                      | RNAST 8 R             | RNAST 8                | 23.5                    | 12                        | 24  | 9.8  | 0.6               | 5 650                                            | 5 890                                             |
| 14                      | RNAST 10 R            | RNAST 10               | 42.5                    | 14                        | 30  | 11.8 | 1                 | 9 790                                            | 9 680                                             |
| 16                      | RNAST 12 R            | RNAST 12               | 49.5                    | 16                        | 32  | 11.8 | 1                 | 10 500                                           | 10 900                                            |
| 20                      | RNAST 15 R            | RNAST 15               | 50                      | 20                        | 35  | 11.8 | 1                 | 12 400                                           | 14 300                                            |
| 22                      | RNAST 17 R            | RNAST 17               | 90                      | 22                        | 40  | 15.8 | 1                 | 17 600                                           | 20 900                                            |
| 25                      | RNAST 20 R            | RNAST 20               | 135                     | 25                        | 47  | 15.8 | 1                 | 19 400                                           | 24 500                                            |
| 30                      | RNAST 25 R            | RNAST 25               | 152                     | 30                        | 52  | 15.8 | 1                 | 20 800                                           | 28 400                                            |
| 38                      | RNAST 30 R            | RNAST 30               | 255                     | 38                        | 62  | 19.8 | 1                 | 30 500                                           | 45 400                                            |
| 42                      | RNAST 35 R            | RNAST 35               | 375                     | 42                        | 72  | 19.8 | 1                 | 32 400                                           | 50 600                                            |
| 50                      | RNAST 40 R            | RNAST 40               | 420                     | 50                        | 80  | 19.8 | 1.5               | 35 900                                           | 61 100                                            |
| 55                      | RNAST 45 R            | RNAST 45               | 460                     | 55                        | 85  | 19.8 | 1.5               | 37 400                                           | 66 400                                            |
| 60                      | RNAST 50 R            | RNAST 50               | 500                     | 60                        | 90  | 19.8 | 1.5               | 38 900                                           | 71 700                                            |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r*  
Remarks1. No oil hole is provided.  
2. Not provided with prepacked grease. Perform proper lubrication for use.

Separable Roller Followers, Open Type With Cage/With Inner Ring



Shaft dia. 6 – 50mm

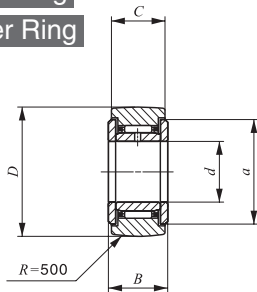
NAS...R NAST

| Shaft<br>dia.<br>mm | Identification number |                        | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |     |     |      |                 |                    |       | Basic dynamic<br>load rating<br><br>$C$<br><br>N | Basic static<br>load rating<br><br>$C_0$<br><br>N | Assembled<br>inner ring |
|---------------------|-----------------------|------------------------|-------------------------|---------------------------|-----|-----|------|-----------------|--------------------|-------|--------------------------------------------------|---------------------------------------------------|-------------------------|
|                     | Open type             |                        |                         | $d$                       | $D$ | $B$ | $C$  | $r_s^{(1)}$ min | $r_{1s}^{(1)}$ min | $F_w$ |                                                  |                                                   |                         |
|                     | Crowned outer ring    | Cylindrical outer ring |                         |                           |     |     |      |                 |                    |       |                                                  |                                                   |                         |
| 6                   | NAST 6 R              | NAST 6                 | 17.8                    | 6                         | 19  | 10  | 9.8  | 0.3             | 0.3                | 10    | 4 160                                            | 4 550                                             | LRT 61010 S             |
| 8                   | NAST 8 R              | NAST 8                 | 28                      | 8                         | 24  | 10  | 9.8  | 0.6             | 0.3                | 12    | 5 650                                            | 5 890                                             | LRT 81210 S             |
| 10                  | NAST 10 R             | NAST 10                | 49.5                    | 10                        | 30  | 12  | 11.8 | 1               | 0.3                | 14    | 9 790                                            | 9 680                                             | LRT 101412 S            |
| 12                  | NAST 12 R             | NAST 12                | 58                      | 12                        | 32  | 12  | 11.8 | 1               | 0.3                | 16    | 10 500                                           | 10 900                                            | LRT 121612 S            |
| 15                  | NAST 15 R             | NAST 15                | 62                      | 15                        | 35  | 12  | 11.8 | 1               | 0.3                | 20    | 12 400                                           | 14 300                                            | LRT 152012 S            |
| 17                  | NAST 17 R             | NAST 17                | 109                     | 17                        | 40  | 16  | 15.8 | 1               | 0.3                | 22    | 17 600                                           | 20 900                                            | LRT 172216 S            |
| 20                  | NAST 20 R             | NAST 20                | 157                     | 20                        | 47  | 16  | 15.8 | 1               | 0.3                | 25    | 19 400                                           | 24 500                                            | LRT 202516 S            |
| 25                  | NAST 25 R             | NAST 25                | 180                     | 25                        | 52  | 16  | 15.8 | 1               | 0.3                | 30    | 20 800                                           | 28 400                                            | LRT 253016 S            |
| 30                  | NAST 30 R             | NAST 30                | 320                     | 30                        | 62  | 20  | 19.8 | 1               | 0.6                | 38    | 30 500                                           | 45 400                                            | LRT 303820 S            |
| 35                  | NAST 35 R             | NAST 35                | 440                     | 35                        | 72  | 20  | 19.8 | 1               | 0.6                | 42    | 32 400                                           | 50 600                                            | LRT 354220 S            |
| 40                  | NAST 40 R             | NAST 40                | 530                     | 40                        | 80  | 20  | 19.8 | 1.5             | 1                  | 50    | 35 900                                           | 61 100                                            | LRT 405020 S            |
| 45                  | NAST 45 R             | NAST 45                | 580                     | 45                        | 85  | 20  | 19.8 | 1.5             | 1                  | 55    | 37 400                                           | 66 400                                            | LRT 455520 S            |
| 50                  | NAST 50 R             | NAST 50                | 635                     | 50                        | 90  | 20  | 19.8 | 1.5             | 1                  | 60    | 38 900                                           | 71 700                                            | LRT 506020 S            |
|                     |                       |                        |                         |                           |     |     |      |                 |                    |       |                                                  |                                                   |                         |

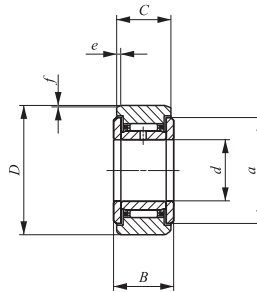
Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r* or *r*<sub>1</sub>  
Remarks1. No oil hole is provided.  
2. Not provided with prepacked grease. Perform proper lubrication for use.

ROLLER FOLLOWERS

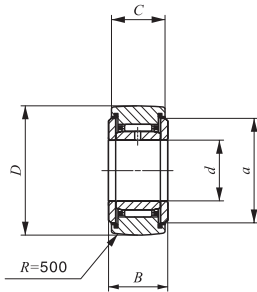
Separable Roller Followers, Shield Type **With Cage/With Inner Ring**  
Separable Roller Followers, Sealed Type **With Cage/With Inner Ring**



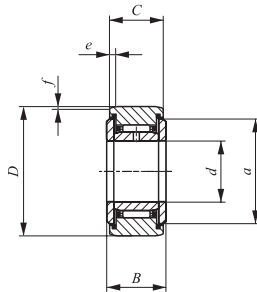
NAST ... ZZR



NAST ... ZZ



NAST ... ZZUUR



NAST ... ZZUU

Shaft dia. 6 – 50mm

| Shaft<br>dia.<br><br>mm | Identification number |                        |                    |                        | Mass<br>(Ref.) |
|-------------------------|-----------------------|------------------------|--------------------|------------------------|----------------|
|                         | Shield type           |                        | Sealed type        |                        |                |
|                         | Crowned outer ring    | Cylindrical outer ring | Crowned outer ring | Cylindrical outer ring | 9              |
| 6                       | NAST 6 ZZR            | NAST 6 ZZ              | NAST 6 ZZUUR       | NAST 6 ZZUU            | 24.5           |
| 8                       | NAST 8 ZZR            | NAST 8 ZZ              | NAST 8 ZZUUR       | NAST 8 ZZUU            | 39             |
| 10                      | NAST 10 ZZR           | NAST 10 ZZ             | NAST 10 ZZUUR      | NAST 10 ZZUU           | 65             |
| 12                      | NAST 12 ZZR           | NAST 12 ZZ             | NAST 12 ZZUUR      | NAST 12 ZZUU           | 75             |
| 15                      | NAST 15 ZZR           | NAST 15 ZZ             | NAST 15 ZZUUR      | NAST 15 ZZUU           | 83             |
| 17                      | NAST 17 ZZR           | NAST 17 ZZ             | NAST 17 ZZUUR      | NAST 17 ZZUU           | 135            |
| 20                      | NAST 20 ZZR           | NAST 20 ZZ             | NAST 20 ZZUUR      | NAST 20 ZZUU           | 195            |
| 25                      | NAST 25 ZZR           | NAST 25 ZZ             | NAST 25 ZZUUR      | NAST 25 ZZUU           | 225            |
| 30                      | NAST 30 ZZR           | NAST 30 ZZ             | NAST 30 ZZUUR      | NAST 30 ZZUU           | 400            |
| 35                      | NAST 35 ZZR           | NAST 35 ZZ             | NAST 35 ZZUUR      | NAST 35 ZZUU           | 550            |
| 40                      | NAST 40 ZZR           | NAST 40 ZZ             | NAST 40 ZZUUR      | NAST 40 ZZUU           | 710            |
| 45                      | NAST 45 ZZR           | NAST 45 ZZ             | NAST 45 ZZUUR      | NAST 45 ZZUU           | 760            |
| 50                      | NAST 50 ZZR           | NAST 50 ZZ             | NAST 50 ZZUUR      | NAST 50 ZZUU           | 830            |

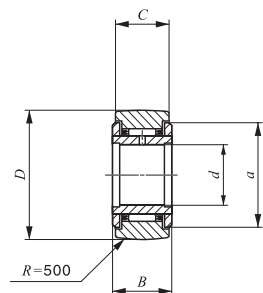
Remarks1. The inner ring has an oil hole.  
2. The sealed type is provided with prepacked grease. The shield type is not provided with prepacked grease. Perform proper lubrication for use.

| Boundary dimensions<br>mm |    |    |      |      |     |     | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|---------------------------|----|----|------|------|-----|-----|----------------------------------------|----------------------------------------------------|
| d                         | D  | B  | C    | a    | e   | f   |                                        |                                                    |
| 6                         | 19 | 14 | 13.8 | 14   | 2.5 | 0.8 | 4 160                                  | 4 550                                              |
| 8                         | 24 | 14 | 13.8 | 17.5 | 2.5 | 0.8 | 5 650                                  | 5 890                                              |
| 10                        | 30 | 16 | 15.8 | 23.5 | 2.5 | 0.8 | 9 790                                  | 9 680                                              |
| 12                        | 32 | 16 | 15.8 | 25.5 | 2.5 | 0.8 | 10 500                                 | 10 900                                             |
| 15                        | 35 | 16 | 15.8 | 29   | 2.5 | 0.8 | 12 400                                 | 14 300                                             |
| 17                        | 40 | 20 | 19.8 | 32.5 | 3   | 1   | 17 600                                 | 20 900                                             |
| 20                        | 47 | 20 | 19.8 | 38   | 3   | 1   | 19 400                                 | 24 500                                             |
| 25                        | 52 | 20 | 19.8 | 43   | 3   | 1   | 20 800                                 | 28 400                                             |
| 30                        | 62 | 25 | 24.8 | 50.5 | 4   | 1.2 | 30 500                                 | 45 400                                             |
| 35                        | 72 | 25 | 24.8 | 53.5 | 4   | 1.2 | 32 400                                 | 50 600                                             |
| 40                        | 80 | 26 | 25.8 | 61.5 | 4   | 1.2 | 35 900                                 | 61 100                                             |
| 45                        | 85 | 26 | 25.8 | 66.5 | 4   | 1.2 | 37 400                                 | 66 400                                             |
| 50                        | 90 | 26 | 25.8 | 76   | 4   | 1.2 | 38 900                                 | 71 700                                             |

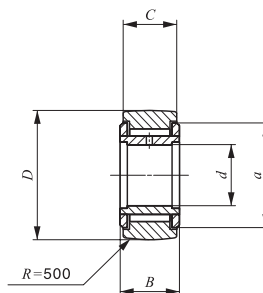
I  
NAST  
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ROLLER FOLLOWERS

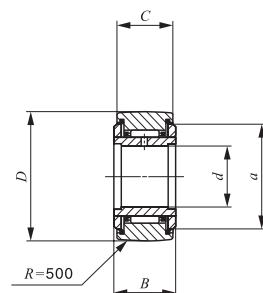
Non-separable Roller Followers · With Cage/With Inner Ring  
High carbon steel made Full Complement Type/With Inner Ring



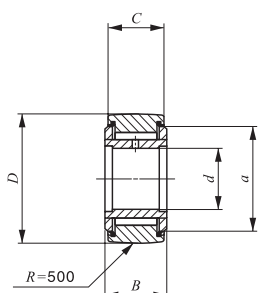
NART ... R



NART ... VR



NART ... UUR



NART ... VUUR

Shaft dia. 5 – 40mm

| Shaft<br>dia.<br><br>mm | Identification number |                 |                    |                   | Mass<br>(Ref.)<br><br>g |
|-------------------------|-----------------------|-----------------|--------------------|-------------------|-------------------------|
|                         | Shield type           |                 | Sealed type        |                   |                         |
|                         | Crowned outer ring    |                 | Crowned outer ring |                   |                         |
|                         | With cage             | Full complement | With cage          | Full complement   |                         |
| 5                       | NART 5 R<br>—         | —<br>NART 5 VR  | NART 5 UUR<br>—    | —<br>NART 5 VUUR  | 14.5<br>15.1            |
| 6                       | NART 6 R<br>—         | —<br>NART 6 VR  | NART 6 UUR<br>—    | —<br>NART 6 VUUR  | 20.5<br>21.5            |
| 8                       | NART 8 R<br>—         | —<br>NART 8 VR  | NART 8 UUR<br>—    | —<br>NART 8 VUUR  | 41.5<br>42.5            |
| 10                      | NART 10 R<br>—        | —<br>NART 10 VR | NART 10 UUR<br>—   | —<br>NART 10 VUUR | 64.5<br>66.5            |
| 12                      | NART 12 R<br>—        | —<br>NART 12 VR | NART 12 UUR<br>—   | —<br>NART 12 VUUR | 71<br>73                |
| 15                      | NART 15 R<br>—        | —<br>NART 15 VR | NART 15 UUR<br>—   | —<br>NART 15 VUUR | 102<br>106              |
| 17                      | NART 17 R<br>—        | —<br>NART 17 VR | NART 17 UUR<br>—   | —<br>NART 17 VUUR | 149<br>155              |
| 20                      | NART 20 R<br>—        | —<br>NART 20 VR | NART 20 UUR<br>—   | —<br>NART 20 VUUR | 250<br>255              |
| 25                      | NART 25 R<br>—        | —<br>NART 25 VR | NART 25 UUR<br>—   | —<br>NART 25 VUUR | 285<br>295              |
| 30                      | NART 30 R<br>—        | —<br>NART 30 VR | NART 30 UUR<br>—   | —<br>NART 30 VUUR | 470<br>485              |
| 35                      | NART 35 R<br>—        | —<br>NART 35 VR | NART 35 UUR<br>—   | —<br>NART 35 VUUR | 640<br>655              |
| 40                      | NART 40 R<br>—        | —<br>NART 40 VR | NART 40 UUR<br>—   | —<br>NART 40 VUUR | 845<br>865              |

Remarks1. The inner ring has an oil hole.  
2. The sealed type is provided with prepacked grease. The shield type is not provided with prepacked grease. Perform proper lubrication for use.

| Boundary dimensions<br>mm |    |    |    |      | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum<br>allowable<br>static load<br>N |
|---------------------------|----|----|----|------|----------------------------------------|----------------------------------------------------|------------------------------------------|
| d                         | D  | B  | C  | a    |                                        |                                                    |                                          |
| 5                         | 16 | 12 | 11 | 12   | 3 650                                  | 3 680                                              | 3 680                                    |
| 5                         | 16 | 12 | 11 | 12   | 6 810                                  | 8 370                                              | 7 310                                    |
| 6                         | 19 | 12 | 11 | 14   | 4 250                                  | 4 740                                              | 4 740                                    |
| 6                         | 19 | 12 | 11 | 14   | 7 690                                  | 10 300                                             | 10 300                                   |
| 8                         | 24 | 15 | 14 | 17.5 | 5 640                                  | 5 900                                              | 5 900                                    |
| 8                         | 24 | 15 | 14 | 17.5 | 11 800                                 | 15 600                                             | 15 600                                   |
| 10                        | 30 | 15 | 14 | 23.5 | 8 030                                  | 7 540                                              | 7 540                                    |
| 10                        | 30 | 15 | 14 | 23.5 | 15 600                                 | 18 100                                             | 17 500                                   |
| 12                        | 32 | 15 | 14 | 25.5 | 8 580                                  | 8 470                                              | 8 470                                    |
| 12                        | 32 | 15 | 14 | 25.5 | 16 800                                 | 20 500                                             | 18 600                                   |
| 15                        | 35 | 19 | 18 | 29   | 13 700                                 | 16 400                                             | 16 400                                   |
| 15                        | 35 | 19 | 18 | 29   | 25 200                                 | 36 400                                             | 24 000                                   |
| 17                        | 40 | 21 | 20 | 32.5 | 17 600                                 | 21 000                                             | 21 000                                   |
| 17                        | 40 | 21 | 20 | 32.5 | 32 000                                 | 46 300                                             | 33 100                                   |
| 20                        | 47 | 25 | 24 | 38   | 23 000                                 | 30 700                                             | 30 700                                   |
| 20                        | 47 | 25 | 24 | 38   | 41 600                                 | 67 300                                             | 67 300                                   |
| 25                        | 52 | 25 | 24 | 43   | 24 700                                 | 35 400                                             | 35 400                                   |
| 25                        | 52 | 25 | 24 | 43   | 45 500                                 | 79 100                                             | 79 100                                   |
| 30                        | 62 | 29 | 28 | 50.5 | 33 600                                 | 51 400                                             | 51 400                                   |
| 30                        | 62 | 29 | 28 | 50.5 | 59 900                                 | 110 000                                            | 92 500                                   |
| 35                        | 72 | 29 | 28 | 53.5 | 35 700                                 | 57 400                                             | 57 400                                   |
| 35                        | 72 | 29 | 28 | 53.5 | 63 100                                 | 121 000                                            | 121 000                                  |
| 40                        | 80 | 32 | 30 | 61.5 | 44 900                                 | 81 500                                             | 81 500                                   |
| 40                        | 80 | 32 | 30 | 61.5 | 76 300                                 | 164 000                                            | 164 000                                  |

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ROLLER FOLLOWERS

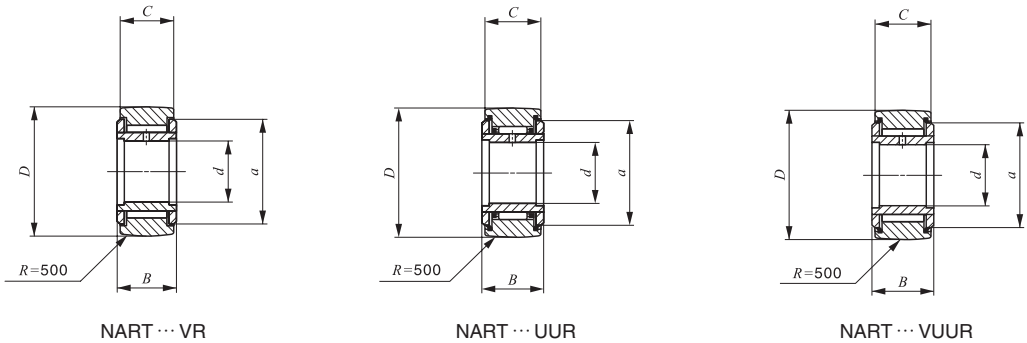
Non-separable Roller Followers · With Cage/With Inner Ring  
High carbon steel made Full Complement Type/With Inner Ring



Shaft dia. 45 – 50mm

| Shaft<br>dia.<br>mm | Identification number |                 |                    |                 | Mass<br>(Ref.)<br><br>g |
|---------------------|-----------------------|-----------------|--------------------|-----------------|-------------------------|
|                     | Shield type           |                 | Sealed type        |                 |                         |
|                     | Crowned outer ring    |                 | Crowned outer ring |                 |                         |
|                     | With cage             | Full complement | With cage          | Full complement |                         |
| 45                  | NART 45 R             | —               | NART 45 UUR        | —               | 915                     |
|                     | —                     | NART 45 VR      | —                  | NART 45 VUUR    | 935                     |
| 50                  | NART 50 R             | —               | NART 50 UUR        | —               | 980                     |
|                     | —                     | NART 50 VR      | —                  | NART 50 VUUR    | 1 010                   |

Remarks1. The inner ring has an oil hole.  
2. The sealed type is provided with prepacked grease. The shield type is not provided with prepacked grease. Perform proper lubrication for use.



| Boundary dimensions<br>mm |    |    |    |      | Basic dynamic<br>load rating<br>C | Basic static<br>load rating<br>C <sub>0</sub> | Maximum<br>allowable<br>static load |
|---------------------------|----|----|----|------|-----------------------------------|-----------------------------------------------|-------------------------------------|
| d                         | D  | B  | C  | a    | N                                 | N                                             | N                                   |
| 45                        | 85 | 32 | 30 | 66.5 | 46 800                            | 88 600                                        | 88 600                              |
| 45                        | 85 | 32 | 30 | 66.5 | 80 300                            | 181 000                                       | 181 000                             |
| 50                        | 90 | 32 | 30 | 76   | 48 600                            | 95 600                                        | 95 600                              |
| 50                        | 90 | 32 | 30 | 76   | 84 300                            | 198 000                                       | 198 000                             |

Non-separable Roller Followers · Stainless Steel Made With Cage/With Inner Ring

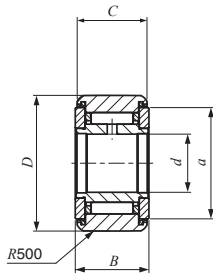


NART...FR

Shaft dia. 5 – 30mm

| Shaft dia.<br>mm | Identification number |              | Mass (Ref.)<br>g | Boundary dimensions<br>mm |    |    |    |      |
|------------------|-----------------------|--------------|------------------|---------------------------|----|----|----|------|
|                  | Shield type           | Sealed type  |                  | d                         | D  | B  | C  | a    |
| 5                | NART 5 FR             | NART 5 FUUR  | 13               | 5                         | 16 | 12 | 11 | 12   |
| 6                | NART 6 FR             | NART 6 FUUR  | 19               | 6                         | 19 | 12 | 11 | 14   |
| 8                | NART 8 FR             | NART 8 FUUR  | 39               | 8                         | 24 | 15 | 14 | 17.5 |
| 10               | NART 10 FR            | NART 10 FUUR | 61               | 10                        | 30 | 15 | 14 | 22.5 |
| 12               | NART 12 FR            | NART 12 FUUR | 67               | 12                        | 32 | 15 | 14 | 25.5 |
| 15               | NART 15 FR            | NART 15 FUUR | 99               | 15                        | 35 | 19 | 18 | 27.5 |
| 17               | NART 17 FR            | NART 17 FUUR | 146              | 17                        | 40 | 21 | 20 | 31   |
| 20               | NART 20 FR            | NART 20 FUUR | 241              | 20                        | 47 | 25 | 24 | 36.5 |
| 25               | NART 25 FR            | NART 25 FUUR | 269              | 25                        | 52 | 25 | 24 | 43   |
| 30               | NART 30 FR            | NART 30 FUUR | 447              | 30                        | 62 | 29 | 28 | 50   |

Remarks1. The inner ring has an oil hole.  
2. The sealed type is provided with prepacked grease. The shield type is not provided with prepacked grease. Perform proper lubrication for use.

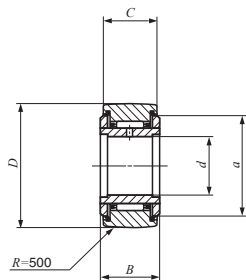


NART...FUUR

| Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N | Maximum allowable<br>static load<br>N |
|----------------------------------------|----------------------------------------------------|---------------------------------------|
| 2 930                                  | 2 920                                              | 2 920                                 |
| 3 400                                  | 3 790                                              | 3 790                                 |
| 4 340                                  | 5 510                                              | 5 510                                 |
| 6 330                                  | 7 830                                              | 7 830                                 |
| 6 510                                  | 8 400                                              | 8 400                                 |
| 9 620                                  | 14 700                                             | 14 700                                |
| 11 800                                 | 20 200                                             | 20 200                                |
| 16 500                                 | 27 700                                             | 27 700                                |
| 19 800                                 | 28 300                                             | 28 300                                |
| 26 900                                 | 41 200                                             | 41 200                                |

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C-Lube Roller Followers With Cage/With Inner Ring



Shaft dia. 5 – 20mm

NART ... UUR/SG

| Shaft<br>dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |          |          |          |          |
|---------------------|-----------------------|---------------------|---------------------------|----------|----------|----------|----------|
|                     | Sealed type           |                     | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>a</i> |
| 5                   | NART 5 UUR / SG       | 14.5                | 5                         | 16       | 12       | 11       | 12       |
| 6                   | NART 6 UUR / SG       | 20.5                | 6                         | 19       | 12       | 11       | 14       |
| 8                   | NART 8 UUR / SG       | 41.5                | 8                         | 24       | 15       | 14       | 17.5     |
| 10                  | NART 10 UUR / SG      | 64.5                | 10                        | 30       | 15       | 14       | 23.5     |
| 12                  | NART 12 UUR / SG      | 71                  | 12                        | 32       | 15       | 14       | 25.5     |
| 15                  | NART 15 UUR / SG      | 102                 | 15                        | 35       | 19       | 18       | 29       |
| 17                  | NART 17 UUR / SG      | 149                 | 17                        | 40       | 21       | 20       | 32.5     |
| 20                  | NART 20 UUR / SG      | 250                 | 20                        | 47       | 25       | 24       | 38       |

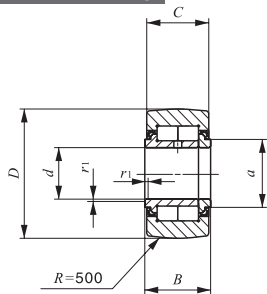
Remark This bearing cannot be re-lubricated as thermosetting solid-type lubricant C-Lube fills its inner space.

| Basic dynamic<br>load rating<br><i>C</i> | Basic static<br>load rating<br><i>C</i> <sub>0</sub> | Maximum<br>allowable<br>static load |
|------------------------------------------|------------------------------------------------------|-------------------------------------|
| N                                        | N                                                    | N                                   |
| 3 650                                    | 3 680                                                | 3 680                               |
| 4 250                                    | 4 740                                                | 4 740                               |
| 5 640                                    | 5 900                                                | 5 900                               |
| 8 030                                    | 7 540                                                | 7 540                               |
| 8 580                                    | 8 470                                                | 8 470                               |
| 13 700                                   | 16 400                                               | 16 400                              |
| 17 600                                   | 21 000                                               | 21 000                              |
| 23 000                                   | 30 700                                               | 30 700                              |

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ROLLER FOLLOWERS

Cylindrical Roller Followers Full Complement Type/With Inner Ring

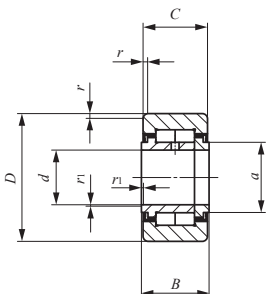


NURT ... R

Shaft dia. 15 – 50mm

| Shaft<br>dia.<br>mm | Identification number |                        | Mass<br>(Ref.)<br><br>g | Boundary dimensions<br>mm |     |     |     |     |                          |
|---------------------|-----------------------|------------------------|-------------------------|---------------------------|-----|-----|-----|-----|--------------------------|
|                     | Crowned outer ring    | Cylindrical outer ring |                         | $d$                       | $D$ | $B$ | $C$ | $a$ | $r_s$ min <sup>(1)</sup> |
| 15                  | NURT 15 R             | NURT 15                | 100                     | 15                        | 35  | 19  | 18  | 20  | 0.6                      |
|                     | NURT 15-1 R           | NURT 15-1              | 160                     | 15                        | 42  | 19  | 18  | 20  | 0.6                      |
| 17                  | NURT 17 R             | NURT 17                | 147                     | 17                        | 40  | 21  | 20  | 22  | 1                        |
|                     | NURT 17-1 R           | NURT 17-1              | 222                     | 17                        | 47  | 21  | 20  | 22  | 1                        |
| 20                  | NURT 20 R             | NURT 20                | 245                     | 20                        | 47  | 25  | 24  | 27  | 1                        |
|                     | NURT 20-1 R           | NURT 20-1              | 321                     | 20                        | 52  | 25  | 24  | 27  | 1                        |
| 25                  | NURT 25 R             | NURT 25                | 281                     | 25                        | 52  | 25  | 24  | 31  | 1                        |
|                     | NURT 25-1 R           | NURT 25-1              | 450                     | 25                        | 62  | 25  | 24  | 31  | 1                        |
| 30                  | NURT 30 R             | NURT 30                | 466                     | 30                        | 62  | 29  | 28  | 38  | 1                        |
|                     | NURT 30-1 R           | NURT 30-1              | 697                     | 30                        | 72  | 29  | 28  | 38  | 1                        |
| 35                  | NURT 35 R             | NURT 35                | 630                     | 35                        | 72  | 29  | 28  | 44  | 1                        |
|                     | NURT 35-1 R           | NURT 35-1              | 840                     | 35                        | 80  | 29  | 28  | 44  | 1                        |
| 40                  | NURT 40 R             | NURT 40                | 817                     | 40                        | 80  | 32  | 30  | 49  | 1                        |
|                     | NURT 40-1 R           | NURT 40-1              | 1 130                   | 40                        | 90  | 32  | 30  | 49  | 1                        |
| 45                  | NURT 45 R             | NURT 45                | 883                     | 45                        | 85  | 32  | 30  | 53  | 1                        |
|                     | NURT 45-1 R           | NURT 45-1              | 1 400                   | 45                        | 100 | 32  | 30  | 53  | 1                        |
| 50                  | NURT 50 R             | NURT 50                | 950                     | 50                        | 90  | 32  | 30  | 58  | 1                        |
|                     | NURT 50-1 R           | NURT 50-1              | 1 690                   | 50                        | 110 | 32  | 30  | 58  | 1                        |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r$  or  $r_1$   
Remarks1. The inner ring has an oil hole.  
2. Provided with prepacked grease.



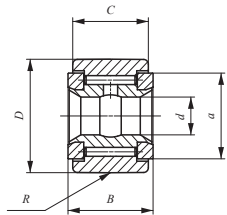
NURT

| $r_{1s\min}^{(1)}$ | Basic dynamic<br>load rating<br>$C$ | Basic static<br>load rating<br>$C_0$ | Maximum<br>allowable<br>static load |
|--------------------|-------------------------------------|--------------------------------------|-------------------------------------|
|                    | N                                   | N                                    | N                                   |
| 0.3                | 23 400                              | 27 300                               | 11 800                              |
|                    | 23 400                              | 27 300                               | 27 300                              |
| 0.3                | 25 200                              | 30 900                               | 20 300                              |
|                    | 25 200                              | 30 900                               | 30 900                              |
| 0.3                | 38 900                              | 49 000                               | 27 200                              |
|                    | 38 900                              | 49 000                               | 49 000                              |
| 0.3                | 43 100                              | 58 100                               | 30 000                              |
|                    | 43 100                              | 58 100                               | 58 100                              |
| 0.3                | 58 200                              | 75 300                               | 35 200                              |
|                    | 58 200                              | 75 300                               | 75 300                              |
| 0.6                | 63 900                              | 88 800                               | 57 000                              |
|                    | 63 900                              | 88 800                               | 88 800                              |
| 0.6                | 86 500                              | 122 000                              | 75 300                              |
|                    | 86 500                              | 122 000                              | 122 000                             |
| 0.6                | 91 500                              | 135 000                              | 78 700                              |
|                    | 91 500                              | 135 000                              | 135 000                             |
| 0.6                | 96 300                              | 148 000                              | 82 100                              |
|                    | 96 300                              | 148 000                              | 148 000                             |

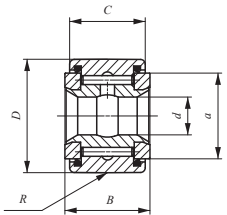
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ROLLER FOLLOWERS

Non-separable Roller Followers, Inch Series **Full Complement Type / With Inner Ring**



CRY...VR



CRY...VUUR

Shaft dia. 6.350 – 31.750mm

| Shaft dia.<br>mm<br>(inch) | Identification number           |                                   | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch) |                |                |                |
|----------------------------|---------------------------------|-----------------------------------|---------------------|------------------------------|----------------|----------------|----------------|
|                            | Shield type<br>Crown outer ring | Sealed type<br>Crowned outer ring |                     | d                            | D              | B              | C              |
| 6.350<br>(1/4)             | CRY 12 VR                       | CRY 12 VUUR                       | 24                  | 6.350 (1/4)                  | 19.050 (3/4)   | 14.288(0.5625) | 12.700 (1/2)   |
|                            | CRY 14 VR                       | CRY 14 VUUR                       | 34                  | 6.350 (1/4)                  | 22.225 (7/8)   | 14.288(0.5625) | 12.700 (1/2)   |
| 7.938<br>(5/16)            | CRY 16 VR                       | CRY 16 VUUR                       | 56                  | 7.938 (5/16)                 | 25.400 (1)     | 17.463(0.6875) | 15.875 (5/8)   |
|                            | CRY 18 VR                       | CRY 18 VUUR                       | 72                  | 7.938 (5/16)                 | 28.575 (1 1/8) | 17.463(0.6875) | 15.875 (5/8)   |
| 9.525<br>(3/8)             | CRY 20 VR                       | CRY 20 VUUR                       | 103                 | 9.525 (3/8)                  | 31.750 (1 1/4) | 20.638(0.8125) | 19.050 (3/4)   |
|                            | CRY 22 VR                       | CRY 22 VUUR                       | 128                 | 9.525 (3/8)                  | 34.925 (1 3/8) | 20.638(0.8125) | 19.050 (3/4)   |
| 11.112<br>(7/16)           | CRY 24 VR                       | CRY 24 VUUR                       | 176                 | 11.112 (7/16)                | 38.100 (1 1/2) | 23.813(0.9375) | 22.225 (7/8)   |
|                            | CRY 26 VR                       | CRY 26 VUUR                       | 210                 | 11.112 (7/16)                | 41.275 (1 5/8) | 23.813(0.9375) | 22.225 (7/8)   |
| 12.700<br>(1/2)            | CRY 28 VR                       | CRY 28 VUUR                       | 276                 | 12.700 (1/2)                 | 44.450 (1 3/4) | 26.988(1.0625) | 25.400 (1)     |
|                            | CRY 30 VR                       | CRY 30 VUUR                       | 321                 | 12.700 (1/2)                 | 47.625 (1 7/8) | 26.988(1.0625) | 25.400 (1)     |
| 15.875<br>(5/8)            | CRY 32 VR                       | CRY 32 VUUR                       | 442                 | 15.875 (5/8)                 | 50.800 (2)     | 33.338(1.3125) | 31.750 (1 1/4) |
|                            | CRY 36 VR                       | CRY 36 VUUR                       | 575                 | 15.875 (5/8)                 | 57.150 (2 1/4) | 33.338(1.3125) | 31.750 (1 1/4) |
| 19.050<br>(3/4)            | CRY 40 VR                       | CRY 40 VUUR                       | 835                 | 19.050 (3/4)                 | 63.500 (2 1/2) | 39.688(1.5625) | 38.100 (1 1/2) |
|                            | CRY 44 VR                       | CRY 44 VUUR                       | 1 031               | 19.050 (3/4)                 | 69.850 (2 3/4) | 39.688(1.5625) | 38.100 (1 1/2) |
| 25.400<br>(1)              | CRY 48 VR                       | CRY 48 VUUR                       | 1 370               | 25.400 (1)                   | 76.200 (3)     | 46.038(1.8125) | 44.450 (1 3/4) |
|                            | CRY 52 VR                       | CRY 52 VUUR                       | 1 640               | 25.400 (1)                   | 82.550 (3 1/4) | 46.038(1.8125) | 44.450 (1 3/4) |
| 28.575<br>(1 1/8)          | CRY 56 VR                       | CRY 56 VUUR                       | 2 160               | 28.575 (1 1/8)               | 88.900 (3 1/2) | 52.388(2.0625) | 50.800 (2)     |
| 31.750<br>(1 1/4)          | CRY 64 VR                       | CRY 64 VUUR                       | 3 190               | 31.750 (1 1/4)               | 101.600 (4)    | 58.738(2.3125) | 57.150 (2 1/4) |

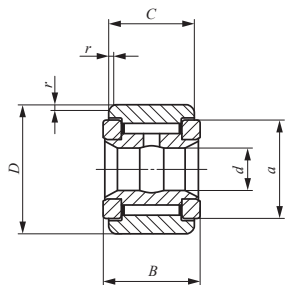
Remarks1. The inner ring has an oil groove and an oil hole.  
2. Provided with prepacked grease.

| <i>a</i>    |          | <i>R</i> | Shaft dia. mm |        |           |        |           |         | Basic dynamic<br>load rating | Basic static<br>load rating |
|-------------|----------|----------|---------------|--------|-----------|--------|-----------|---------|------------------------------|-----------------------------|
|             |          |          | Push fit      |        | Drive fit |        | Press fit |         | <i>C</i>                     | <i>C</i> <sub>0</sub>       |
|             |          |          | Min.          | Max.   | Min.      | Max.   | Min.      | Max.    | N                            | N                           |
| 14.4(0.567) | 250 (10) | 6.332    | 6.342         | 6.348  | 6.358     | 6.353  | 6.363     | 8 710   | 12 300                       |                             |
| 14.4(0.567) | 250 (10) | 6.332    | 6.342         | 6.348  | 6.358     | 6.353  | 6.363     | 8 710   | 12 300                       |                             |
| 19.6(0.772) | 300 (12) | 7.920    | 7.930         | 7.935  | 7.945     | 7.940  | 7.950     | 13 100  | 22 700                       |                             |
| 19.6(0.772) | 300 (12) | 7.920    | 7.930         | 7.935  | 7.945     | 7.940  | 7.950     | 13 100  | 22 700                       |                             |
| 25.0(0.984) | 360 (14) | 9.507    | 9.517         | 9.523  | 9.533     | 9.528  | 9.538     | 23 600  | 31 700                       |                             |
| 25.0(0.984) | 360 (14) | 9.507    | 9.517         | 9.523  | 9.533     | 9.528  | 9.538     | 23 600  | 31 700                       |                             |
| 28.8(1.134) | 500 (20) | 11.095   | 11.105        | 11.110 | 11.120    | 11.115 | 11.125    | 28 200  | 40 100                       |                             |
| 28.8(1.134) | 500 (20) | 11.095   | 11.105        | 11.110 | 11.120    | 11.115 | 11.125    | 28 200  | 40 100                       |                             |
| 32.7(1.287) | 500 (20) | 12.682   | 12.692        | 12.698 | 12.708    | 12.708 | 12.718    | 35 300  | 55 600                       |                             |
| 32.7(1.287) | 500 (20) | 12.682   | 12.692        | 12.698 | 12.708    | 12.708 | 12.718    | 35 300  | 55 600                       |                             |
| 36.0(1.417) | 600 (24) | 15.857   | 15.867        | 15.873 | 15.883    | 15.883 | 15.893    | 45 700  | 80 600                       |                             |
| 36.0(1.417) | 600 (24) | 15.857   | 15.867        | 15.873 | 15.883    | 15.883 | 15.893    | 45 700  | 80 600                       |                             |
| 43.3(1.705) | 760 (30) | 19.032   | 19.042        | 19.048 | 19.058    | 19.058 | 19.068    | 61 400  | 116 000                      |                             |
| 43.3(1.705) | 760 (30) | 19.032   | 19.042        | 19.048 | 19.058    | 19.058 | 19.068    | 61 400  | 116 000                      |                             |
| 54.0(2.125) | 760 (30) | 25.377   | 25.390        | 25.397 | 25.410    | 25.408 | 25.420    | 77 600  | 172 000                      |                             |
| 54.0(2.125) | 760 (30) | 25.377   | 25.390        | 25.397 | 25.410    | 25.408 | 25.420    | 77 600  | 172 000                      |                             |
| 61.9(2.437) | 760 (30) | 28.522   | 28.565        | 28.572 | 28.585    | 28.583 | 28.595    | 111 000 | 239 000                      |                             |
| 71.0(2.797) | 760 (30) | 31.727   | 31.740        | 31.747 | 31.760    | 31.758 | 31.770    | 142 000 | 317 000                      |                             |

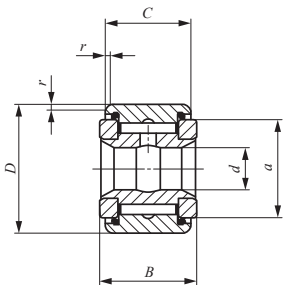
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ROLLER FOLLOWERS

Non-separable Roller Followers, Inch Series **Full Complement Type /With Inner Ring**



CRY...V



CRY...VUU

Shaft dia. 6.350 – 31.750mm

| Shaft dia.<br>mm<br>(inch) | Identification number                 |                                       | Mass<br>(Ref.)<br>g | Boundary dimensions mm(inch) |                  |                |                  |
|----------------------------|---------------------------------------|---------------------------------------|---------------------|------------------------------|------------------|----------------|------------------|
|                            | Shield type<br>Cylindrical outer ring | Sealed type<br>Cylindrical outer ring |                     | d                            | D                | B              | C                |
| 6.350<br>(1/4)             | CRY 12 V                              | CRY 12 VUU                            | 24                  | 6.350 ( 1/4 )                | 19.050 ( 3/4 )   | 14.288(0.5625) | 12.700 ( 1/2 )   |
|                            | CRY 14 V                              | CRY 14 VUU                            | 34                  | 6.350 ( 1/4 )                | 22.225 ( 7/8 )   | 14.288(0.5625) | 12.700 ( 1/2 )   |
| 7.938<br>(5/16)            | CRY 16 V                              | CRY 16 VUU                            | 56                  | 7.938 ( 5/16 )               | 25.400 ( 1 )     | 17.463(0.6875) | 15.875 ( 5/8 )   |
|                            | CRY 18 V                              | CRY 18 VUU                            | 72                  | 7.938 ( 5/16 )               | 28.575 ( 1 1/8 ) | 17.463(0.6875) | 15.875 ( 5/8 )   |
| 9.525<br>(3/8)             | CRY 20 V                              | CRY 20 VUU                            | 103                 | 9.525 ( 3/8 )                | 31.750 ( 1 1/4 ) | 20.638(0.8125) | 19.050 ( 3/4 )   |
|                            | CRY 22 V                              | CRY 22 VUU                            | 128                 | 9.525 ( 3/8 )                | 34.925 ( 1 3/8 ) | 20.638(0.8125) | 19.050 ( 3/4 )   |
| 11.112<br>(7/16)           | CRY 24 V                              | CRY 24 VUU                            | 176                 | 11.112 ( 7/16 )              | 38.100 ( 1 1/2 ) | 23.813(0.9375) | 22.225 ( 7/8 )   |
|                            | CRY 26 V                              | CRY 26 VUU                            | 210                 | 11.112 ( 7/16 )              | 41.275 ( 1 5/8 ) | 23.813(0.9375) | 22.225 ( 7/8 )   |
| 12.700<br>(1/2)            | CRY 28 V                              | CRY 28 VUU                            | 276                 | 12.700 ( 1/2 )               | 44.450 ( 1 3/4 ) | 26.988(1.0625) | 25.400 ( 1 )     |
|                            | CRY 30 V                              | CRY 30 VUU                            | 321                 | 12.700 ( 1/2 )               | 47.625 ( 1 7/8 ) | 26.988(1.0625) | 25.400 ( 1 )     |
| 15.875<br>(5/8)            | CRY 32 V                              | CRY 32 VUU                            | 442                 | 15.875 ( 5/8 )               | 50.800 ( 2 )     | 33.338(1.3125) | 31.750 ( 1 1/4 ) |
|                            | CRY 36 V                              | CRY 36 VUU                            | 575                 | 15.875 ( 5/8 )               | 57.150 ( 2 1/4 ) | 33.338(1.3125) | 31.750 ( 1 1/4 ) |
| 19.050<br>(3/4)            | CRY 40 V                              | CRY 40 VUU                            | 835                 | 19.050 ( 3/4 )               | 63.500 ( 2 1/2 ) | 39.688(1.5625) | 38.100 ( 1 1/2 ) |
|                            | CRY 44 V                              | CRY 44 VUU                            | 1 031               | 19.050 ( 3/4 )               | 69.850 ( 2 3/4 ) | 39.688(1.5625) | 38.100 ( 1 1/2 ) |
| 25.400<br>( 1 )            | CRY 48 V                              | CRY 48 VUU                            | 1 370               | 25.400 ( 1 )                 | 76.200 ( 3 )     | 46.038(1.8125) | 44.450 ( 1 3/4 ) |
|                            | CRY 52 V                              | CRY 52 VUU                            | 1 640               | 25.400 ( 1 )                 | 82.550 ( 3 1/4 ) | 46.038(1.8125) | 44.450 ( 1 3/4 ) |
| 28.575<br>(1 1/8)          | CRY 56 V                              | CRY 56 VUU                            | 2 160               | 28.575 ( 1 1/8 )             | 88.900 ( 3 1/2 ) | 52.388(2.0625) | 50.800 ( 2 )     |
| 31.750<br>(1 1/4)          | CRY 64 V                              | CRY 64 VUU                            | 3 190               | 31.750 ( 1 1/4 )             | 101.600 ( 4 )    | 58.738(2.3125) | 57.150 ( 2 1/4 ) |

Remarks1. The inner ring has an oil groove and an oil hole.  
2. Provided with prepacked grease.

| $a$<br><br>$r$ |                          | Shaft dia. mm |        |           |        |           |        | Basic dynamic<br>load rating | Basic static<br>load rating |
|----------------|--------------------------|---------------|--------|-----------|--------|-----------|--------|------------------------------|-----------------------------|
|                |                          | Push fit      |        | Drive fit |        | Press fit |        | $C$                          | $C_0$                       |
|                |                          | Min.          | Max.   | Min.      | Max.   | Min.      | Max.   | N                            | N                           |
| 14.4(0.567)    | 0.794 ( $\frac{1}{32}$ ) | 6.332         | 6.342  | 6.348     | 6.358  | 6.353     | 6.363  | 8 710                        | 12 300                      |
| 14.4(0.567)    | 0.794 ( $\frac{1}{32}$ ) | 6.332         | 6.342  | 6.348     | 6.358  | 6.353     | 6.363  | 8 710                        | 12 300                      |
| 19.6(0.772)    | 1.191 ( $\frac{3}{64}$ ) | 7.920         | 7.930  | 7.935     | 7.945  | 7.940     | 7.950  | 13 100                       | 22 700                      |
| 19.6(0.772)    | 1.588 ( $\frac{1}{16}$ ) | 7.920         | 7.930  | 7.935     | 7.945  | 7.940     | 7.950  | 13 100                       | 22 700                      |
| 25.0(0.984)    | 1.588 ( $\frac{1}{16}$ ) | 9.507         | 9.517  | 9.523     | 9.533  | 9.528     | 9.538  | 23 600                       | 31 700                      |
| 25.0(0.984)    | 1.588 ( $\frac{1}{16}$ ) | 9.507         | 9.517  | 9.523     | 9.533  | 9.528     | 9.538  | 23 600                       | 31 700                      |
| 28.8(1.134)    | 1.588 ( $\frac{1}{16}$ ) | 11.095        | 11.105 | 11.110    | 11.120 | 11.115    | 11.125 | 28 200                       | 40 100                      |
| 28.8(1.134)    | 1.588 ( $\frac{1}{16}$ ) | 11.095        | 11.105 | 11.110    | 11.120 | 11.115    | 11.125 | 28 200                       | 40 100                      |
| 32.7(1.287)    | 1.588 ( $\frac{1}{16}$ ) | 12.682        | 12.692 | 12.698    | 12.708 | 12.708    | 12.718 | 35 300                       | 55 600                      |
| 32.7(1.287)    | 1.588 ( $\frac{1}{16}$ ) | 12.682        | 12.692 | 12.698    | 12.708 | 12.708    | 12.718 | 35 300                       | 55 600                      |
| 36.0(1.417)    | 1.588 ( $\frac{1}{16}$ ) | 15.857        | 15.867 | 15.873    | 15.883 | 15.883    | 15.893 | 45 700                       | 80 600                      |
| 36.0(1.417)    | 1.588 ( $\frac{1}{16}$ ) | 15.857        | 15.867 | 15.873    | 15.883 | 15.883    | 15.893 | 45 700                       | 80 600                      |
| 43.3(1.705)    | 2.381 ( $\frac{3}{32}$ ) | 19.032        | 19.042 | 19.048    | 19.058 | 19.058    | 19.068 | 61 400                       | 116 000                     |
| 43.3(1.705)    | 2.381 ( $\frac{3}{32}$ ) | 19.032        | 19.042 | 19.048    | 19.058 | 19.058    | 19.068 | 61 400                       | 116 000                     |
| 54.0(2.125)    | 2.381 ( $\frac{3}{32}$ ) | 25.377        | 25.390 | 25.397    | 25.410 | 25.408    | 25.420 | 77 600                       | 172 000                     |
| 54.0(2.125)    | 2.381 ( $\frac{3}{32}$ ) | 25.377        | 25.390 | 25.397    | 25.410 | 25.408    | 25.420 | 77 600                       | 172 000                     |
| 61.9(2.437)    | 2.381 ( $\frac{3}{32}$ ) | 28.522        | 28.565 | 28.572    | 28.585 | 28.583    | 28.595 | 111 000                      | 239 000                     |
| 71.0(2.797)    | 2.381 ( $\frac{3}{32}$ ) | 31.727        | 31.740 | 31.747    | 31.760 | 31.758    | 31.770 | 142 000                      | 317 000                     |

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# CROSSED ROLLER BEARINGS

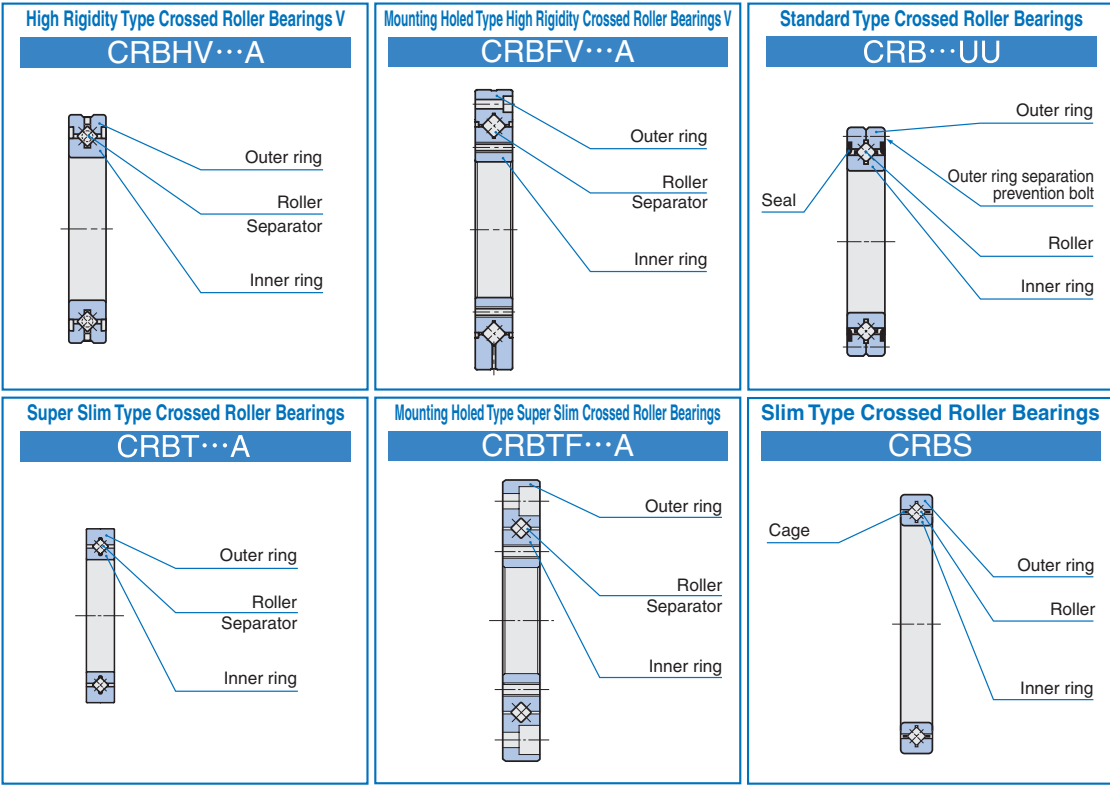
- High Rigidity Type Crossed Roller Bearings V
- Mounting Holed Type High Rigidity Crossed Roller Bearings V
- Standard Type Crossed Roller Bearings
- Super Slim Type Crossed Roller Bearings
- Mounting Holed Type Super Slim Crossed Roller Bearings
- Slim Type Crossed Roller Bearings



## Structure and Features

IKO Crossed Roller Bearings are compact bearings with their rollers alternately crossed at right angles to each other between inner and outer rings. They can take loads from any directions at the same time such as radial, thrust and moment loads. The rollers make line-contact with raceway surfaces, and, therefore, elastic deformation due to bearing loads is very small. These bearings are widely used in the rotating parts of industrial robots, machine tools, medical equipment, etc., which require compactness, high rigidity and high rotational accuracy. In addition, bearings made of stainless steel or those with inner and outer rings provided with mounting holes are also available on request. Please contact IKO.

### Structure of Crossed Roller Bearings



J  
CRBHV  
CRBFV  
CRB(C)  
CRBT  
CRBTF  
CRBS

Types

Crossed Roller Bearings are available in the types shown in Table 1.

Table 1 Crossed Roller Bearing Type

| Type                                                                 |             | With Cage | With Separator | Full Complement |
|----------------------------------------------------------------------|-------------|-----------|----------------|-----------------|
| High Rigidity Type Crossed Roller Bearings<br>CRBHV                  | Open type   | —         | CRBHV···A      | —               |
|                                                                      | Sealed type | —         | CRBHV···AUU    | —               |
| Mounting Holed Type High Rigidity Crossed Roller Bearings V<br>CRBFV | Open type   | —         | CRBFV···A      | —               |
|                                                                      | Sealed type | —         | CRBFV···AUU    | —               |
| Standard Type Crossed Roller Bearings<br>CRBC, CRB                   | Open type   | CRBC      | —              | CRB             |
|                                                                      | Sealed type | CRBC···UU | —              | CRB···UU        |
| Super Slim Type Crossed Roller Bearings<br>CRBT                      | Open type   | —         | CRBT···A       | —               |
| Mounting Holed Type Super Slim Crossed Roller Bearings<br>CRBTF      | Open type   | —         | CRBTF···A      | —               |
| Slim Type Crossed Roller Bearings<br>CRBS                            | Open type   | CRBS      | —              | CRBS···V        |
|                                                                      | Sealed type | —         | CRBS···AUU     | CRBS···VUU      |

High Rigidity Type Crossed Roller Bearings V

Both inner and outer rings have a solid one-piece construction. Therefore, high accuracy and high rigidity are achieved, and mounting errors can be minimized. As separators are incorporated between the cylindrical rollers for smooth rotation, these bearings are suitable for applications where rotational speed is comparatively high.

Mounting Holed Type High Rigidity Crossed Roller Bearings

Mounting holes are prepared on outer ring and inner ring providing easy mounting together with high rigidity and high accuracy.

Standard Type Crossed Roller Bearings

The outer ring is made of two split pieces, which are bolted together to prevent separation during transportation or mounting. So, handling is easy.

Super Slim Type Crossed Roller Bearings

This Type is extremely compact bearing having 5.5mm of sectional height and 5mm of width. Separators are incorporated between Cylindrical rollers for smooth rotation. These compactness, lightness and smoothness contribute downsizing of the machine and saving driving power.

Mounting Holed Type Super Slim Crossed Roller Bearings

These bearings are extremely compact and lightweight at a width of just 5 mm, with both outer and inner rings integrated (non-separable), and mounting holes in the rings for easy mounting to equipment.

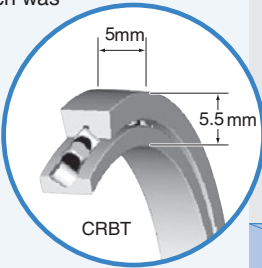
Slim Type Crossed Roller Bearings

These bearings are slim bearings having a small outside diameter, in comparison with the bore diameter, and a narrow width. The type with cage and the type with separator provide smooth rotation and are suitable for applications where rotational speed is comparatively high.

Features of Super Slim Type Crossed Roller Bearing CRBT

The world's thinnest roller type!  
Very low cross sectional height of 5.5 mm

The cross sectional height is reduced by 69% in comparison with CRBS, which was the thinnest before (bearing bore diameter 50 mm). The width is also as small as 5 mm and the cross sectional area is reduced by 43% in comparison with conventional products.



Comparison of bearing bore diameter 50 mm

| Sectional shape     |      |                        |                 |                             |
|---------------------|------|------------------------|-----------------|-----------------------------|
| Series              | Item | Super Slim<br>CRBT505A | Slim<br>CRBS508 | High rigidity<br>CRBHV5013A |
| Outer diameter      | mm   | 61                     | 66              | 80                          |
| Width               | mm   | 5                      | 8               | 13                          |
| Sectional height    | mm   | 5.5                    | 8               | 15                          |
| C                   | N    | 2280                   | 4900            | 17300                       |
| C <sub>0</sub>      | N    | 3200                   | 6170            | 20900                       |
| Mass                | g    | 32.3                   | 84              | 290                         |
| Compared with CRBHV |      | 0.11                   | 0.29            | 1.00                        |
| Compared with CRBS  |      | 0.38                   | 1.00            | 3.45                        |

Significant weight saving by 38% in comparison with conventional types was realized

Weight reduction is thoroughly pursued. The mass ratio is 0.38 and significant weight saving was realized in comparison with conventional slim type CRBS (bearing bore diameter 50 mm).

Features of Mounting Holed Type Crossed Roller Bearings CRBFV, CRBTF

High rigidity and high accuracy

The single structure to reduce the mounting errors is adopted for both inner and outer rings. Further, mounting holes for direct fixing on mating mounting surface are available. So high rigidity and high accuracy guide can be easily realized, being less subject to the structure of the housing and the accuracy.

Contributing to miniaturization

It can be easily mounted to a device with bolts without need for housing and fixing plate, so surrounding parts of the bearing can be made compact. Further, it allows for reduction of the number of parts and assembly processes, which contributes to miniaturization and weight saving of devices.

Complex mounting structure is not required  
Easy bolt-on installation

With mounting holes

No division for both inner and outer rings and high rigidity single structure

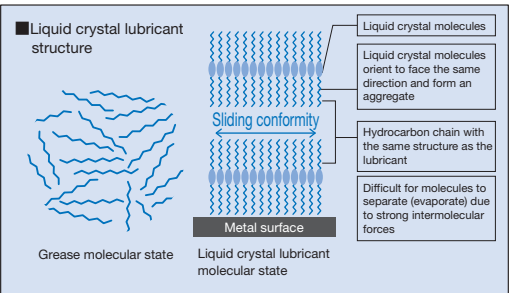
Single structure for both inner and outer rings!  
Mounting Holed Type High Rigidity Crossed Roller Bearing V  
Mounting Holed Type Super Slim Crossed Roller Bearings  
**CRBFV, CRBTF**

CRBHV  
CRBFV  
CRB(C)  
CRBT  
CRBTF  
CRBS

LCL Crossed Roller Bearings

Neither grease nor oil  
World's first Liquid Crystal Lubricant

Liquid Crystal Lubricants are completely different from greases composed of base oils and thickeners. **These are composed only of liquid crystal compounds, forming a new type of lubricant never seen before.** Conventional grease base oils lubricate using dissimilar molecules, causing difficulties with adhesion to metal surfaces and evaporation. Liquid Crystal Lubricant forms molecular aggregates, improving adhesion to metal surfaces and minimizing evaporation. The Liquid Crystal Lubricant used in LCL Crossed Roller Bearings is the world's first Liquid Crystal Lubricant for bearings, achieving excellent lubrication functionality even under high contact pressure during rolling contact and succeeding in creating revolutionary new functions.



■ Features of LCL Crossed Roller Bearings

Superior load durability

Long-term durability exceeds 7 times that of fluorine grease at room temperature and atmospheric pressure.

Excellent outgas properties

The outgassing characteristics in high vacuum environments show excellent performance even at high temperatures.

Minimizes lubricant evaporation

There is zero mass loss even at 100°C. Liquid Crystal Lubricants have no loss due to evaporation.

Low rotational torque

The rotational torque is lower than that of fluorine grease or lithium soap-based grease.



LCL Crossed Roller Bearings are individually made to order. If needed, please contact IKO.

Identification number

The identification number of Crossed Roller Bearings consists of a model code, dimensions, any supplemental codes and a classification symbol. Some examples are shown below.

Examples of identification number

|           | Model code | Dimensions | Supplemental code | Classification symbol |
|-----------|------------|------------|-------------------|-----------------------|
| Example 1 | CRBHV      | 150 25 A   | UU C1             | P6                    |
| Example 2 | CRBC       | 150 25     | UU C1             | P6                    |
| Example 3 | CRBT       | 30 5 A     | C1                |                       |
| Example 4 | CRBS       | 150 8 A    | UU C1             |                       |
| Example 5 | CRBFV      | 115 28 A   | D UU C1           | RP6                   |

| Model code |                                                                              |
|------------|------------------------------------------------------------------------------|
| CRBHV ...A | High Rigidity Type Crossed Roller Bearings V (With Separator)                |
| CRBFV ...A | Mounting Holed Type High Rigidity Crossed Roller Bearings V (With Separator) |
| CRBC       | Standard Type Crossed Roller Bearings (With Cage)                            |
| CRB        | Standard Type Crossed Roller Bearings (Full complement)                      |
| CRBT ...A  | Super Slim Type Crossed Roller Bearings (With Separator)                     |
| CRBTF ...A | Mounting Holed Type Super Slim Crossed Roller Bearings (With Separator)      |
| CRBS       | Slim Type Crossed Roller Bearings (With Cage)                                |
| CRBS ...A  | Slim Type Crossed Roller Bearings (With Separator)                           |
| CRBS ...V  | Slim Type Crossed Roller Bearings (Full complement)                          |

| Dimension                                                                                                                                                                                                                            |                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| The dimension indicates the bore diameter of the bearing. (unit : mm)                                                                                                                                                                |                                                                                                |
| The dimension indicates the bearing width. (unit : mm)                                                                                                                                                                               |                                                                                                |
| Supplemental code - 1 <sup>(1)</sup>                                                                                                                                                                                                 |                                                                                                |
| T                                                                                                                                                                                                                                    | With female threaded mounting holes on the inner ring                                          |
| No symbol                                                                                                                                                                                                                            | With counter-bored mounting holes on both inner ring and outer ring in the same direction.     |
| D                                                                                                                                                                                                                                    | With counter-bored mounting holes on both inner ring and outer ring in the opposite direction. |
| Note <sup>(1)</sup> Applicable to Mounting Holed Type Crossed Roller Bearings.<br>Note that with female threaded mounting holes on the inner ring (T) is only applicable for Mounting Holed Type Super Slim Crossed Roller Bearings. |                                                                                                |

| Supplemental code - 2 |                      |                                         |
|-----------------------|----------------------|-----------------------------------------|
| No symbol             | Open type            | For application,<br>please see table 2. |
| UU                    | Sealed type          |                                         |
| U                     | One side sealed type |                                         |
| Supplemental code - 3 |                      |                                         |
| T1                    | : T1 clearance       | For application,<br>please see table 3. |
| C1                    | : C1 clearance       |                                         |
| C2                    | : C2 clearance       |                                         |
| No symbol             | : Normal clearance   |                                         |

| Classification symbol                |                             |
|--------------------------------------|-----------------------------|
| No symbol                            | Accuracy class 0            |
| P6                                   | Accuracy class 6            |
| P5                                   | Accuracy class 5            |
| P4                                   | Accuracy class 4            |
| P2                                   | Accuracy class 2            |
| RP6                                  | Rotational accuracy class 6 |
| RP5                                  | Rotational accuracy class 5 |
| RP4                                  | Rotational accuracy class 4 |
| RP2                                  | Rotational accuracy class 2 |
| For application, please see table 4. |                             |

Rotational accuracy class--classes specifying accuracy standards for only rotational accuracy (radial runout, axial runout).

Internal Structures and Shapes

Various types are lined up in Crossed Roller Bearing series, including the type with cage, the type with separator, open type, sealed type, etc.

Roller guide method

Crossed Roller Bearings include the type with cage, type with separator and full complement type. The type with cage and the type with separator have a small coefficient of friction and are suitable for comparatively high speed rotations, while the full complement type is suitable for heavy load applications at low speed rotations.

Seal structure

Crossed Roller Bearings include the open type and sealed type. The sealed type bearing incorporates seals made of special synthetic rubber that have excellent sealing performance against dust and dirt penetration and grease leakage. However, excess grease may be discharged during initial operations.

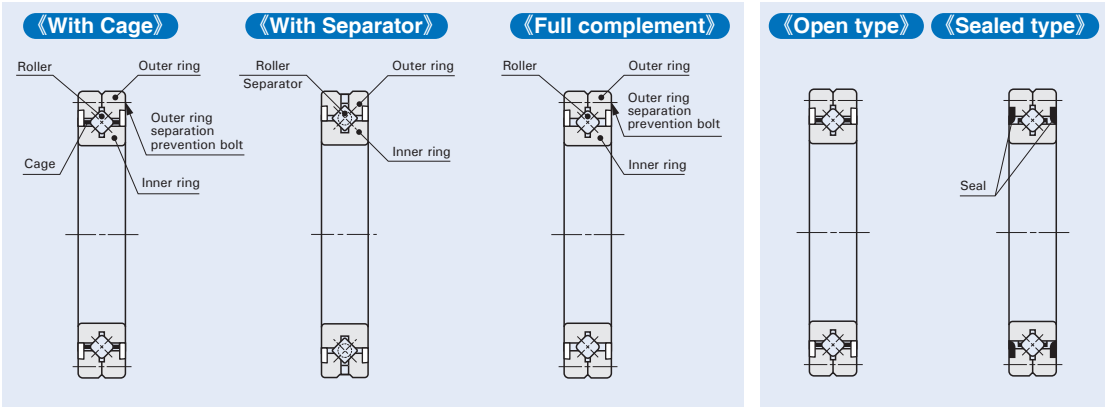


Table 2 Seal Specification

| Model code  | No Symbol | UU | U |
|-------------|-----------|----|---|
| CRBHV ... A | ○         | ○  | — |
| CRBFV ... A | ○         | ○  | — |
| CRBC        | ○         | ○  | ○ |
| CRB         | ○         | ○  | ○ |
| CRBT ... A  | ○         | —  | — |
| CRBTF ... A | ○         | —  | — |
| CRBS        | ○         | —  | — |
| CRBS ... A  | —         | ○  | ○ |
| CRBS ... V  | ○         | ○  | ○ |

Table 3 Clearance Specification

| Model code  | T1 | C1 | C2 | No Symbol |
|-------------|----|----|----|-----------|
| CRBHV ... A | ○  | ○  | ○  | —         |
| CRBFV ... A | ○  | ○  | ○  | —         |
| CRBC        | ○  | ○  | ○  | —         |
| CRB         | ○  | ○  | ○  | —         |
| CRBT ... A  | —  | ○  | —  | —         |
| CRBTF ... A | —  | ○  | —  | —         |
| CRBS        | ○  | ○  | —  | ○         |
| CRBS ... A  | ○  | ○  | —  | ○         |
| CRBS ... V  | ○  | ○  | —  | ○         |

Table 4 Accuracy Class

| Model code  | No Symbol | P6 RP6 | P5 RP5 | P4 RP4 | P2 RP2 |
|-------------|-----------|--------|--------|--------|--------|
| CRBHV ... A | ○         | ○      | ○      | ○      | ○      |
| CRBFV ... A | ○         | ○      | ○      | ○      | ○      |
| CRBC        | ○         | ○      | ○      | ○      | ○      |
| CRB         | ○         | ○      | ○      | ○      | ○      |
| CRBT ... A  | ○         | —      | —      | —      | —      |
| CRBTF ... A | ○         | —      | —      | —      | —      |
| CRBS        | ○         | —      | —      | —      | —      |
| CRBS ... A  | ○         | —      | —      | —      | —      |
| CRBS ... V  | ○         | —      | —      | —      | —      |

Dynamic Equivalent Load

The direction of basic dynamic load rating of Crossed Roller Bearing is the radial direction. When a load in any direction other than the direction of basic dynamic load rating or a complex load is applied, calculate the dynamic equivalent load to calculate the rating life.

$$P_r = X \left( F_r + \frac{2M}{D_{pw}} \right) + Y F_a \dots\dots\dots(1)$$

where,  $P_r$  : Dynamic equivalent radial load, N  
 $F_r$  : Radial load, N  
 $F_a$  : Axial load, N  
 $M$  : Moment, N-mm  
 $D_{pw}$  : Pitch circle diameter of roller set, mm  
 $\left( D_{pw} \doteq \frac{d + D}{2} \right)$

$X$  : Radial load factor (Refer to Table 5.)  
 $Y$  : Axial load factor (Refer to Table 5.)

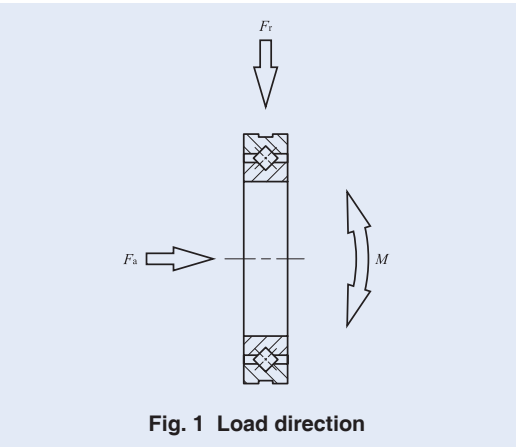


Fig. 1 Load direction

Table 5 Radial load factor and axial load factor

| Conditions                             | $X$  | $Y$  |
|----------------------------------------|------|------|
| $\frac{F_a}{F_r + 2M/D_{pw}} \leq 1.5$ | 1    | 0.45 |
| $\frac{F_a}{F_r + 2M/D_{pw}} > 1.5$    | 0.67 | 0.67 |

Static Equivalent Load

The direction of basic static load rating of Crossed Roller Bearing is the radial direction. When a load in any direction other than the direction of basic static load rating or a complex load is applied, calculate the static equivalent load to calculate the static safety factor.

$$P_{0r} = F_r + \frac{2M}{D_{pw}} + 0.44 F_a \dots\dots\dots(2)$$

where,  $P_{0r}$  : Static equivalent radial load, N  
 $F_r$  : Radial load, N  
 $F_a$  : Axial load, N  
 $M$  : Moment, N-mm  
 $D_{pw}$  : Pitch circle diameter of roller set, mm  
 $\left( D_{pw} \doteq \frac{d + D}{2} \right)$

Accuracy

The accuracy of Crossed Roller Bearings, Mounting Holed Type Super Slim Crossed Roller Bearings, Slim Type Crossed Roller Bearings and Mounting Holed

Type High Rigidity Crossed Roller Bearings V is shown below in Table 6 - 10.2.  
Bearings with special accuracy are also options. Please consult IKO.

Table 6 Tolerances and allowable values of inner rings and tolerances of outer ring width

unit:  $\mu$  m

| Nominal bore diameter |       | $\Delta_{dmp}^{(1)}$<br>Single plane mean bore dia. deviation |     |      |     |      |     |      |     | $\Delta_{Bs}$<br>Deviation of a single inner ring width |      | $\Delta_{Cs}^{(2)}$<br>Deviation of a single outer ring width |      | $K_{ia}$<br>Radial run-out of assembled bearing inner ring |        |        |        |        | $S_{ia}$<br>Assembled bearing inner ring face run-out with raceway |        |        |        |        |
|-----------------------|-------|---------------------------------------------------------------|-----|------|-----|------|-----|------|-----|---------------------------------------------------------|------|---------------------------------------------------------------|------|------------------------------------------------------------|--------|--------|--------|--------|--------------------------------------------------------------------|--------|--------|--------|--------|
|                       |       | Class 0 RP6-2                                                 |     | P6   |     | P5   |     | P4   |     | High                                                    | Low  | High                                                          | Low  | Class 0                                                    | P6 RP6 | P5 RP5 | P4 RP4 | P2 RP2 | Class 0                                                            | P6 RP6 | P5 RP5 | P4 RP4 | P2 RP2 |
| Over                  | Incl. | High                                                          | Low | High | Low | High | Low | High | Low |                                                         |      |                                                               |      |                                                            |        |        |        |        |                                                                    |        |        |        |        |
| 18                    | 30    | 0                                                             | -10 | 0    | -8  | 0    | -6  | 0    | -5  | 0                                                       | -75  | 0                                                             | -100 | 13                                                         | 8      | 4      | 3      | 2.5    | 13                                                                 | 8      | 4      | 3      | 2.5    |
| 30                    | 50    | 0                                                             | -12 | 0    | -10 | 0    | -8  | 0    | -6  | 0                                                       | -75  | 0                                                             | -100 | 15                                                         | 10     | 5      | 4      | 2.5    | 15                                                                 | 10     | 5      | 4      | 2.5    |
| 50                    | 80    | 0                                                             | -15 | 0    | -12 | 0    | -9  | 0    | -7  | 0                                                       | -75  | 0                                                             | -100 | 20                                                         | 10     | 5      | 4      | 2.5    | 20                                                                 | 10     | 5      | 4      | 2.5    |
| 80                    | 120   | 0                                                             | -20 | 0    | -15 | 0    | -10 | 0    | -8  | 0                                                       | -75  | 0                                                             | -100 | 25                                                         | 13     | 6      | 5      | 2.5    | 25                                                                 | 13     | 6      | 5      | 2.5    |
| 120                   | 150   | 0                                                             | -25 | 0    | -18 | 0    | -13 | 0    | -10 | 0                                                       | -100 | 0                                                             | -120 | 30                                                         | 18     | 8      | 6      | 2.5    | 30                                                                 | 18     | 8      | 6      | 2.5    |
| 150                   | 180   | 0                                                             | -25 | 0    | -18 | 0    | -13 | 0    | -10 | 0                                                       | -100 | 0                                                             | -120 | 30                                                         | 18     | 8      | 6      | 5      | 30                                                                 | 18     | 8      | 6      | 5      |
| 180                   | 250   | 0                                                             | -30 | 0    | -22 | 0    | -15 | 0    | -12 | 0                                                       | -100 | 0                                                             | -120 | 40                                                         | 20     | 10     | 8      | 5      | 40                                                                 | 20     | 10     | 8      | 5      |
| 250                   | 315   | 0                                                             | -35 | 0    | -25 | 0    | -18 | —    | —   | 0                                                       | -120 | 0                                                             | -150 | 50                                                         | 25     | 13     | 10     | 7      | 50                                                                 | 25     | 13     | 10     | 7      |
| 315                   | 400   | 0                                                             | -40 | 0    | -30 | 0    | -23 | —    | —   | 0                                                       | -150 | 0                                                             | -200 | 60                                                         | 30     | 15     | 12     | 8      | 60                                                                 | 30     | 15     | 12     | 8      |
| 400                   | 500   | 0                                                             | -45 | 0    | -35 | —    | —   | —    | —   | 0                                                       | -150 | 0                                                             | -200 | 65                                                         | 35     | 18     | 14     | 10     | 65                                                                 | 35     | 18     | 14     | 10     |
| 500                   | 630   | 0                                                             | -50 | 0    | -40 | —    | —   | —    | —   | 0                                                       | -150 | 0                                                             | -200 | 70                                                         | 40     | 20     | 16     | 12     | 70                                                                 | 40     | 20     | 16     | 12     |
| 630                   | 800   | 0                                                             | -75 | —    | —   | —    | —   | —    | —   | 0                                                       | -150 | 0                                                             | -200 | 80                                                         | 50     | 25     | 20     | 15     | 80                                                                 | 50     | 25     | 20     | 15     |

Notes<sup>(1)</sup> For accuracy class P2 and other classes without a numerical description, the highest grade numerical value among the lower accuracy classes in the same nominal bore diameter range is applied.  
<sup>(2)</sup> For High Rigidity Type Crossed Roller Bearings V, the tolerances for deviation of a single inner ring width are applicable to those of a single outer ring width.  
Remark The accuracy specified in this table is not applicable to (Mounting Holed Type) Super Slim Crossed Roller Bearings, Slim Type Crossed Roller Bearings, and Mounting Holed Type High Rigidity Crossed Roller Bearings V.

Table 7 Tolerances and allowable values of outer ring

unit:  $\mu$  m

| Nominal outside diameter<br>$D$<br>mm |       | $\Delta D_{mp}^{(1)}$<br>Single plane mean outside dia. deviation |       |      |      |      |      |      |      | $K_{ea}$<br>Radial run-out of assembled bearing outer ring |           |           |                          |                          | $S_{ea}$<br>Assembled bearing outer ring face run-out with raceway |           |           |                          |                          |
|---------------------------------------|-------|-------------------------------------------------------------------|-------|------|------|------|------|------|------|------------------------------------------------------------|-----------|-----------|--------------------------|--------------------------|--------------------------------------------------------------------|-----------|-----------|--------------------------|--------------------------|
|                                       |       | Class 0<br>RP6-2                                                  |       | P6   |      | P5   |      | P4   |      | Class<br>0                                                 | P6<br>RP6 | P5<br>RP5 | P4 <sup>(2)</sup><br>RP4 | P2 <sup>(2)</sup><br>RP2 | Class<br>0                                                         | P6<br>RP6 | P5<br>RP5 | P4 <sup>(2)</sup><br>RP4 | P2 <sup>(2)</sup><br>RP2 |
|                                       |       | High                                                              | Low   | High | Low  | High | Low  | High | Low  |                                                            |           |           |                          |                          |                                                                    |           |           |                          |                          |
| Over                                  | Incl. | High                                                              | Low   | High | Low  | High | Low  | High | Low  |                                                            |           |           |                          |                          |                                                                    |           |           |                          |                          |
| 30                                    | 50    | 0                                                                 | - 11  | 0    | - 9  | 0    | - 7  | 0    | - 6  | 20                                                         | 10        | 7         | 5                        | 2.5                      | 20                                                                 | 10        | 7         | 5                        | 2.5                      |
| 50                                    | 80    | 0                                                                 | - 13  | 0    | - 11 | 0    | - 9  | 0    | - 7  | 25                                                         | 13        | 8         | 5                        | 4                        | 25                                                                 | 13        | 8         | 5                        | 4                        |
| 80                                    | 120   | 0                                                                 | - 15  | 0    | - 13 | 0    | - 10 | 0    | - 8  | 35                                                         | 18        | 10        | 6                        | 5                        | 35                                                                 | 18        | 10        | 6                        | 5                        |
| 120                                   | 150   | 0                                                                 | - 18  | 0    | - 15 | 0    | - 11 | 0    | - 9  | 40                                                         | 20        | 11        | 7                        | 5                        | 40                                                                 | 20        | 11        | 7                        | 5                        |
| 150                                   | 180   | 0                                                                 | - 25  | 0    | - 18 | 0    | - 13 | 0    | - 10 | 45                                                         | 23        | 13        | 8                        | 5                        | 45                                                                 | 23        | 13        | 8                        | 5                        |
| 180                                   | 250   | 0                                                                 | - 30  | 0    | - 20 | 0    | - 15 | 0    | - 11 | 50                                                         | 25        | 15        | 10                       | 7                        | 50                                                                 | 25        | 15        | 10                       | 7                        |
| 250                                   | 315   | 0                                                                 | - 35  | 0    | - 25 | 0    | - 18 | 0    | - 13 | 60                                                         | 30        | 18        | 11                       | 7                        | 60                                                                 | 30        | 18        | 11                       | 7                        |
| 315                                   | 400   | 0                                                                 | - 40  | 0    | - 28 | 0    | - 20 | —    | —    | 70                                                         | 35        | 20        | —                        | —                        | 70                                                                 | 35        | 20        | —                        | —                        |
| 400                                   | 500   | 0                                                                 | - 45  | 0    | - 33 | 0    | - 23 | —    | —    | 80                                                         | 40        | 23        | —                        | —                        | 80                                                                 | 40        | 23        | —                        | —                        |
| 500                                   | 630   | 0                                                                 | - 50  | 0    | - 38 | 0    | - 28 | —    | —    | 100                                                        | 50        | 25        | —                        | —                        | 100                                                                | 50        | 25        | —                        | —                        |
| 630                                   | 800   | 0                                                                 | - 75  | 0    | - 45 | —    | —    | —    | —    | 120                                                        | 60        | 30        | —                        | —                        | 120                                                                | 60        | 30        | —                        | —                        |
| 800                                   | 1000  | 0                                                                 | - 100 | 0    | - 60 | —    | —    | —    | —    | 120                                                        | 75        | 35        | —                        | —                        | 120                                                                | 75        | 35        | —                        | —                        |
| 1000                                  | 1030  | 0                                                                 | - 125 | —    | —    | —    | —    | —    | —    | 120                                                        | 75        | 35        | —                        | —                        | 120                                                                | 75        | 35        | —                        | —                        |

Notes<sup>(1)</sup> For accuracy class P2 and other classes without a numerical description, the highest grade numerical value among the lower accuracy classes in the same nominal bore diameter range is applied.  
<sup>(2)</sup> P4 and P2 apply to High Rigidity Type Crossed Roller Bearings V. For Standard Type Crossed Roller Bearings, the tolerance values for P5 are applicable to P4 and P2.  
Remark The accuracy specified in this table is not applicable to (Mounting Holed Type) Super Slim Crossed Roller Bearings, Slim Type Crossed Roller Bearings, and Mounting Holed Type High Rigidity Crossed Roller Bearings V.

Table 8 Tolerances and allowable values of Mounting Holed Type Super Slim Crossed Roller Bearings unit: μm

| $d$<br>Nominal bore diameter<br>mm | $\Delta_{dmp}$<br>Single plane mean bore dia. deviation |             | $\Delta_{Dmp}$<br>Single plane mean outside dia. deviation |             | $\Delta_{Bs}$ and $\Delta_{Cs}$<br>Deviations of a single inner ring width and outer ring width |      | $K_{ia}$ and $S_{ia}$<br>Radial and axial run-out of assembled bearing inner ring | $K_{ea}$ and $S_{ea}$<br>Radial and axial run-out of assembled bearing outer ring |
|------------------------------------|---------------------------------------------------------|-------------|------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|                                    | High                                                    | Low         | High                                                       | Low         | High                                                                                            | Low  |                                                                                   |                                                                                   |
| 10                                 | 0                                                       | − 8( − 8)   | 0                                                          | − 9( − 11)  | 0                                                                                               | − 75 | 10(13)                                                                            | 15(20)                                                                            |
| 15                                 | 0                                                       | − 8         | 0                                                          | − 9         | 0                                                                                               | − 75 | 10                                                                                | 15                                                                                |
| 20                                 | 0                                                       | − 10( − 10) | 0                                                          | − 11( − 13) | 0                                                                                               | − 75 | 13(13)                                                                            | 20(20)                                                                            |
| 30                                 | 0                                                       | − 10( − 10) | 0                                                          | − 11( − 13) | 0                                                                                               | − 75 | 13(15)                                                                            | 20(25)                                                                            |
| 40                                 | 0                                                       | − 12( − 12) | 0                                                          | − 13( − 13) | 0                                                                                               | − 75 | 15(15)                                                                            | 25(25)                                                                            |
| 50                                 | 0                                                       | − 12        | 0                                                          | − 13        | 0                                                                                               | − 75 | 15                                                                                | 25                                                                                |

Remark The values in ( ) represent that of Mounting Holed Type Super Slim Crossed Roller Bearings.

Table 9 Tolerances and allowable values of Slim Type Crossed Roller Bearings unit: μm

| $d$<br>Nominal bore<br>diameter<br>mm | $\Delta_{dmp}$<br>Single plane mean bore dia.<br>deviation |      | $\Delta_{Dmp}$<br>Single plane mean outside dia.<br>deviation |      | $\Delta_{Bs}$ and $\Delta_{Cs}$<br>Deviations of a single inner ring width<br>and outer ring width |       | $K_{ia}$ and $S_{ia}$<br>Radial and axial run-out<br>of assembled bearing<br>inner ring | $K_{ea}$ and $S_{ea}$<br>Radial and axial run-out<br>of assembled bearing<br>outer ring |
|---------------------------------------|------------------------------------------------------------|------|---------------------------------------------------------------|------|----------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|                                       | High                                                       | Low  | High                                                          | Low  | High                                                                                               | Low   |                                                                                         |                                                                                         |
| 50                                    | 0                                                          | − 15 | 0                                                             | − 13 | 0                                                                                                  | − 127 | 13                                                                                      | 13                                                                                      |
| 60                                    | 0                                                          | − 15 | 0                                                             | − 13 | 0                                                                                                  | − 127 | 13                                                                                      | 13                                                                                      |
| 70                                    | 0                                                          | − 15 | 0                                                             | − 15 | 0                                                                                                  | − 127 | 15                                                                                      | 15                                                                                      |
| 80                                    | 0                                                          | − 20 | 0                                                             | − 15 | 0                                                                                                  | − 127 | 15                                                                                      | 15                                                                                      |
| 90                                    | 0                                                          | − 20 | 0                                                             | − 15 | 0                                                                                                  | − 127 | 15                                                                                      | 15                                                                                      |
| 100                                   | 0                                                          | − 20 | 0                                                             | − 15 | 0                                                                                                  | − 127 | 15                                                                                      | 15                                                                                      |
| 110                                   | 0                                                          | − 20 | 0                                                             | − 20 | 0                                                                                                  | − 127 | 20                                                                                      | 20                                                                                      |
| 120                                   | 0                                                          | − 25 | 0                                                             | − 20 | 0                                                                                                  | − 127 | 20                                                                                      | 20                                                                                      |
| 130                                   | 0                                                          | − 25 | 0                                                             | − 25 | 0                                                                                                  | − 127 | 25                                                                                      | 25                                                                                      |
| 140                                   | 0                                                          | − 25 | 0                                                             | − 25 | 0                                                                                                  | − 127 | 25                                                                                      | 25                                                                                      |
| 150                                   | 0                                                          | − 25 | 0                                                             | − 25 | 0                                                                                                  | − 127 | 25                                                                                      | 25                                                                                      |
| 160                                   | 0                                                          | − 25 | 0                                                             | − 25 | 0                                                                                                  | − 127 | 25                                                                                      | 25                                                                                      |
| 170                                   | 0                                                          | − 25 | 0                                                             | − 30 | 0                                                                                                  | − 127 | 25                                                                                      | 25                                                                                      |
| 180                                   | 0                                                          | − 30 | 0                                                             | − 30 | 0                                                                                                  | − 127 | 30                                                                                      | 30                                                                                      |
| 190                                   | 0                                                          | − 30 | 0                                                             | − 30 | 0                                                                                                  | − 127 | 30                                                                                      | 30                                                                                      |
| 200                                   | 0                                                          | − 30 | 0                                                             | − 30 | 0                                                                                                  | − 127 | 30                                                                                      | 30                                                                                      |

Table 10.1 Tolerances and allowable values of inner rings of Mounting Holed Type High Rigidity Crossed Roller Bearings V unit: μm

| d<br>Nominal bore<br>diameter<br>mm |       | $\Delta_{dmp}$<br>Single plane mean bore dia. deviation |      |      |      |      |      |      |     |        |      | $\Delta_{Bs}$<br>Deviation of<br>a single inner<br>ring width |     | $K_{ia}$<br>Radial run-out of assembled<br>bearing inner ring |           |           |           |           | $S_{ia}$<br>Assembled bearing inner ring<br>face run-out with raceway |           |           |           |           |
|-------------------------------------|-------|---------------------------------------------------------|------|------|------|------|------|------|-----|--------|------|---------------------------------------------------------------|-----|---------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------------------------------------------------------------------|-----------|-----------|-----------|-----------|
|                                     |       | Class 0<br>RP6-2                                        |      |      |      | P6   |      | P5   |     | P4, P2 |      |                                                               |     | Class<br>0                                                    | P6<br>RP6 | P5<br>RP5 | P4<br>RP4 | P2<br>RP2 | Class<br>0                                                            | P6<br>RP6 | P5<br>RP5 | P4<br>RP4 | P2<br>RP2 |
|                                     |       | High                                                    | Low  | High | Low  | High | Low  | High | Low | High   | Low  |                                                               |     |                                                               |           |           |           |           |                                                                       |           |           |           |           |
| Over                                | Incl. | High                                                    | Low  | High | Low  | High | Low  | High | Low | High   | Low  | 0                                                             | RP6 | RP5                                                           | RP4       | RP2       | 0         | RP6       | RP5                                                                   | RP4       | RP2       |           |           |
| —                                   | 20    | 0                                                       | — 10 | 0    | — 8  | 0    | — 6  | 0    | — 5 | 0      | — 75 | 13                                                            | 8   | 4                                                             | 3         | 2.5       | 13        | 8         | 4                                                                     | 3         | 2.5       |           |           |
| 20                                  | 30    | 0                                                       | — 10 | 0    | — 8  | 0    | — 6  | 0    | — 5 | 0      | — 75 | 15                                                            | 10  | 5                                                             | 4         | 2.5       | 15        | 10        | 5                                                                     | 4         | 2.5       |           |           |
| 30                                  | 35    | 0                                                       | — 12 | 0    | — 10 | 0    | — 8  | 0    | — 6 | 0      | — 75 | 15                                                            | 10  | 5                                                             | 4         | 2.5       | 15        | 10        | 5                                                                     | 4         | 2.5       |           |           |
| 35                                  | 50    | 0                                                       | — 12 | 0    | — 10 | 0    | — 8  | 0    | — 6 | 0      | — 75 | 20                                                            | 10  | 5                                                             | 4         | 2.5       | 20        | 10        | 5                                                                     | 4         | 2.5       |           |           |
| 50                                  | 65    | 0                                                       | — 15 | 0    | — 12 | 0    | — 9  | 0    | — 7 | 0      | — 75 | 20                                                            | 10  | 5                                                             | 4         | 2.5       | 20        | 10        | 5                                                                     | 4         | 2.5       |           |           |
| 65                                  | 80    | 0                                                       | — 15 | 0    | — 12 | 0    | — 9  | 0    | — 7 | 0      | — 75 | 25                                                            | 13  | 6                                                             | 5         | 2.5       | 25        | 13        | 6                                                                     | 5         | 2.5       |           |           |
| 80                                  | 100   | 0                                                       | — 20 | 0    | — 15 | 0    | — 10 | 0    | — 8 | 0      | — 75 | 25                                                            | 13  | 6                                                             | 5         | 2.5       | 25        | 13        | 6                                                                     | 5         | 2.5       |           |           |
| 100                                 | 120   | 0                                                       | — 20 | 0    | — 15 | 0    | — 10 | 0    | — 8 | 0      | — 75 | 30                                                            | 18  | 8                                                             | 6         | 2.5       | 30        | 18        | 8                                                                     | 6         | 2.5       |           |           |

Table 10.2 Tolerances and allowable values of outer rings of Mounting Holed Type High Rigidity Crossed Roller Bearings V unit: μm

| D<br>Nominal<br>outside<br>diameter<br>mm |       | $\Delta_{Dmp}$<br>Single plane mean outside dia. deviation |      |      |      |      |      |      |      |        |      | $\Delta_{Cs}$<br>Deviation of<br>a single outer<br>ring width |     | $K_{ea}$<br>Radial run-out of assembled<br>bearing outer ring |     |     |    |     | $S_{ea}$<br>Assembled bearing outer ring<br>face run-out with raceway |     |     |    |    |
|-------------------------------------------|-------|------------------------------------------------------------|------|------|------|------|------|------|------|--------|------|---------------------------------------------------------------|-----|---------------------------------------------------------------|-----|-----|----|-----|-----------------------------------------------------------------------|-----|-----|----|----|
|                                           |       | Class 0<br>RP6-2                                           |      |      |      | P6   |      | P5   |      | P4, P2 |      |                                                               |     | Class                                                         | P6  | P5  | P4 | P2  | Class                                                                 | P6  | P5  | P4 | P2 |
|                                           |       | High                                                       | Low  | High | Low  | High | Low  | High | Low  |        |      |                                                               |     |                                                               |     |     |    |     |                                                                       |     |     |    |    |
|                                           |       |                                                            |      |      |      |      |      |      |      |        |      |                                                               |     |                                                               |     |     |    |     |                                                                       |     |     |    |    |
| Over                                      | Incl. | High                                                       | Low  | High | Low  | High | Low  | High | Low  | High   | Low  | 0                                                             | RP6 | RP5                                                           | RP4 | RP2 | 0  | RP6 | RP5                                                                   | RP4 | RP2 |    |    |
| 50                                        | 60    | 0                                                          | − 13 | 0    | − 11 | 0    | − 9  | 0    | − 7  | 0      | − 75 | 20                                                            | 10  | 7                                                             | 5   | 2.5 | 20 | 10  | 7                                                                     | 5   | 2.5 |    |    |
| 60                                        | 80    | 0                                                          | − 13 | 0    | − 11 | 0    | − 9  | 0    | − 7  | 0      | − 75 | 25                                                            | 13  | 8                                                             | 5   | 4   | 25 | 13  | 8                                                                     | 5   | 4   |    |    |
| 80                                        | 95    | 0                                                          | − 15 | 0    | − 13 | 0    | − 10 | 0    | − 8  | 0      | − 75 | 25                                                            | 13  | 8                                                             | 5   | 4   | 25 | 13  | 8                                                                     | 5   | 4   |    |    |
| 95                                        | 120   | 0                                                          | − 15 | 0    | − 13 | 0    | − 10 | 0    | − 8  | 0      | − 75 | 35                                                            | 18  | 10                                                            | 6   | 5   | 35 | 18  | 10                                                                    | 6   | 5   |    |    |
| 120                                       | 140   | 0                                                          | − 18 | 0    | − 15 | 0    | − 11 | 0    | − 9  | 0      | − 75 | 35                                                            | 18  | 10                                                            | 6   | 5   | 35 | 18  | 10                                                                    | 6   | 5   |    |    |
| 140                                       | 150   | 0                                                          | − 18 | 0    | − 15 | 0    | − 11 | 0    | − 9  | 0      | − 75 | 40                                                            | 20  | 11                                                            | 7   | 5   | 40 | 20  | 11                                                                    | 7   | 5   |    |    |
| 150                                       | 165   | 0                                                          | − 25 | 0    | − 18 | 0    | − 13 | 0    | − 10 | 0      | − 75 | 40                                                            | 20  | 11                                                            | 7   | 5   | 40 | 20  | 11                                                                    | 7   | 5   |    |    |
| 165                                       | 180   | 0                                                          | − 25 | 0    | − 18 | 0    | − 13 | 0    | − 10 | 0      | − 75 | 45                                                            | 23  | 13                                                            | 8   | 5   | 45 | 23  | 13                                                                    | 8   | 5   |    |    |
| 180                                       | 210   | 0                                                          | − 30 | 0    | − 20 | 0    | − 15 | 0    | − 11 | 0      | − 75 | 45                                                            | 23  | 13                                                            | 8   | 5   | 45 | 23  | 13                                                                    | 8   | 5   |    |    |
| 210                                       | 240   | 0                                                          | − 30 | 0    | − 20 | 0    | − 15 | 0    | − 11 | 0      | − 75 | 50                                                            | 25  | 15                                                            | 10  | 7   | 50 | 25  | 15                                                                    | 10  | 7   |    |    |

Clearance

The radial internal clearances of Crossed Roller Bearings, Mounting Holed Type Super Slim Crossed Roller Bearings, Slim Type Crossed Roller Bearings and Mounting Holed Type High Rigidity Crossed Roller Bearings V are shown below in Table 11.1-11.4.

Table 11.1 Radial internal clearances unit: μm

| d<br>Nominal bore diameter<br>mm | Radial internal clearance |      |      |      |      |      |      |      |
|----------------------------------|---------------------------|------|------|------|------|------|------|------|
|                                  | T1                        |      | C1   |      | C2   |      |      |      |
|                                  | Min.                      | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| —                                | 30                        | − 10 | 0    | 0    | 10   | 10   | 20   | 20   |
| 30                               | 40                        | − 10 | 0    | 0    | 10   | 10   | 20   | 20   |
| 40                               | 50                        | − 10 | 0    | 0    | 10   | 10   | 25   | 25   |
| 50                               | 65                        | − 10 | 0    | 0    | 10   | 10   | 25   | 25   |
| 65                               | 80                        | − 10 | 0    | 0    | 15   | 15   | 30   | 30   |
| 80                               | 100                       | − 10 | 0    | 0    | 15   | 15   | 35   | 35   |
| 100                              | 120                       | − 15 | 0    | 0    | 15   | 15   | 35   | 35   |
| 120                              | 140                       | − 15 | 0    | 0    | 20   | 20   | 45   | 45   |
| 140                              | 160                       | − 15 | 0    | 0    | 20   | 20   | 50   | 50   |
| 160                              | 200                       | − 15 | 0    | 0    | 20   | 20   | 50   | 50   |
| 200                              | 250                       | − 20 | 0    | 0    | 25   | 25   | 60   | 60   |
| 250                              | 315                       | − 20 | 0    | 0    | 25   | 25   | 60   | 60   |
| 315                              | 400                       | − 25 | 0    | 0    | 30   | 30   | 70   | 70   |
| 400                              | 500                       | − 30 | 0    | 0    | 40   | 40   | 85   | 85   |
| 500                              | 630                       | − 30 | 0    | 0    | 50   | 50   | 100  | 100  |
| 630                              | 710                       | − 30 | 0    | 0    | 60   | 60   | 120  | 120  |
| 710                              | 800                       | − 40 | 0    | 0    | 70   | 70   | 140  | 140  |

Remark This table is not applicable to Mounting Holed Type Super Slim Crossed Roller Bearings, Slim Type Crossed Roller Bearings and Mounting Holed Type High Rigidity Crossed Roller Bearings V.

Table 11.2 Radial internal clearances for Mounting Holed Type Super Slim Crossed Roller Bearings unit: μm

| d<br>Nominal bore diameter of bearing<br>mm | Radial internal clearance |      |
|---------------------------------------------|---------------------------|------|
|                                             | Min.                      | Max. |
| 10                                          | 0                         | 15   |
| 15                                          | 0                         | 15   |
| 20                                          | 0                         | 15   |
| 30                                          | 0                         | 15   |
| 40                                          | 0                         | 15   |
| 50                                          | 0                         | 15   |

Table 11.3 Radial internal clearances of Slim Type Crossed Roller Bearings unit: μm

| d<br>Nominal bore diameter<br>mm | Radial internal clearance |      |      |      |        |      |
|----------------------------------|---------------------------|------|------|------|--------|------|
|                                  | T1                        |      | C1   |      | Normal |      |
|                                  | Min.                      | Max. | Min. | Max. | Min.   | Max. |
| 50                               | − 8                       | 0    | 0    | 15   | 30     | 56   |
| 60                               | − 8                       | 0    | 0    | 15   | 30     | 56   |
| 70                               | − 8                       | 0    | 0    | 15   | 30     | 56   |
| 80                               | − 8                       | 0    | 0    | 15   | 41     | 66   |
| 90                               | − 8                       | 0    | 0    | 15   | 41     | 66   |
| 100                              | − 8                       | 0    | 0    | 15   | 41     | 66   |
| 110                              | − 8                       | 0    | 0    | 15   | 41     | 66   |
| 120                              | − 8                       | 0    | 0    | 15   | 51     | 76   |
| 130                              | − 8                       | 0    | 0    | 15   | 51     | 76   |
| 140                              | − 8                       | 0    | 0    | 15   | 51     | 76   |
| 150                              | − 8                       | 0    | 0    | 15   | 51     | 76   |
| 160                              | − 10                      | 0    | 0    | 20   | 51     | 76   |
| 170                              | − 10                      | 0    | 0    | 20   | 51     | 76   |
| 180                              | − 10                      | 0    | 0    | 20   | 61     | 86   |
| 190                              | − 10                      | 0    | 0    | 20   | 61     | 86   |
| 200                              | − 10                      | 0    | 0    | 20   | 61     | 86   |

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Table 11.4 Radial internal clearances of Mounting Holed Type High Rigidity Crossed Roller Bearings V

unit: μm

| d<br>Nominal bore diameter<br>mm |       | Radial internal clearance |      |      |      |      |      |
|----------------------------------|-------|---------------------------|------|------|------|------|------|
|                                  |       | T1                        |      | C1   |      | C2   |      |
| Over                             | Incl. | Min.                      | Max. | Min. | Max. | Min. | Max. |
| —                                | 20    | — 10                      | 0    | 0    | 10   | 10   | 20   |
| 20                               | 25    | — 10                      | 0    | 0    | 10   | 10   | 20   |
| 25                               | 35    | — 10                      | 0    | 0    | 10   | 10   | 25   |
| 35                               | 65    | — 10                      | 0    | 0    | 15   | 15   | 30   |
| 65                               | 80    | — 10                      | 0    | 0    | 15   | 15   | 35   |
| 80                               | 95    | — 15                      | 0    | 0    | 15   | 15   | 35   |
| 95                               | 110   | — 15                      | 0    | 0    | 20   | 20   | 45   |
| 110                              | 125   | — 15                      | 0    | 0    | 20   | 20   | 50   |

Fit

The standard fits of Crossed Roller Bearings are shown in Table 12.1, and recommended fits for Slim Type Crossed Roller Bearings with normal clearances are shown in Table 12.2. For Super Slim Type Crossed Roller Bearings, it is recommended to use a slight interference fit adjusted to the actual measured dimensions. For large bearings, fit based on the actual measured dimensions of the bearings is recommended, and fit allowance should be chosen as small as possible in accordance with the tolerance class given in Table 12.1. When complex loads or shock loads are applied or when high rotational accuracy and rigidity of the bearing are required, it is recommended to use a slight interference fit adjusted to the actual measured dimensions for both inner and outer rings. For the interference fit, the radial internal clearance after the fit decreases by approximately 70% to 90% of the interference amount. To avoid excessive pre-load due to fit, it is recommended to use a slight interference fit adjusted to the actual measured dimensions for both T1 and C1 clearances.

Table 12.1 Recommended fits for Crossed Roller Bearings under normal load

| Radial internal clearance | Tolerance class          |              |                          |              |
|---------------------------|--------------------------|--------------|--------------------------|--------------|
|                           | Inner ring rotating load |              | Outer ring rotating load |              |
|                           | Shaft                    | Housing bore | Shaft                    | Housing bore |
| C1 clearance              | h5                       | H7           | g5                       | J7 (1)       |
| C2 clearance              | j5                       | H7           | g5                       | J7 (1)       |

Note(1) It is recommended that a slight interference fit adjusted to the actual measured dimensions of the bearing is used.

Table 12.2 Recommended fits for Slim Type Crossed Roller Bearings with normal clearances

(Dimensional tolerances of shaft and housing bore)

unit: μm

| d<br>Nominal bore diameter<br>mm | Inner ring rotating load |     |              |     | Outer ring rotating load |      |              |      |
|----------------------------------|--------------------------|-----|--------------|-----|--------------------------|------|--------------|------|
|                                  | Shaft                    |     | Housing bore |     | Shaft                    |      | Housing bore |      |
|                                  | High                     | Low | High         | Low | High                     | Low  | High         | Low  |
| 50                               | + 15                     | 0   | + 13         | 0   | — 15                     | — 30 | — 13         | — 25 |
| 60                               | + 15                     | 0   | + 13         | 0   | — 15                     | — 30 | — 13         | — 25 |
| 70                               | + 15                     | 0   | + 15         | 0   | — 15                     | — 30 | — 15         | — 30 |
| 80                               | + 20                     | 0   | + 15         | 0   | — 20                     | — 40 | — 15         | — 30 |
| 90                               | + 20                     | 0   | + 15         | 0   | — 20                     | — 40 | — 15         | — 30 |
| 100                              | + 20                     | 0   | + 15         | 0   | — 20                     | — 40 | — 15         | — 30 |
| 110                              | + 20                     | 0   | + 20         | 0   | — 20                     | — 40 | — 20         | — 40 |
| 120                              | + 25                     | 0   | + 20         | 0   | — 25                     | — 50 | — 20         | — 40 |
| 130                              | + 25                     | 0   | + 25         | 0   | — 25                     | — 50 | — 25         | — 50 |
| 140                              | + 25                     | 0   | + 25         | 0   | — 25                     | — 50 | — 25         | — 50 |
| 150                              | + 25                     | 0   | + 25         | 0   | — 25                     | — 50 | — 25         | — 50 |
| 160                              | + 25                     | 0   | + 25         | 0   | — 25                     | — 50 | — 25         | — 50 |
| 170                              | + 25                     | 0   | + 30         | 0   | — 25                     | — 50 | — 30         | — 60 |
| 180                              | + 30                     | 0   | + 30         | 0   | — 30                     | — 60 | — 30         | — 60 |
| 190                              | + 30                     | 0   | + 30         | 0   | — 30                     | — 60 | — 30         | — 60 |
| 200                              | + 30                     | 0   | + 30         | 0   | — 30                     | — 60 | — 30         | — 60 |

Allowable rotational speed

Allowable rotational speeds of Crossed Roller Bearings are affected by mounting and operating conditions. The values in general operation are shown in Table 13.

Table 13 d<sub>m</sub>n values(1) of Crossed Roller Bearings

| Type                        | Lubricant   | Grease | Oil     |
|-----------------------------|-------------|--------|---------|
|                             |             |        |         |
| With cage or with separator | Open type   | 75 000 | 150 000 |
|                             | Sealed type | 60 000 | —       |
| Full complement             | Open type   | 50 000 | 75 000  |
|                             | Sealed type | 40 000 | —       |

Note(1)  $d_m n \text{ value} = d_m \times n$   
where,  $d_m$  : Mean value of bearing bore and outside diameters, mm  
 $n$  : Number of rotations per minute, min<sup>-1</sup>

Rotational torque

Rotational torque of IKO Crossed Roller Bearings are lower than that of plain bearings and the difference between the static torque and the dynamic (kinetic) torque is small. Therefore, these bearings minimize power consumption and operating temperature rise of machinery and increase the overall efficiency of machines.

The rotational torque is affected by many factors, but the following equations can be used expediently.

$$T = \mu P_{0r} \frac{D_{pw}}{2}$$
  
where,  $T$  : Rotational torque, N·mm  
 $\mu$  : Friction coefficient (Approx. 0.010)  
 $P_{0r}$  : Static equivalent radial load, N  
 $D_{pw}$  : Pitch circle diameter, mm  
$$(D_{pw} \doteq \frac{d + D}{2})$$

Lubrication

These bearings are generally lubricated with grease. Grease is supplied through the clearance between the inner ring and the outer ring. Grease specification is shown in Table 14, ALVANIA GREASE EP2 (Shell Lubricants Japan K.K.) is prepacked as the lubricating grease. For bearings without prepacked grease, supply grease or oil for use. Operating without grease or oil will increase the wear of the rolling contact surfaces and cause a short bearing life.

When using a special grease, carefully examine the grease properties and contents such as base oil viscosity and extreme pressure additives. In this case, please contact IKO.

Table 14 Bearings with prepacked grease

○ : With prepacked grease    × : Without prepacked grease

| Model code  | Seal specification       |                     |                                |
|-------------|--------------------------|---------------------|--------------------------------|
|             | Open type<br>(No symbol) | Sealed type<br>(UU) | One side<br>sealed type<br>(U) |
| CRBHV... A  | ×                        | ○                   | —                              |
| CRBFV... A  | ×                        | ○                   | —                              |
| CRBC        | ×                        | ○                   | ×                              |
| CRB         | ×                        | ○                   | ×                              |
| CRBT ... A  | ○                        | —                   | —                              |
| CRBTF ... A | ○                        | —                   | —                              |
| CRBS        | ×                        | —                   | —                              |
| CRBS ... A  | —                        | ○                   | ×                              |
| CRBS ... V  | ×                        | ○                   | ×                              |

Oil Hole

For Crossed Roller Bearings, oil holes and oil grooves can be provided on bearing rings if requested. Not applicable to the Super Slim Type (Mounting Holed Type). When an oil hole is required on the outer ring, attach "OH" before the clearance symbol in the identification number. When an oil hole and an oil groove are required on the outer ring, attach "-OG" at the same place in the identification number. For an oil hole on the inner ring, attach "/OH", and for an oil hole and an oil groove on the inner ring, attach "/OG", at the same place in the identification number. High Rigidity Type Crossed Roller Bearings V and Mounting Holed Type High Rigidity Type Crossed Roller Bearings V have an oil groove and two oil holes on the outer ring as standard. Table 15 shows availability of oil holes for each bearing type.

Table 15 Oil holes

| Bearing type | Oil hole code |      |      |      |
|--------------|---------------|------|------|------|
|              | /nOH          | /nOG | -nOH | -nOG |
| CRBHV ... A  | ○             | ○    | —    | —(1) |
| CRBFV ... A  | —             | —    | —    | —(1) |
| CRBC         | ○             | ○    | ○    | ○    |
| CRB          | ○             | ○    | ○    | ○    |
| CRBT ... A   | —             | —    | —    | —    |
| CRBTF ... A  | —             | —    | —    | —    |
| CRBS         | ○             | —    | ○    | —    |
| CRBS ... A   | ○             | —    | ○    | —    |
| CRBS ... V   | ○             | —    | ○    | —    |

Notes(1) CRBHV ... A and CRBFV ... A are provided with an oil groove and two oil holes on the outer ring.  
Remark n denotes the number of oil holes not exceeding 4. For one oil hole, number is not indicated.  
When preparing multiple oil holes, please contact IKO.

**Example 1** When the inner ring has 4 oil holes

CRBC 10020 / 4OH C1

4 Oil holes  
In inner ring

**Example 2** When the outer ring has a single oil hole

CRBC 10020 - OH C1

1 Oil hole  
In outer ring

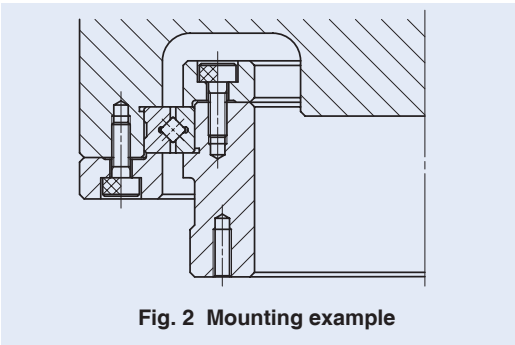
Operating Temperature Range

The operating temperature range for Crossed Roller Bearings is  $-20^{\circ}\text{C} \sim +120^{\circ}\text{C}$ . However, the maximum allowable temperature for types with separator and with seal is  $+110^{\circ}\text{C}$ , and  $+100^{\circ}\text{C}$  when they are continuously operated.

Mounting

When the rigidity of the mounting parts is not sufficient, stress concentration will occur at the contact area between the rollers and raceways, and the bearing performance will be deteriorated significantly. Therefore, it is necessary to carefully examine the rigidity of housing and the strength of fixing bolts when a large moment will be applied. The shoulder height diameters ( $d_a$  and  $D_a$ ) that are related to mounting should certainly satisfy the values shown in the dimension tables. When these dimensions are incorrect, deformations of inner and outer rings will occur and the bearing performance will be deteriorated remarkably.

1. Other than Mounting Holed Type Crossed Roller Bearings V



❶ The inner and outer rings should be securely fixed in the axial direction by using fixing plates, etc. Recommended thickness of the fixing plate is 1/2 or more of the bearing width  $B$ . The dimensions in the axial direction of the housing bore and the fixing

plates should be determined to get a secure fixing while considering the dimension of bearing width which is given a minus tolerance. (See Fig.2)

❷ The depth of the housing bore is recommended to be equal to or larger than the bearing width.

❸ Separation prevention bolts for the outer ring of Standard Type Crossed Roller Bearings are provided to prevent separation of two halves of the outer ring during transportation or mounting. When mounting, they should be loosened slightly.

❹ High Rigidity Type Crossed Roller Bearings V, Super Slim Type Crossed Roller Bearings and Slim Type Crossed Roller Bearings have a plug for hole for inserting rollers. When mounting the bearings, locate the plug at a position that is not included in the maximum loading zone. The plug location can be found by the pin pressed at the side of the outer ring.

2. Mounting Holed Type High Rigidity Crossed Roller Bearings V, Mounting Holed Type Super Slim Crossed Roller Bearings

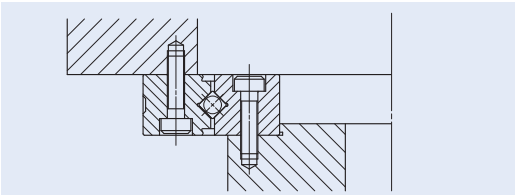


Fig. 3 Example of direct mounting to the mating surface of Mounting Holed Type High Rigidity Crossed Roller Bearings V

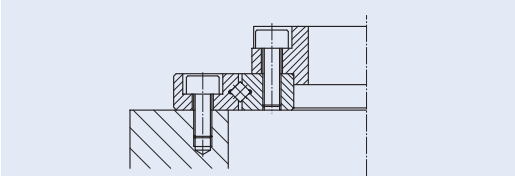


Fig. 4 Example of direct mounting to the mating surface of Mounting Holed Type Super Slim Crossed Roller Bearings

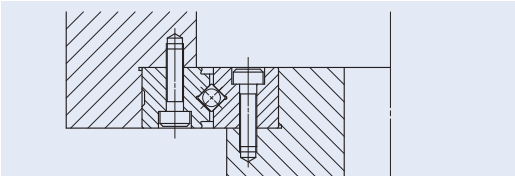


Fig. 5 Example of mounting to the housing of Mounting Holed Type High Rigidity Crossed Roller Bearings V

❶ Mounting Holed Type High Rigidity Crossed Roller Bearings V, Mounting Holed Type Super Slim Crossed Roller Bearings can be mounted directly to the mounting surface by fixing bolts. (See Fig. 3, Fig. 4)

❷ If large number of radial load and/or moment is expected, it is recommended to prepare flange part. (See Fig.5)

❸ Mounting Holed Type High Rigidity Crossed Roller Bearings V, Mounting Holed Type Super Slim Crossed Roller Bearings have a plug for hole for inserting cylindrical rollers. When mounting the bearings, locate the plug at a position that is not included in the maximum loading zone. The plug location can be found by the pin pressed at the side of the outer ring.

Tightening torque of mounting bolts

The standard tightening torque values for Mounting Holed Type High Rigidity Crossed Roller Bearings V, Mounting Holed Type Super Slim Crossed Roller Bearings mounting bolts are shown in Table 16. When machines or equipment are subjected to severe vibration, shock, large fluctuating load, or moment load, the bolts should be tightened with a torque 1.2 to 1.5 times higher than the standard torque values shown. If the mating member material is cast iron or aluminum, reduce the tightening torque depending on the strength characteristics of the mating member material.

Please do not tighten with too much torque as abnormal frictional torque or short life may occur.

Table 16 Tightening torque of mounting bolts

| Bolt size  | Tightening torque<br>N · m |
|------------|----------------------------|
| M2.5 × 0.4 | 0.58                       |
| M3 × 0.5   | 1.7                        |
| M4 × 0.7   | 4.0                        |
| M5 × 0.8   | 7.9                        |
| M8 × 1.25  | 32                         |

Above values are for Carbon steel bolt (Strength division 12.9)

Double Row Angular Contact Roller Bearing

We manufacture Double Row Angular Contact Roller Bearings to order. If needed, please contact IKO. Double Row Angular Contact Roller Bearings have a large number of cylindrical rollers with a large contact area with a raceway and an excellent load capability, between the inner and outer rings arranged in a double row of raceways. This underpins even higher rigidity and lower torque than High Rigidity Type Crossed Roller Bearings V.

The mounting holes in both inner and outer rings facilitate installation to your machines and equipment. Further, the integrated structure (non split) constructed in both inner and outer rings can avoid installation errors, yielding extra-high-rigidity and high-accuracy guiding performance without being affected by other peripheral structures such as housing or pressure plate.

For lubrication, use the two oil holes on the outer ring outer surface shown in Fig. 6.

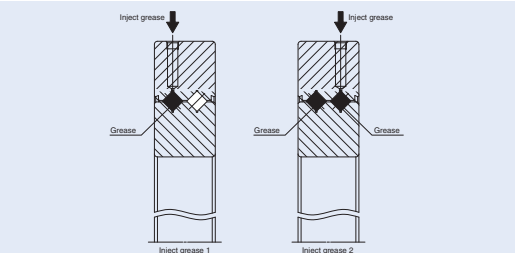


Fig. 6 Grease

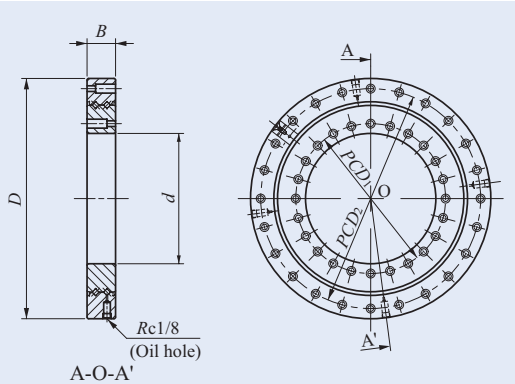
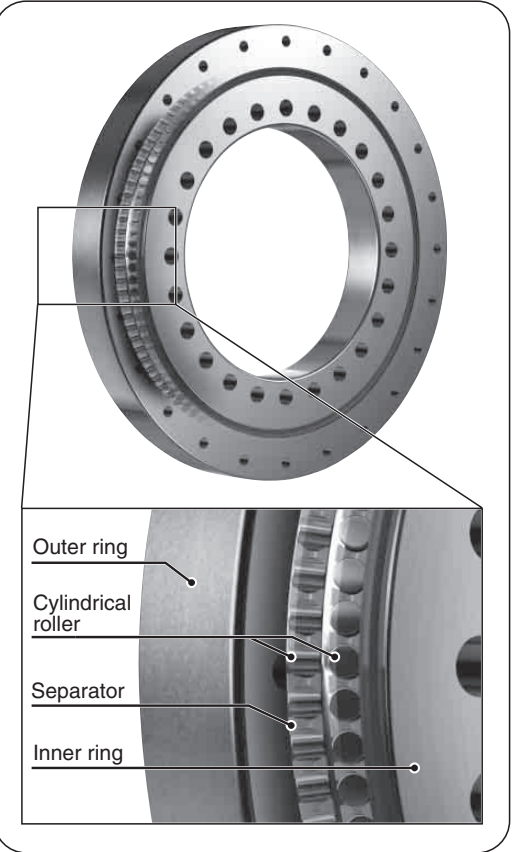


Fig. 7 Manufacturing example

Table 17 Example of manufacturing dimensions

| Boundary dimensions<br>mm |     |    |                  |                  |                  | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|---------------------------|-----|----|------------------|------------------|------------------|----------------------------------------|----------------------------------------------------|
| d                         | D   | B  | r <sub>min</sub> | PCD <sub>1</sub> | PCD <sub>2</sub> |                                        |                                                    |
| 160                       | 295 | 35 | 2                | 184              | 270              | 60 300                                 | 167 000                                            |
| 210                       | 380 | 40 | 2.5              | 240              | 350              | 108 000                                | 313 000                                            |
| 350                       | 540 | 50 | 2.5              | 385              | 505              | 235 000                                | 725 000                                            |

Structure of Double-acting Angular Roller Bearing



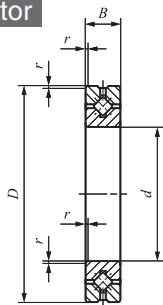
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CROSSED ROLLER BEARINGS

High Rigidity Type Crossed Roller Bearings V

Open Type/With Separator

Sealed Type/With Separator

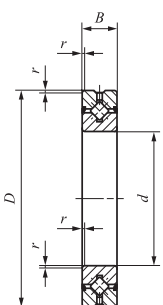


CRBHV ... A

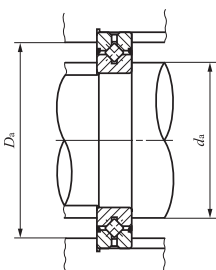
Shaft dia. 20 – 300mm

| Shaft dia.<br>mm | Identification number<br>High Rigidity Type Crossed Roller Bearings V |                  | Mass<br>(Ref.)<br>kg | Boundary dimensions mm |     |    |                                      |
|------------------|-----------------------------------------------------------------------|------------------|----------------------|------------------------|-----|----|--------------------------------------|
|                  | Open Type                                                             | Sealed Type      |                      | d                      | D   | B  | r <sup>(1)</sup><br>r <sub>min</sub> |
| 20               | CRBHV 208 A                                                           | CRBHV 208 A UU   | 0.04                 | 20                     | 36  | 8  | 0.3                                  |
| 25               | CRBHV 258 A                                                           | CRBHV 258 A UU   | 0.05                 | 25                     | 41  | 8  | 0.3                                  |
| 30               | CRBHV 3010 A                                                          | CRBHV 3010 A UU  | 0.12                 | 30                     | 55  | 10 | 0.3                                  |
| 35               | CRBHV 3510 A                                                          | CRBHV 3510 A UU  | 0.13                 | 35                     | 60  | 10 | 0.3                                  |
| 40               | CRBHV 4010 A                                                          | CRBHV 4010 A UU  | 0.15                 | 40                     | 65  | 10 | 0.3                                  |
| 45               | CRBHV 4510 A                                                          | CRBHV 4510 A UU  | 0.16                 | 45                     | 70  | 10 | 0.3                                  |
| 50               | CRBHV 5013 A                                                          | CRBHV 5013 A UU  | 0.29                 | 50                     | 80  | 13 | 0.6                                  |
| 60               | CRBHV 6013 A                                                          | CRBHV 6013 A UU  | 0.33                 | 60                     | 90  | 13 | 0.6                                  |
| 70               | CRBHV 7013 A                                                          | CRBHV 7013 A UU  | 0.38                 | 70                     | 100 | 13 | 0.6                                  |
| 80               | CRBHV 8016 A                                                          | CRBHV 8016 A UU  | 0.74                 | 80                     | 120 | 16 | 0.6                                  |
| 90               | CRBHV 9016 A                                                          | CRBHV 9016 A UU  | 0.81                 | 90                     | 130 | 16 | 0.6                                  |
| 100              | CRBHV 10020 A                                                         | CRBHV 10020 A UU | 1.45                 | 100                    | 150 | 20 | 0.6                                  |
| 110              | CRBHV 11020 A                                                         | CRBHV 11020 A UU | 1.56                 | 110                    | 160 | 20 | 0.6                                  |
| 120              | CRBHV 12025 A                                                         | CRBHV 12025 A UU | 2.62                 | 120                    | 180 | 25 | 1                                    |
| 130              | CRBHV 13025 A                                                         | CRBHV 13025 A UU | 2.82                 | 130                    | 190 | 25 | 1                                    |
| 140              | CRBHV 14025 A                                                         | CRBHV 14025 A UU | 2.96                 | 140                    | 200 | 25 | 1                                    |
| 150              | CRBHV 15025 A                                                         | CRBHV 15025 A UU | 3.16                 | 150                    | 210 | 25 | 1                                    |
| 200              | CRBHV 20025 A                                                         | CRBHV 20025 A UU | 4.00                 | 200                    | 260 | 25 | 1                                    |
| 250              | CRBHV 25025 A                                                         | CRBHV 25025 A UU | 4.97                 | 250                    | 310 | 25 | 1.5                                  |
| 300              | CRBH 30025 A                                                          | CRBH 30025 A UU  | 5.29                 | 300                    | 360 | 25 | 1.5                                  |

Note<sup>(1)</sup> Minimum allowable single value of chamfer dimension *r*  
Remarks1. The outer ring has an oil groove and two oil holes.  
2. No grease is prepacked for Open Type. Perform proper lubrication. Grease is prepacked for Sealed Type.  
3. If one side sealed type are needed, please contact IKO.



CRBHV ... AUU

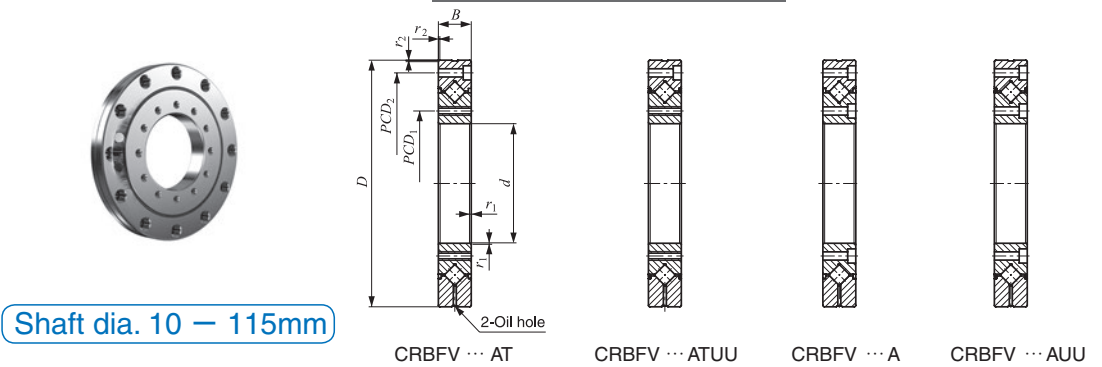


| Mounting dimensions mm |                | Basic dynamic load rating | Basic static load rating |
|------------------------|----------------|---------------------------|--------------------------|
| d <sub>a</sub>         | D <sub>a</sub> | C<br>N                    | C <sub>0</sub><br>N      |
| 24                     | 31             | 2 910                     | 2 430                    |
| 29                     | 36             | 3 120                     | 2 810                    |
| 36.5                   | 48.5           | 7 600                     | 8 370                    |
| 41.5                   | 53.5           | 7 900                     | 9 130                    |
| 46.5                   | 58.5           | 8 610                     | 10 600                   |
| 51.5                   | 63.5           | 8 860                     | 11 300                   |
| 56                     | 74             | 17 300                    | 20 900                   |
| 66                     | 84             | 18 800                    | 24 300                   |
| 76                     | 94             | 20 100                    | 27 700                   |
| 88                     | 112            | 32 100                    | 43 400                   |
| 98                     | 122            | 33 100                    | 46 800                   |
| 110                    | 140            | 50 900                    | 72 200                   |
| 120                    | 150            | 52 400                    | 77 400                   |
| 132                    | 168            | 73 400                    | 108 000                  |
| 142                    | 178            | 75 900                    | 115 000                  |
| 152                    | 188            | 81 900                    | 130 000                  |
| 162                    | 198            | 84 300                    | 138 000                  |
| 212                    | 248            | 92 300                    | 169 000                  |
| 262                    | 298            | 102 000                   | 207 000                  |
| 312                    | 348            | 112 000                   | 245 000                  |

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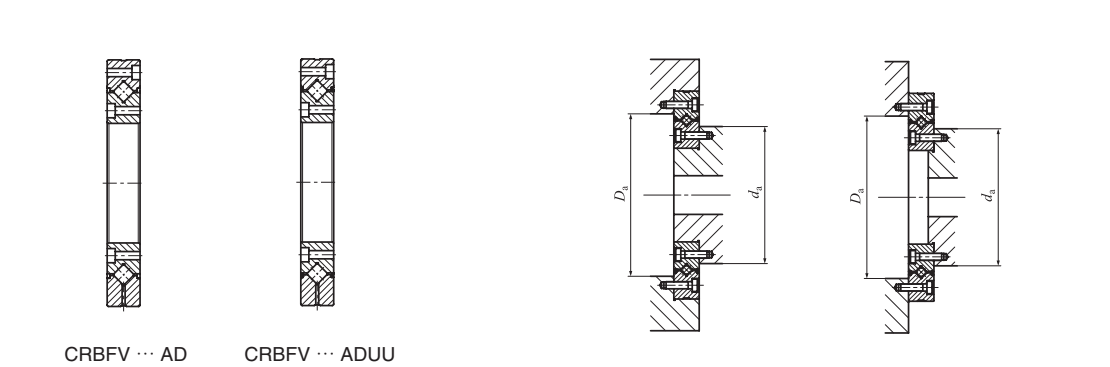
CROSSED ROLLER BEARINGS

Mounting Holed Type High Rigidity Open Type/With Separator  
Crossed Roller Bearings V Sealed Type/With Separator



| Shaft dia.<br>mm | Identification number                                                   |                   | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |     |    |                                     |                                     |
|------------------|-------------------------------------------------------------------------|-------------------|----------------------|---------------------------|-----|----|-------------------------------------|-------------------------------------|
|                  | Mounting Holed Type High Rigidity Crossed Roller Bearing V<br>Open Type | Sealed Type       |                      | d                         | D   | B  | <sup>(1)</sup><br>r <sub>1min</sub> | <sup>(1)</sup><br>r <sub>2min</sub> |
| 10               | CRBFV 108 AT                                                            | CRBFV 108 AT UU   | 0.12                 | 10                        | 52  | 8  | 0.3                                 | 0.3                                 |
| 20               | CRBFV 2012 AT                                                           | CRBFV 2012 AT UU  | 0.31                 | 20                        | 70  | 12 | 0.3                                 | 0.3                                 |
| 25               | CRBFV 2512 AT                                                           | CRBFV 2512 AT UU  | 0.40                 | 25                        | 80  | 12 | 0.6                                 | 0.6                                 |
| 35               | CRBFV 3515 AT                                                           | CRBFV 3515 AT UU  | 0.66                 | 35                        | 95  | 15 | 0.6                                 | 0.6                                 |
| 55               | CRBFV 5515 AT                                                           | CRBFV 5515 AT UU  | 0.96                 | 55                        | 120 | 15 | 0.6                                 | 0.6                                 |
| 80               | CRBFV 8022 AT                                                           | CRBFV 8022 AT UU  | 2.63                 | 80                        | 165 | 22 | 0.6                                 | 1                                   |
|                  | CRBFV 8022 A                                                            | CRBFV 8022 A UU   | 2.60                 |                           |     |    |                                     |                                     |
|                  | CRBFV 8022 AD                                                           | CRBFV 8022 AD UU  | 2.60                 |                           |     |    |                                     |                                     |
| 90               | CRBFV 9025 AT                                                           | CRBFV 9025 AT UU  | 4.83                 | 90                        | 210 | 25 | 1.5                                 | 1.5                                 |
|                  | CRBFV 9025 A                                                            | CRBFV 9025 A UU   | 4.67                 |                           |     |    |                                     |                                     |
|                  | CRBFV 9025 AD                                                           | CRBFV 9025 AD UU  | 4.67                 |                           |     |    |                                     |                                     |
| 115              | CRBFV 11528 AT                                                          | CRBFV 11528 AT UU | 6.81                 | 115                       | 240 | 28 | 1.5                                 | 1.5                                 |
|                  | CRBFV 11528 A                                                           | CRBFV 11528 A UU  | 6.63                 |                           |     |    |                                     |                                     |
|                  | CRBFV 11528 AD                                                          | CRBFV 11528 AD UU | 6.63                 |                           |     |    |                                     |                                     |

Note<sup>(1)</sup> Minimum allowable single value of chamfer diameter  $r_1$  and  $r_2$ .  
Remarks1. The outer ring has an oil groove and two oil holes.  
2. No grease is prepacked for Open Type. Perform proper lubrication. Grease is prepacked for Sealed Type.  
3. If one side sealed type are needed, please contact IKO.



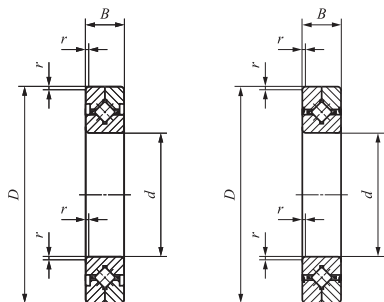
| Mounting holes mm |                                                                |                  |                                                                | Mounting dimensions<br>mm |                | Basic dynamic<br>load rating<br>C<br>N | Basic static<br>load rating<br>C <sub>0</sub><br>N |
|-------------------|----------------------------------------------------------------|------------------|----------------------------------------------------------------|---------------------------|----------------|----------------------------------------|----------------------------------------------------|
| PCD <sub>1</sub>  | Inner ring<br>Mounting holes                                   | PCD <sub>2</sub> | Outer ring<br>Mounting holes                                   | d <sub>a</sub>            | D <sub>a</sub> |                                        |                                                    |
| 16                | 4-M3 through                                                   | 42               | 6- $\phi$ 3.4 through<br>$\phi$ 6.5 counter bore depth 3.3     | 24                        | 31             | 2 910                                  | 2 430                                              |
| 28                | 6-M3 through                                                   | 57               | 6- $\phi$ 3.4 through<br>$\phi$ 6.5 counter bore depth 3.3     | 36.5                      | 48.5           | 7 600                                  | 8 370                                              |
| 35                | 6-M3 through                                                   | 67               | 6- $\phi$ 3.4 through<br>$\phi$ 6.5 counter bore depth 3.3     | 46.5                      | 58.5           | 8 610                                  | 10 600                                             |
| 45                | 8-M4 through                                                   | 83               | 8- $\phi$ 4.5 through<br>$\phi$ 8 counter bore depth 4.4       | 56                        | 74             | 17 300                                 | 20 900                                             |
| 65                | 8-M5 through                                                   | 105              | 8- $\phi$ 5.5 through<br>$\phi$ 9.5 counter bore depth 5.4     | 76                        | 94             | 20 100                                 | 27 700                                             |
| 97                | 10-M5 through                                                  | 148              | 10- $\phi$ 5.5 through<br>$\phi$ 9.5 counter bore<br>depth 5.4 | 107                       | 137            | 51 100                                 | 72 000                                             |
|                   | 10- $\phi$ 5.5 through<br>$\phi$ 9.5 counter bore<br>depth 5.4 |                  |                                                                |                           |                |                                        |                                                    |
| 112               | 12-M8 through                                                  | 187              | 12- $\phi$ 9 through<br>$\phi$ 14 counter bore<br>depth 12     | 132                       | 168            | 73 400                                 | 108 000                                            |
|                   | 12- $\phi$ 9 through<br>$\phi$ 14 counter bore<br>depth 12     |                  |                                                                |                           |                |                                        |                                                    |
| 139               | 12-M8 through                                                  | 217              | 12- $\phi$ 9 through<br>$\phi$ 14 counter bore<br>depth 13.5   | 162                       | 198            | 84 300                                 | 138 000                                            |
|                   | 12- $\phi$ 9 through<br>$\phi$ 14 counter bore<br>depth 13.5   |                  |                                                                |                           |                |                                        |                                                    |

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CROSSED ROLLER BEARINGS

Standard Type Crossed Roller Bearings

- Open Type/With Cage
- Open Type/Full Complement Type
- Sealed Type/With Cage
- Sealed Type/Full Complement Type

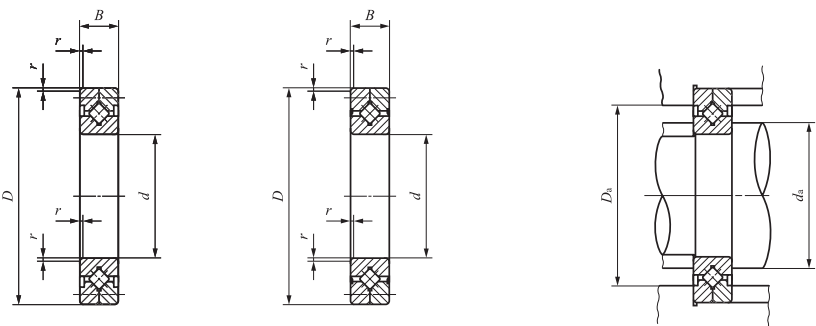


CRBC CRBC...UU

Shaft dia. 30 – 200mm

| Shaft<br>dia.<br><br>mm | Identification number |               |                 |              |  | Mass<br>(Ref.)<br><br>kg | Boundary dimensions<br>mm |          |          |
|-------------------------|-----------------------|---------------|-----------------|--------------|--|--------------------------|---------------------------|----------|----------|
|                         | With Cage             |               | Full complement |              |  |                          | <i>d</i>                  | <i>D</i> | <i>B</i> |
|                         | Open Type             | Sealed Type   | Open Type       | Sealed Type  |  |                          |                           |          |          |
| 30                      | CRBC 3010             | CRBC 3010 UU  | CRB 3010        | CRB 3010 UU  |  | 0.12                     | 30                        | 55       | 10       |
| 40                      | CRBC 4010             | CRBC 4010 UU  | CRB 4010        | CRB 4010 UU  |  | 0.15                     | 40                        | 65       | 10       |
| 50                      | CRBC 5013             | CRBC 5013 UU  | CRB 5013        | CRB 5013 UU  |  | 0.29                     | 50                        | 80       | 13       |
| 60                      | CRBC 6013             | CRBC 6013 UU  | CRB 6013        | CRB 6013 UU  |  | 0.33                     | 60                        | 90       | 13       |
| 70                      | CRBC 7013             | CRBC 7013 UU  | CRB 7013        | CRB 7013 UU  |  | 0.38                     | 70                        | 100      | 13       |
| 80                      | CRBC 8016             | CRBC 8016 UU  | CRB 8016        | CRB 8016 UU  |  | 0.74                     | 80                        | 120      | 16       |
| 90                      | CRBC 9016             | CRBC 9016 UU  | CRB 9016        | CRB 9016 UU  |  | 0.81                     | 90                        | 130      | 16       |
| 100                     | CRBC 10020            | CRBC 10020 UU | CRB 10020       | CRB 10020 UU |  | 1.45                     | 100                       | 150      | 20       |
| 110                     | CRBC 11020            | CRBC 11020 UU | CRB 11020       | CRB 11020 UU |  | 1.56                     | 110                       | 160      | 20       |
| 120                     | CRBC 12025            | CRBC 12025 UU | CRB 12025       | CRB 12025 UU |  | 2.62                     | 120                       | 180      | 25       |
| 130                     | CRBC 13025            | CRBC 13025 UU | CRB 13025       | CRB 13025 UU |  | 2.82                     | 130                       | 190      | 25       |
| 140                     | CRBC 14025            | CRBC 14025 UU | CRB 14025       | CRB 14025 UU |  | 2.96                     | 140                       | 200      | 25       |
| 150                     | CRBC 15025            | CRBC 15025 UU | CRB 15025       | CRB 15025 UU |  | 3.16                     | 150                       | 210      | 25       |
|                         | CRBC 15030            | CRBC 15030 UU | CRB 15030       | CRB 15030 UU |  | 5.30                     | 150                       | 230      | 30       |
| 200                     | CRBC 20025            | CRBC 20025 UU | CRB 20025       | CRB 20025 UU |  | 4.00                     | 200                       | 260      | 25       |
|                         | CRBC 20030            | —             | CRB 20030       | —            |  | 6.70                     | 200                       | 280      | 30       |
|                         | CRBC 20035            | —             | CRB 20035       | —            |  | 9.58                     | 200                       | 295      | 35       |

Note(1) Minimum allowable single value of chamfer dimension r  
Remarks1. No oil hole is provided.  
2. No grease is prepacked for Open Type. Perform proper lubrication. Grease is prepacked for Sealed Type.



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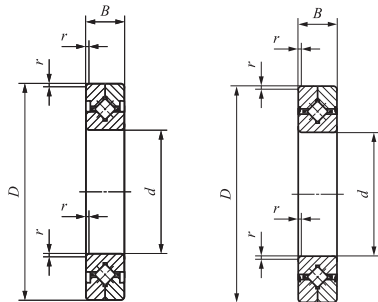
| r <sub>min</sub> <sup>(1)</sup> | Mounting dimensions mm |                | CRBC                                |                                                 | CRB                                 |                                                 |
|---------------------------------|------------------------|----------------|-------------------------------------|-------------------------------------------------|-------------------------------------|-------------------------------------------------|
|                                 | d <sub>a</sub>         | D <sub>a</sub> | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N | Basic dynamic load rating<br>C<br>N | Basic static load rating<br>C <sub>0</sub><br>N |
|                                 |                        |                |                                     |                                                 |                                     |                                                 |
| 0.3                             | 34                     | 44             | 3 830                               | 4 130                                           | 5 290                               | 6 350                                           |
| 0.3                             | 44                     | 54             | 4 280                               | 5 140                                           | 5 980                               | 8 040                                           |
| 0.6                             | 55                     | 71             | 10 700                              | 12 600                                          | 14 200                              | 18 400                                          |
| 0.6                             | 64                     | 81             | 11 600                              | 14 600                                          | 15 400                              | 21 500                                          |
| 0.6                             | 75                     | 91             | 12 300                              | 16 700                                          | 17 000                              | 25 500                                          |
| 0.6                             | 86                     | 107            | 18 200                              | 25 500                                          | 24 300                              | 37 500                                          |
| 1                               | 98                     | 118            | 19 400                              | 28 600                                          | 25 900                              | 42 100                                          |
| 1                               | 108                    | 134            | 31 500                              | 45 100                                          | 39 400                              | 61 100                                          |
| 1                               | 118                    | 144            | 33 500                              | 50 700                                          | 41 200                              | 66 700                                          |
| 1.5                             | 132                    | 164            | 47 700                              | 70 500                                          | 59 900                              | 95 400                                          |
| 1.5                             | 140                    | 172            | 49 200                              | 74 800                                          | 61 000                              | 99 800                                          |
| 1.5                             | 151                    | 183            | 50 700                              | 79 200                                          | 64 100                              | 108 000                                         |
| 1.5                             | 160                    | 192            | 53 800                              | 87 700                                          | 65 000                              | 113 000                                         |
| 1.5                             | 166                    | 202            | 69 200                              | 108 000                                         | 85 900                              | 144 000                                         |
| 2                               | 208                    | 239            | 60 200                              | 110 000                                         | 75 300                              | 148 000                                         |
| 2                               | 218                    | 262            | 108 000                             | 178 000                                         | 133 000                             | 234 000                                         |
| 2                               | 221                    | 274            | 137 000                             | 215 000                                         | 168 000                             | 282 000                                         |

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CROSSED ROLLER BEARINGS

Standard Type Crossed Roller Bearings

- Open Type/With Cage
- Open Type/Full Complement Type
- Sealed Type/With Cage
- Sealed Type/Full Complement Type



CRBC 25025  
CRBC 30025

CRB 25025UU  
CRB 30025UU

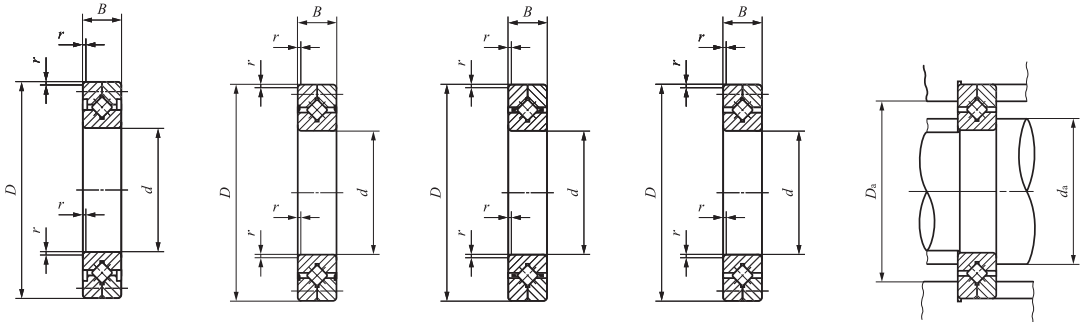
Shaft dia. 250 — 800mm

| Shaft<br>dia.<br><br>mm | Identification number |               |                 |              | Mass<br>(Ref.)<br><br>kg | Boundary dimensions<br>mm |          |          |
|-------------------------|-----------------------|---------------|-----------------|--------------|--------------------------|---------------------------|----------|----------|
|                         | With Cage             |               | Full complement |              |                          | <i>d</i>                  | <i>D</i> | <i>B</i> |
|                         | Open Type             | Sealed Type   | Open Type       | Sealed Type  |                          |                           |          |          |
| 250                     | CRBC 25025            | CRBC 25025 UU | CRB 25025       | CRB 25025 UU | 4.97                     | 250                       | 310      | 25       |
|                         | CRBC 25030            | —             | CRB 25030       | —            | 8.10                     | 250                       | 330      | 30       |
|                         | CRBC 25040            | —             | CRB 25040       | —            | 14.8                     | 250                       | 355      | 40       |
| 300                     | CRBC 30025            | CRBC 30025 UU | CRB 30025       | CRB 30025 UU | 5.88                     | 300                       | 360      | 25       |
|                         | CRBC 30035            | —             | CRB 30035       | —            | 13.4                     | 300                       | 395      | 35       |
|                         | CRBC 30040            | —             | CRB 30040       | —            | 17.2                     | 300                       | 405      | 40       |
| 400                     | CRBC 40035            | —             | CRB 40035       | —            | 14.5                     | 400                       | 480      | 35       |
|                         | CRBC 40040            | —             | CRB 40040       | —            | 23.5                     | 400                       | 510      | 40       |
|                         | CRBC 40070            | —             | CRB 40070       | —            | 72.4                     | 400                       | 580      | 70       |
| 500                     | CRBC 50040            | —             | CRB 50040       | —            | 26.0                     | 500                       | 600      | 40       |
|                         | CRBC 50050            | —             | CRB 50050       | —            | 41.7                     | 500                       | 625      | 50       |
|                         | CRBC 50070            | —             | CRB 50070       | —            | 86.1                     | 500                       | 680      | 70       |
| 600                     | CRBC 60040            | —             | CRB 60040       | —            | 30.6                     | 600                       | 700      | 40       |
|                         | CRBC 60070            | —             | CRB 60070       | —            | 102                      | 600                       | 780      | 70       |
|                         | CRBC 600120           | —             | CRB 600120      | —            | 274                      | 600                       | 870      | 120      |
| 700                     | CRBC 70045            | —             | CRB 70045       | —            | 46.5                     | 700                       | 815      | 45       |
|                         | CRBC 70070            | —             | CRB 70070       | —            | 115                      | 700                       | 880      | 70       |
|                         | CRBC 700150           | —             | CRB 700150      | —            | 478                      | 700                       | 1 020    | 150      |
| 800                     | CRBC 80070            | —             | CRB 80070       | —            | 109                      | 800                       | 950      | 70       |
|                         | CRBC 800100           | —             | CRB 800100      | —            | 247                      | 800                       | 1 030    | 100      |

Note(1) Minimum allowable single value of chamfer dimension *r*

Remarks1. No oil hole is provided.

2. No grease is prepacked for Open Type. Perform proper lubrication. Grease is prepacked for Sealed Type.



CRB 25025  
CRB 30025

CRB 25025UU  
CRB 30025UU

CRBC

CRB

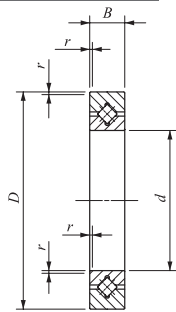
| $r_{min}^{(1)}$ | Mounting dimensions mm |       | CRBC                                  |                                        | CRB                                   |                                        |
|-----------------|------------------------|-------|---------------------------------------|----------------------------------------|---------------------------------------|----------------------------------------|
|                 | $d_a$                  | $D_a$ | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N | Basic dynamic load rating<br>$C$<br>N | Basic static load rating<br>$C_0$<br>N |
|                 |                        |       |                                       |                                        |                                       |                                        |
| 2.5             | 259                    | 290   | 67 200                                | 136 000                                | 83 900                                | 183 000                                |
| 2.5             | 265                    | 310   | 116 000                               | 208 000                                | 146 000                               | 283 000                                |
| 2.5             | 271                    | 330   | 179 000                               | 299 000                                | 215 000                               | 382 000                                |
| 2.5             | 310                    | 341   | 73 800                                | 162 000                                | 91 900                                | 217 000                                |
| 2.5             | 318                    | 372   | 163 000                               | 299 000                                | 205 000                               | 408 000                                |
| 2.5             | 321                    | 381   | 194 000                               | 351 000                                | 235 000                               | 451 000                                |
| 2.5             | 414                    | 457   | 133 000                               | 300 000                                | 165 000                               | 400 000                                |
| 2.5             | 423                    | 483   | 222 000                               | 455 000                                | 270 000                               | 590 000                                |
| 2.5             | 430                    | 532   | 470 000                               | 811 000                                | 576 000                               | 1 060 000                              |
| 2.5             | 517                    | 573   | 212 000                               | 497 000                                | 259 000                               | 648 000                                |
| 2.5             | 531                    | 592   | 247 000                               | 561 000                                | 306 000                               | 747 000                                |
| 2.5             | 530                    | 633   | 536 000                               | 1 020 000                              | 653 000                               | 1 330 000                              |
| 3               | 621                    | 676   | 231 000                               | 581 000                                | 287 000                               | 774 000                                |
| 3               | 630                    | 734   | 591 000                               | 1 230 000                              | 700 000                               | 1 540 000                              |
| 3               | 643                    | 817   | 1 250 000                             | 2 210 000                              | 1 490 000                             | 2 800 000                              |
| 3               | 730                    | 785   | 250 000                               | 681 000                                | 313 000                               | 917 000                                |
| 3               | 731                    | 834   | 630 000                               | 1 390 000                              | 766 000                               | 1 810 000                              |
| 3               | 751                    | 953   | 1 660 000                             | 3 010 000                              | 1 980 000                             | 3 820 000                              |
| 4               | 831                    | 907   | 417 000                               | 1 090 000                              | 513 000                               | 1 440 000                              |
| 4               | 840                    | 972   | 936 000                               | 2 040 000                              | 1 140 000                             | 2 640 000                              |

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CROSSED ROLLER BEARINGS

Super Slim Type Crossed Roller Bearings    Open Type/With Separator

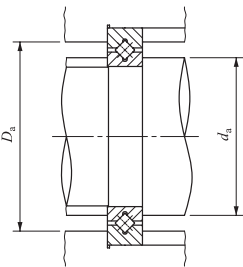


CRBT...A

Shaft dia. 10 – 50mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |    |   |                                 | Mounting<br>dimensions mm |                | Basic dynamic<br>load rating<br><br>C<br>N |
|------------------|-----------------------|---------------------|---------------------------|----|---|---------------------------------|---------------------------|----------------|--------------------------------------------|
|                  |                       |                     | d                         | D  | B | r <sup>(1)</sup> <sub>min</sub> | d <sub>a</sub>            | D <sub>a</sub> |                                            |
| 10               | CRBT 105 A            | 9.0                 | 10                        | 21 | 5 | 0.15                            | 12.5                      | 17             | 1 120                                      |
| 15               | CRBT 155 A            | 11.9                | 15                        | 26 | 5 | 0.15                            | 17.5                      | 22             | 1 320                                      |
| 20               | CRBT 205 A            | 14.8                | 20                        | 31 | 5 | 0.15                            | 22.5                      | 27             | 1 400                                      |
| 30               | CRBT 305 A            | 20.7                | 30                        | 41 | 5 | 0.15                            | 32.5                      | 37             | 1 770                                      |
| 40               | CRBT 405 A            | 26.5                | 40                        | 51 | 5 | 0.15                            | 42.5                      | 47             | 2 000                                      |
| 50               | CRBT 505 A            | 32.3                | 50                        | 61 | 5 | 0.15                            | 52.5                      | 57             | 2 280                                      |

Note<sup>(1)</sup> Minimum allowable single value of chamfer dimension *r* .  
Remarks1. No oil hole is provided.  
2. Grease is prepacked.

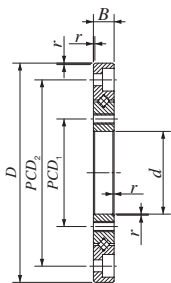


| Basic static<br>load rating<br><br>C <sub>0</sub><br>N |
|--------------------------------------------------------|
| 811                                                    |
| 1 110                                                  |
| 1 290                                                  |
| 1 970                                                  |
| 2 520                                                  |
| 3 200                                                  |

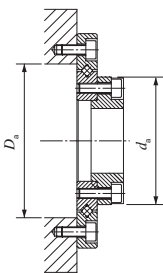
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CROSSED ROLLER BEARINGS

Mounting Holed Type Super Slim Crossed Roller Bearings **Open type/With Separator**



CRBTF...A



Shaft dia 10 — 40mm

| Shaft dia.<br>mm | Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions<br>mm |    |   |                                    | Inner ring<br>Mounting holes |
|------------------|-----------------------|---------------------|---------------------------|----|---|------------------------------------|------------------------------|
|                  |                       |                     | d                         | D  | B | <sup>(1)</sup><br>r <sub>min</sub> |                              |
| 10               | CRBTF 105 AT          | 46                  | 10                        | 43 | 5 | 0.15                               | 6-M2.5 through               |
| 20               | CRBTF 205 AT          | 66                  | 20                        | 53 | 5 | 0.15                               | 6-M2.5 through               |
| 30               | CRBTF 305 AT          | 83                  | 30                        | 63 | 5 | 0.15                               | 8-M2.5 through               |
| 40               | CRBTF 405 AT          | 103                 | 40                        | 73 | 5 | 0.15                               | 8-M2.5 through               |

Note<sup>(1)</sup> Minimum allowable single value of chamfer dimension *r*.  
Remarks1. No oil hole is provided.  
2. Grease is prepacked.

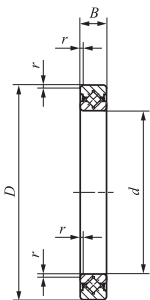
| Mounting holes mm       |                                               | Mounting dimensions<br>mm |                       | Basic dynamic load rating<br><i>C</i> | Basic static load rating<br><i>C</i> <sub>0</sub> |
|-------------------------|-----------------------------------------------|---------------------------|-----------------------|---------------------------------------|---------------------------------------------------|
| <i>PCD</i> <sub>a</sub> | Outer ring<br>Mounting holes                  | <i>d</i> <sub>a</sub>     | <i>D</i> <sub>a</sub> | N                                     | N                                                 |
|                         |                                               |                           |                       |                                       |                                                   |
| 35                      | 6-φ2.9 through<br>φ5.5 counter bore depth 2.8 | 21.5                      | 28                    | 1 500                                 | 1 410                                             |
| 45                      | 6-φ2.9 through<br>φ5.5 counter bore depth 2.8 | 31.5                      | 38                    | 1 890                                 | 2 150                                             |
| 55                      | 8-φ2.9 through<br>φ5.5 counter bore depth 2.8 | 41.5                      | 47.5                  | 2 140                                 | 2 750                                             |
| 65                      | 8-φ2.9 through<br>φ5.5 counter bore depth 2.8 | 51.5                      | 58                    | 2 440                                 | 3 490                                             |

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CROSSED ROLLER BEARINGS

Slim Type Crossed Roller Bearings

- Open Type/With Cage
- Open Type/Full Complement Type
- Sealed Type/With Separator
- Sealed Type/Full Complement Type



CRBS

Shaft dia. 50 – 200mm

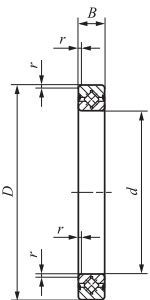
| Shaft<br>dia.<br><br>mm | Identification number  |                 |              |                 |  |             | Mass<br>(Ref.) |
|-------------------------|------------------------|-----------------|--------------|-----------------|--|-------------|----------------|
|                         | With Cage<br>Open Type | With Separator  |              | Full complement |  |             | g              |
|                         |                        | Sealed Type     |              | Open Type       |  | Sealed Type |                |
| 50                      | CRBS 508               | CRBS 508 A UU   | CRBS 508 V   | CRBS 508 V UU   |  | 84          |                |
| 60                      | CRBS 608               | CRBS 608 A UU   | CRBS 608 V   | CRBS 608 V UU   |  | 94          |                |
| 70                      | CRBS 708               | CRBS 708 A UU   | CRBS 708 V   | CRBS 708 V UU   |  | 108         |                |
| 80                      | CRBS 808               | CRBS 808 A UU   | CRBS 808 V   | CRBS 808 V UU   |  | 122         |                |
| 90                      | CRBS 908               | CRBS 908 A UU   | CRBS 908 V   | CRBS 908 V UU   |  | 135         |                |
| 100                     | CRBS 1008              | CRBS 1008 A UU  | CRBS 1008 V  | CRBS 1008 V UU  |  | 152         |                |
| 110                     | CRBS 1108              | CRBS 1108 A UU  | CRBS 1108 V  | CRBS 1108 V UU  |  | 163         |                |
| 120                     | CRBS 1208              | CRBS 1208 A UU  | CRBS 1208 V  | CRBS 1208 V UU  |  | 184         |                |
| 130                     | CRBS 1308              | CRBS 1308 A UU  | CRBS 1308 V  | CRBS 1308 V UU  |  | 199         |                |
| 140                     | CRBS 1408              | CRBS 1408 A UU  | CRBS 1408 V  | CRBS 1408 V UU  |  | 205         |                |
| 150                     | CRBS 1508              | CRBS 1508 A UU  | CRBS 1508 V  | CRBS 1508 V UU  |  | 220         |                |
| 160                     | CRBS 16013             | CRBS 16013 A UU | CRBS 16013 V | CRBS 16013 V UU |  | 620         |                |
| 170                     | CRBS 17013             | CRBS 17013 A UU | CRBS 17013 V | CRBS 17013 V UU |  | 675         |                |
| 180                     | CRBS 18013             | CRBS 18013 A UU | CRBS 18013 V | CRBS 18013 V UU |  | 710         |                |
| 190                     | CRBS 19013             | CRBS 19013 A UU | CRBS 19013 V | CRBS 19013 V UU |  | 740         |                |
| 200                     | CRBS 20013             | CRBS 20013 A UU | CRBS 20013 V | CRBS 20013 V UU |  | 780         |                |

Note<sup>(1)</sup> Minimum allowable single value of chamfer dimension *r*

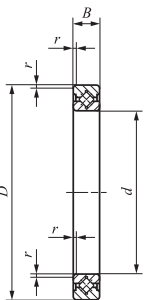
<sup>(2)</sup> No grease is prepacked. Perform proper lubrication.

<sup>(3)</sup> Grease is prepacked.

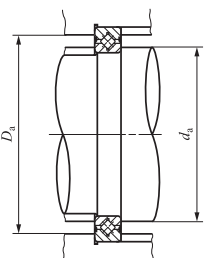
Remark No oil hole is provided.



CRBS...AUU  
...VUU



CRBS...V



| Boundary dimensions<br>mm |          |          |                                                    | Mounting<br>dimensions mm |                       | CRBS <sup>(2)</sup><br>With cage           |                                                        | CRBS...AUU <sup>(3)</sup><br>With Separator |                                                        | CRBS...V <sup>(2)</sup><br>CRBS...VUU <sup>(3)</sup><br>Full complement |                                                        |
|---------------------------|----------|----------|----------------------------------------------------|---------------------------|-----------------------|--------------------------------------------|--------------------------------------------------------|---------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------|
| <i>d</i>                  | <i>D</i> | <i>B</i> | <i>r</i> <sup>(1)</sup><br><i>r</i> <sub>min</sub> | <i>d</i> <sub>a</sub>     | <i>D</i> <sub>a</sub> | Basic dynamic load rating<br><i>C</i><br>N | Basic static load rating<br><i>C</i> <sub>0</sub><br>N | Basic dynamic load rating<br><i>C</i><br>N  | Basic static load rating<br><i>C</i> <sub>0</sub><br>N | Basic dynamic load rating<br><i>C</i><br>N                              | Basic static load rating<br><i>C</i> <sub>0</sub><br>N |
| 50                        | 66       | 8        | 0.4                                                | 54                        | 61                    | 4 900                                      | 6 170                                                  | 4 680                                       | 5 810                                                  | 6 930                                                                   | 9 800                                                  |
| 60                        | 76       | 8        | 0.4                                                | 64                        | 71                    | 5 350                                      | 7 310                                                  | 5 350                                       | 7 310                                                  | 7 600                                                                   | 11 700                                                 |
| 70                        | 86       | 8        | 0.4                                                | 74                        | 81                    | 5 740                                      | 8 440                                                  | 5 740                                       | 8 440                                                  | 8 190                                                                   | 13 600                                                 |
| 80                        | 96       | 8        | 0.4                                                | 84                        | 91                    | 6 130                                      | 9 590                                                  | 6 130                                       | 9 590                                                  | 8 790                                                                   | 15 500                                                 |
| 90                        | 106      | 8        | 0.4                                                | 94                        | 101                   | 6 490                                      | 10 700                                                 | 6 490                                       | 10 700                                                 | 9 310                                                                   | 17 400                                                 |
| 100                       | 116      | 8        | 0.4                                                | 104                       | 111                   | 6 850                                      | 11 900                                                 | 6 530                                       | 11 100                                                 | 9 850                                                                   | 19 300                                                 |
| 110                       | 126      | 8        | 0.4                                                | 114                       | 121                   | 7 160                                      | 13 000                                                 | 6 850                                       | 12 300                                                 | 10 300                                                                  | 21 200                                                 |
| 120                       | 136      | 8        | 0.4                                                | 124                       | 131                   | 7 530                                      | 14 100                                                 | 7 070                                       | 13 000                                                 | 10 900                                                                  | 23 000                                                 |
| 130                       | 146      | 8        | 0.4                                                | 134                       | 141                   | 7 860                                      | 15 300                                                 | 7 270                                       | 13 800                                                 | 11 200                                                                  | 24 600                                                 |
| 140                       | 156      | 8        | 0.4                                                | 144                       | 151                   | 8 060                                      | 16 400                                                 | 7 510                                       | 14 900                                                 | 11 700                                                                  | 26 800                                                 |
| 150                       | 166      | 8        | 0.4                                                | 154                       | 161                   | 8 350                                      | 17 500                                                 | 7 810                                       | 16 000                                                 | 12 100                                                                  | 28 700                                                 |
| 160                       | 186      | 13       | 0.6                                                | 166                       | 179                   | 20 300                                     | 39 900                                                 | 19 400                                      | 37 700                                                 | 26 900                                                                  | 58 200                                                 |
| 170                       | 196      | 13       | 0.6                                                | 176                       | 189                   | 20 900                                     | 42 200                                                 | 20 000                                      | 39 900                                                 | 27 800                                                                  | 61 600                                                 |
| 180                       | 206      | 13       | 0.6                                                | 186                       | 199                   | 21 500                                     | 44 600                                                 | 21 900                                      | 45 700                                                 | 28 600                                                                  | 65 200                                                 |
| 190                       | 216      | 13       | 0.6                                                | 196                       | 209                   | 22 100                                     | 46 900                                                 | 22 900                                      | 49 200                                                 | 29 300                                                                  | 68 600                                                 |
| 200                       | 226      | 13       | 0.6                                                | 206                       | 219                   | 22 500                                     | 49 300                                                 | 23 300                                      | 51 600                                                 | 30 000                                                                  | 72 200                                                 |

CRBHV  
CRBFV  
CRB(C)  
CRBT  
CRBTF  
CRBS

# SPHERICAL BUSHINGS

- Steel-on-steel Spherical Bushings
- Maintenance-free Spherical Bushings



## Structure and Features

IKO Spherical Bushings are self-aligning spherical plain bushings that have inner and outer rings with spherical sliding surfaces, and can take a large radial load and a bi-directional axial load at the same time. There are many types of Spherical Bushings, but they are basically divided into steel-on-steel types and maintenance-free types according to the kind of sliding surfaces.

Steel-on-steel Spherical Bushings have inner and outer rings of high carbon chromium bearing steel, of which sliding surfaces are phosphate-treated and then dry-coated with molybdenum disulfide (MoS<sub>2</sub>). They can, therefore, operate with low torque, and have excellent wear resistance and large load capacity. They are especially suitable for applications where there are alternate loads and shock loads. They have wide applications mainly in industrial and construction machinery.

Maintenance-free Spherical Bushings consist of an outer ring which has a special PTFE liner reinforced with copper alloy meshes on the sliding surface, and a spherical inner ring of which sliding surface has a hard chromium plating. Creep deformation due to compressive load is small, and wear resistance is superior. Thus, they are maintenance-free and can be used for extended periods of time without re-lubrication. They are especially suitable in cases where fixed directional loads are applied and are used mainly in food processing machines and construction machinery and in other applications in which the use of oil is undesirable or lubrication is not possible.

## Types

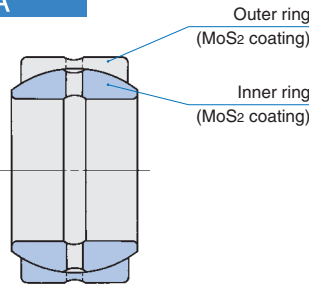
Spherical Bushings are available in various types shown in Table 1.

Table 1 Type of bearing

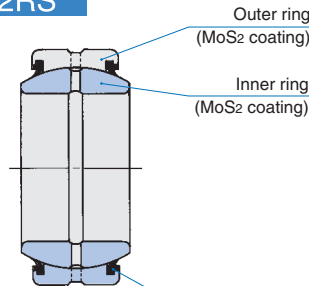
| Type   | Steel-on-steel |               | Maintenance-free |               |
|--------|----------------|---------------|------------------|---------------|
|        | Without seals  | With seals    | Without seals    | With seals    |
| Metric | SB             | —             | GE ... EC        | GE ... EC-2RS |
|        | SB ... A       | —             |                  |               |
|        | GE ... E, ES   | GE ... ES-2RS |                  |               |
|        | GE ... G, GS   | GE ... GS-2RS |                  |               |
| Inch   | SBB            | SBB ... -2RS  | —                | —             |

### Structures of Spherical Bushings

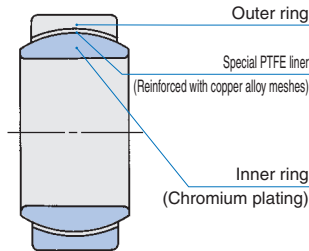
#### Steel-on-steel type SB...A



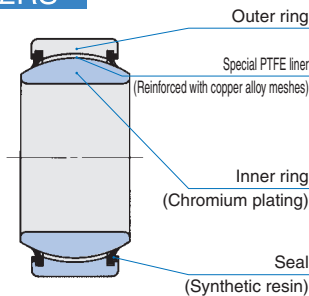
#### Steel-on-steel type GE...ES-2RS



#### Maintenance-free type GE...EC



#### Maintenance-free type GE...EC-2RS



Steel-on-steel Spherical Bushings SB

These bushings have an outer ring split into halves. The split outer ring and the inner ring are held together by a snap ring placed in the groove around the outer periphery of the outer ring.

Steel-on-steel Spherical Bushings SB...A

These bushings have an outer ring split only at one position, and therefore, the outer and inner rings will not separate. Handling before mounting and mounting to the housing are simple. The boundary dimensions are the same as those of the SB type. Therefore, SB and SB...A types are dimensionally interchangeable, but the radial internal clearances of the SB...A type are smaller than those of the SB type.

Steel-on-steel Spherical Bushings GE...E, GE...ES

The dimension series of these types conform to ISO standards and they can be used internationally. The outer ring is split at one position. The GE...E and GE...ES types are available. These are classified by bushing size.

The GE...ES type can be provided with seals, which are double-lip type polyurethane seals effective for prevention against grease leakage and dust penetration. The sealed type is indicated by the suffix "-2RS" at the end of the identification number.

Steel-on-steel Spherical Bushings GE...G, GE...GS

As compared with the GE...E and GE...ES types, these bushings have larger load capacities and larger permissible tilting angles. The dimension series also conform to ISO standards, and they can be used internationally. The outer ring is split at one position. The GE...G and GE...GS types are available. They are classified by bushing size.

The GE...GS type can be provided with seals, which are double-lip type polyurethane seals effective for prevention against grease leakage and dust penetration. The sealed type is indicated by the suffix "-2RS" at the end of the identification number.

Steel-on-steel Spherical Bushings SBB

These are inch series bushings. The outer ring is split at one position. These bushings can be provided with seals, which are double-lip type polyurethane seals effective for prevention against grease leakage and dust penetration. The sealed type is indicated by the suffix "-2RS" at the end of the identification number.

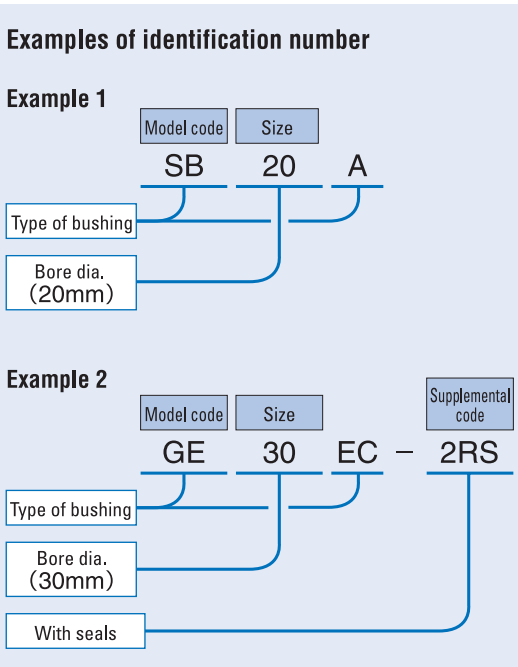
Maintenance-free Spherical Bushings GE...EC

These bushings have the same boundary dimensions as the GE...ES type and can be used internationally. A special PTFE liner reinforced with copper alloy meshes is used on the sliding surface. Therefore, creep deformation due to compressive loads is small, and wear resistance is superior. These bushings are used as maintenance-free bushings.

These bushings can be provided with synthetic resin seals which are effective in preventing dust penetration. They are indicated by the suffix "-2RS" at the end of the identification number. Spherical Bushings with superior rust prevention properties, which can be used in a corrosive environment or in an environment where water splashes, are also available on request. Please consult IKO.

Identification number

The identification number of Spherical Bushings consists of a model code, a size and any supplemental codes. Examples are shown below.



Accuracy

The tolerances of Steel-on-steel Spherical Bushings of the metric series is shown in Table 2.

The tolerances of the GE type are applicable to bushings before splitting the outer ring and after surface treatment.

The tolerances of the SB and SB...A types are applicable to bushings before splitting the outer ring and before surface treatment.

The tolerances of the GE...EC type are applicable to bushings before splitting the outer ring.

The tolerances of the Spherical Bushings of the inch series are shown in Table 3. The tolerances of the bore diameter are applicable to bushings after surface treatment, while other tolerances are applicable to bushings before splitting the outer ring and before surface treatment.

Although minor dimensional changes may occur during surface treatment, they have negligible influence on the overall performance.

Table 2 Tolerances of inner and outer rings of metric series (JIS Class 0) unit: μm

| $d$ or $D$ <sup>(1)</sup><br>Nominal bore dia. or outside dia.<br>mm |       | $\Delta_{dmp}$<br>Single plane<br>mean bore dia.<br>deviation |      | $\Delta_{Dmp}$<br>Single plane<br>mean outside<br>dia. deviation |      | $\Delta_{Bs}$ or $\Delta_{Cs}$<br>Deviation of a single<br>inner ring width or<br>outer ring width |       |
|----------------------------------------------------------------------|-------|---------------------------------------------------------------|------|------------------------------------------------------------------|------|----------------------------------------------------------------------------------------------------|-------|
| Over                                                                 | Incl. | High                                                          | Low  | High                                                             | Low  | High                                                                                               | Low   |
| 2.5                                                                  | 6     | 0                                                             | - 8  | -                                                                | -    | 0                                                                                                  | - 120 |
| 6                                                                    | 18    | 0                                                             | - 8  | 0                                                                | - 8  | 0                                                                                                  | - 120 |
| 18                                                                   | 30    | 0                                                             | - 10 | 0                                                                | - 9  | 0                                                                                                  | - 120 |
| 30                                                                   | 50    | 0                                                             | - 12 | 0                                                                | - 11 | 0                                                                                                  | - 120 |
| 50                                                                   | 80    | 0                                                             | - 15 | 0                                                                | - 13 | 0                                                                                                  | - 150 |
| 80                                                                   | 120   | 0                                                             | - 20 | 0                                                                | - 15 | 0                                                                                                  | - 200 |
| 120                                                                  | 150   | 0                                                             | - 25 | 0                                                                | - 18 | 0                                                                                                  | - 250 |
| 150                                                                  | 180   | 0                                                             | - 25 | 0                                                                | - 25 | 0                                                                                                  | - 250 |
| 180                                                                  | 250   | 0                                                             | - 30 | 0                                                                | - 30 | 0                                                                                                  | - 300 |
| 250                                                                  | 315   | 0                                                             | - 35 | 0                                                                | - 35 | 0                                                                                                  | - 350 |
| 315                                                                  | 400   | 0                                                             | - 40 | 0                                                                | - 40 | 0                                                                                                  | - 400 |
| 400                                                                  | 500   | 0                                                             | - 45 | 0                                                                | - 45 | 0                                                                                                  | - 450 |

Note(1)  $d$  for  $\Delta_{dmp}$ ,  $\Delta_{Bs}$  and  $\Delta_{Cs}$  and  $D$  for  $\Delta_{Dmp}$ , respectively.

Table 3 Tolerances of inner and outer rings of inch series SBB unit: μm

| $d$ or $D$ <sup>(1)</sup><br>Nominal bore dia. or outside dia.<br>mm |         | $\Delta_{dmp}$<br>Single plane<br>mean bore dia.<br>deviation |      | $\Delta_{Dmp}$<br>Single plane<br>mean outside<br>dia. deviation |      | $\Delta_{Bs}$ or $\Delta_{Cs}$<br>Deviation of a single<br>inner ring width or<br>outer ring width |       |
|----------------------------------------------------------------------|---------|---------------------------------------------------------------|------|------------------------------------------------------------------|------|----------------------------------------------------------------------------------------------------|-------|
| Over                                                                 | Incl.   | High                                                          | Low  | High                                                             | Low  | High                                                                                               | Low   |
| -                                                                    | 50.800  | 0                                                             | - 13 | 0                                                                | - 13 | 0                                                                                                  | - 130 |
| 50.800                                                               | 76.200  | 0                                                             | - 15 | 0                                                                | - 15 | 0                                                                                                  | - 130 |
| 76.200                                                               | 80.962  | 0                                                             | - 20 | 0                                                                | - 15 | 0                                                                                                  | - 130 |
| 80.962                                                               | 120.650 | 0                                                             | - 20 | 0                                                                | - 20 | 0                                                                                                  | - 130 |
| 120.650                                                              | 152.400 | 0                                                             | - 25 | 0                                                                | - 25 | 0                                                                                                  | - 130 |
| 152.400                                                              | 177.800 | -                                                             | -    | 0                                                                | - 25 | 0                                                                                                  | - 130 |
| 177.800                                                              | 222.250 | -                                                             | -    | 0                                                                | - 30 | 0                                                                                                  | - 130 |

Note(1)  $d$  for  $\Delta_{dmp}$ ,  $\Delta_{Bs}$  and  $\Delta_{Cs}$  and  $D$  for  $\Delta_{Dmp}$ , respectively.

Clearance

The radial internal clearances of Spherical Bushings are the values before splitting the outer ring, and are shown in Tables 4, 5 and 6. The radial internal clearances of the inch series are shown in the dimension table.

Clearances other than these can also be prepared on request. Please consult IKO.

Table 4 Radial internal clearance of SB and SB...A types (Steel-on-steel) unit: μm

| $d$<br>Nominal bore dia.<br>mm | SB type |      | SB ... A type |      |
|--------------------------------|---------|------|---------------|------|
|                                | Min.    | Max. | Min.          | Max. |
| 12                             | 70      | 125  | 32            | 68   |
| 15                             |         |      | 40            | 82   |
| 20                             |         |      | 75            | 140  |
| 22                             |         |      |               |      |
| 25                             |         |      |               |      |
| 30                             |         |      |               |      |
| 35                             | 85      | 150  |               |      |
| 40                             |         |      |               |      |
| 45                             |         |      |               |      |
| 50                             | 90      | 160  | 72            | 142  |
| 55                             |         |      |               |      |
| 60                             |         |      |               |      |
| 65                             | 95      | 170  |               |      |
| 70                             |         |      |               |      |
| 75                             |         |      |               |      |
| 80                             |         |      |               |      |
| 85                             | 100     | 185  | 85            | 165  |
| 90                             |         |      |               |      |
| 95                             |         |      |               |      |
| 100                            |         |      |               |      |
| 110                            | 110     | 200  |               |      |
| 115                            |         |      |               |      |
| 120                            |         |      |               |      |
| 130                            | 120     | 215  | 100           | 192  |
| 150                            |         |      |               |      |

Table 5 Radial internal clearance of GE type (Steel-on-steel)  
unit:  $\mu\text{m}$

| $d$<br>Nominal bore dia.<br>mm |                   | Radial internal clearance |      |
|--------------------------------|-------------------|---------------------------|------|
| GE···E<br>GE···ES              | GE···G<br>GE···GS | Min.                      | Max. |
| 4                              | —                 | 32                        | 68   |
| 5                              | —                 |                           |      |
| 6                              | —                 |                           |      |
| 8                              | 6                 |                           |      |
| 10                             | 8                 |                           |      |
| 12                             | 10                | 40                        | 82   |
| 15                             | 12                |                           |      |
| 17                             | 15                |                           |      |
| 20                             | 17                | 50                        | 100  |
| 25                             | 20                |                           |      |
| 30                             | 25                |                           |      |
| 35                             | 30                |                           |      |
| 40                             | 35                |                           |      |
| 45                             | 40                | 60                        | 120  |
| 50                             | 45                |                           |      |
| 60                             | 50                |                           |      |
| 70                             | 60                |                           |      |
| 80                             | 70                | 72                        | 142  |
| 90                             | 80                |                           |      |
| 100                            | 90                |                           |      |
| 110                            | 100               | 85                        | 165  |
| 120                            | 110               |                           |      |
| 140                            | 120               |                           |      |
| 160                            | 140               |                           |      |
| 180                            | 160               | 100                       | 192  |
| 200                            | 180               |                           |      |
| 220                            | 200               |                           |      |
| 240                            | 220               |                           |      |
| 260                            | 240               |                           |      |
| 280                            | 260               | 110                       | 214  |
| 300                            | 280               |                           |      |

Remark Also applicable to bushings with seals.

Table 6 Radial internal clearance of GE···EC type (Maintenance-free)  
unit:  $\mu\text{m}$

| $d$<br>Nominal bore dia.<br>mm | Radial internal clearance |      |
|--------------------------------|---------------------------|------|
|                                | Min.                      | Max. |
| 15                             | 0                         | 40   |
| 17                             |                           |      |
| 20                             |                           |      |
| 25                             | 0                         | 50   |
| 30                             |                           |      |
| 35                             |                           |      |
| 40                             |                           |      |
| 45                             | 0                         | 60   |
| 50                             |                           |      |
| 60                             |                           |      |
| 70                             | 0                         | 72   |

Remark Also applicable to bushings with seals.

Fit

The recommended fits for Spherical Bushings are shown in Tables 7 and 8.

Table 7 Recommended fits for Steel-on-steel Spherical Bushings

| Condition                             | Tolerance class |              |
|---------------------------------------|-----------------|--------------|
|                                       | Shaft           | Housing bore |
| Normal operation                      | h6, j6          | H7, J7       |
| With directionally indeterminate load | m6, n6          | M7, N7       |

Remark N7 tolerance is recommended for light metal housings.

Table 8 Recommended fits for Maintenance-free Spherical Bushings

| Tolerance class of shaft | Tolerance class of housing bore |
|--------------------------|---------------------------------|
| h6, j6                   | H7, J7, K7                      |

Remark K7 tolerance is recommended for light metal housings.

Selection of Spherical Bushings

Selection between the steel-on-steel type and the maintenance-free type is made considering the operating conditions such as load, lubrication, temperature, and sliding velocity.

Load capacity

1 Dynamic load capacity

The dynamic load capacity  $C_d$  is the maximum allowable load that can be applied on a spherical bushing under oscillating motion. It is obtained on the basis of the contact pressure on the spherical surfaces. The dynamic load capacity is also used for calculating the life of spherical bushings.

The recommended value of bushing load is obtained by multiplying the dynamic load capacity  $C_d$  by a numerical factor, which differs depending on the bushing type and the load condition. A guideline for selection is shown in Table 9.

Table 9 Guide for determination of load

| Type of bushing  | Load direction |               |
|------------------|----------------|---------------|
|                  | Constant       | Alternate     |
| Steel-on-steel   | $\leq 0.3C_d$  | $\leq 0.6C_d$ |
| Maintenance-free | $\leq C_d$     | $\leq 0.5C_d$ |

When the magnitude of load exceeds the value given in Table 9, please consult IKO.

The dynamic load capacity  $C_{dt}$  considering the influence of bushing temperature can be obtained from the following equation using the temperature factor.

$C_{dt}=f_t C_d$  .....(1)

where,  $C_{dt}$  : Dynamic load capacity considering temperature increase N

$f_t$  : Temperature factor (Refer to Table 10.)

$C_d$  : Dynamic load capacity N (Refer to the dimension tables.)

Table 10 Temperature factor  $f_t$

| Type of bushing  |               | Temperature $^{\circ}\text{C}$ |              |               |                |                |                |
|------------------|---------------|--------------------------------|--------------|---------------|----------------|----------------|----------------|
|                  |               | - 30<br>+ 80                   | + 80<br>+ 90 | + 90<br>+ 100 | + 100<br>+ 120 | + 120<br>+ 150 | + 150<br>+ 180 |
| Steel-on-steel   | Without seals | 1                              | 1            | 1             | 1              | 1              | 0.7            |
|                  | With seals    | 1                              | —            | —             | —              | —              | —              |
| Maintenance-free | Without seals | 1                              | 1            | 0.9           | 0.75           | 0.55           | —              |
|                  | With seals    | 1                              | —            | —             | —              | —              | —              |

2 Static load capacity

The static load capacity  $C_s$  is the maximum static load that can be applied on the spherical bushing without breaking inner and outer rings or causing any permanent deformation severe enough to render the bushing unusable.

It must be noted that if the magnitude of the applied load becomes comparable to the static load capacity of bushing, the stresses in the shaft or housing may also reach to their limits. This possibility must be taken into consideration in the design.

Equivalent radial load

Spherical Bushings can take radial and axial loads at the same time. When the magnitude and direction of loads are constant, the equivalent radial load can be obtained from the following equation.

$P = F_r + YF_a$  .....(2)

where,  $P$  : Equivalent radial load N

$F_r$  : Radial load N

$F_a$  : Axial load N

$Y$  : Axial load factor (Refer to Table 11.)

Table 11 Axial load factor  $Y$

| $F_a/F_r$        | 0.1 | 0.2 | 0.3 | 0.4      | 0.5 | > 0.5    |
|------------------|-----|-----|-----|----------|-----|----------|
| Type of bushing  |     |     |     |          |     |          |
| Steel-on-steel   | 1   | 2   | 3   | 4        | 5   | Unusable |
| Maintenance-free | 1   | 2   | 3   | Unusable |     |          |

Life

The life of Spherical Bushings is defined as the total number of oscillating motions before the bushings cannot be operated normally because of wear, increase in internal clearance, increase in sliding torque, rise of operating temperature, etc.

As the actual life is affected by many factors such as the material of the sliding surface, the magnitude and direction of load, lubrication, sliding velocity, etc., the calculated life can be used as a practical measure of expected service life.

1 Life of Steel-on-steel spherical bushings

[1] Confirmation of  $pV$  value

Before attempting to calculate the life, make sure that the operating conditions are within the permissible range by referring to the  $pV$  diagram in Fig.1.

When the operating conditions are out of the permissible range, please consult IKO.

The contact pressure  $p$  and the sliding velocity  $V$  are obtained from the following equations.

$p = \frac{100P}{C_{dt}}$  .....(3)

$V = 5.82 \times 10^{-4} d_k \beta f$  .....(4)

where,  $p$  : Contact pressure N/mm<sup>2</sup>

$P$  : Equivalent radial load N (Refer to equation (2).)

$C_{dt}$  : Dynamic load capacity considering temperature increase N  
(Refer to equation (1).)

$V$  : Sliding velocity mm/s

$d_k$  : Sphere diameter mm

(Refer to the dimension tables.)

$2\beta$  : Oscillating angle degrees (Refer to Fig.2.)

when  $\beta < 5^{\circ}$ ,  $\beta = 5$

when rotating,  $\beta = 90$

$f$  : Number of oscillations per minute min<sup>-1</sup>

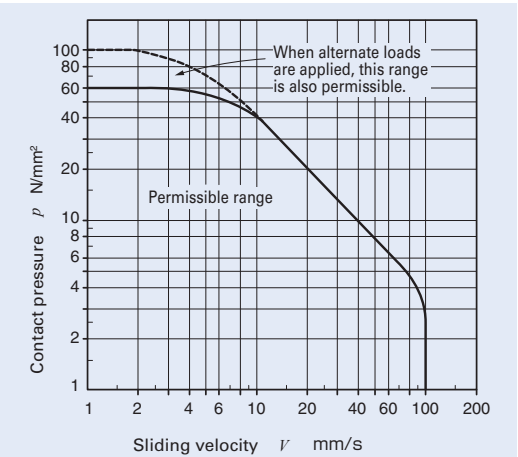


Fig.1  $pV$  diagram of Steel-on-steel spherical bushings

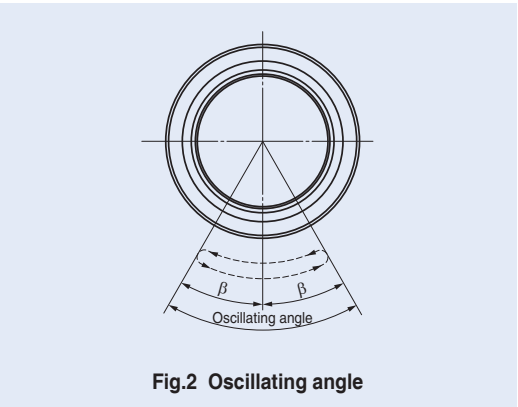


Fig.2 Oscillating angle

[2] Life calculation

The life of steel-on-steel spherical bushings can be calculated from the following equations.

$$G = \frac{3.18b_1b_2b_3}{\sqrt{d_k}\beta} \left(\frac{C_{dt}}{P}\right)^2 \times 10^5 \dots\dots\dots (5)$$

$$L_h = \frac{G}{60f} \dots\dots\dots (6)$$

- where, *G* : Life (Total number of oscillations)
- b*<sub>1</sub> : Load directional factor (Refer to Table 12.)
- b*<sub>2</sub> : Lubrication factor (Refer to Table 13.)
- b*<sub>3</sub> : Sliding velocity factor (Refer to Fig.3.)
- C*<sub>dt</sub> : Dynamic load capacity considering temperature increase N (Refer to equation (1).)
- P* : Equivalent radial load N (Refer to equation (2).)
- L*<sub>h</sub> : Life in hours h
- f* : Number of oscillations per minute min<sup>-1</sup>

Table 12 Load directional factor *b*<sub>1</sub> (Steel-on-steel)

| Load direction                                | Constant | Alternate |
|-----------------------------------------------|----------|-----------|
| Load directional factor <i>b</i> <sub>1</sub> | 1        | 5         |

Table 13 Lubrication factor *b*<sub>2</sub>

| Periodical lubrication                   | None | Regular |
|------------------------------------------|------|---------|
| Lubrication factor <i>b</i> <sub>2</sub> | 1    | 15      |

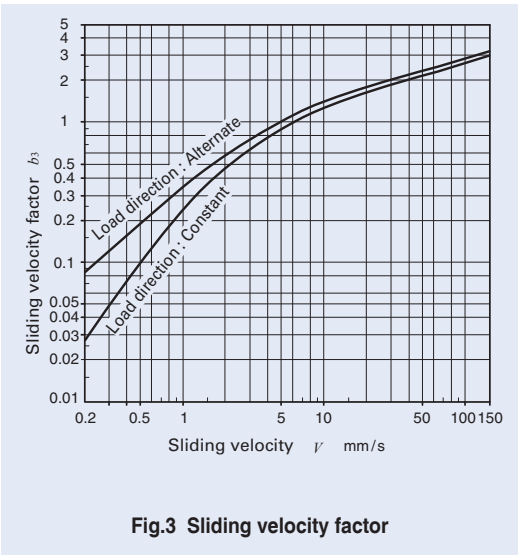


Fig.3 Sliding velocity factor

② Life of Maintenance-free spherical bushings

[1] Confirmation of *pV* value

Before attempting to calculate the life, make sure that the operating conditions are within the permissible range by referring to the *pV* diagram in Fig.4.

When the operating conditions are out of the permissible range, please consult IKO.

The contact pressure *p* and the sliding velocity *V* are obtained from equations (3) and (4) shown on page K6.

[2] Life calculation

The life of maintenance-free spherical bushings is obtained from the total sliding distance *S* which is given in Fig.5 for the contact pressure *p* obtained from equation (3).

The total number of oscillations and life in hours can be obtained from the following equations.

$$G = 16.67 \times b_1 \frac{Sf}{V} \dots\dots\dots (7)$$

$$L_h = \frac{G}{60f} \dots\dots\dots (8)$$

- where, *G* : Life (Total number of oscillations)
- b*<sub>1</sub> : Load directional factor (Refer to Table 14.)
- S* : Total sliding distance m (Refer to Fig.5.)
- f* : Number of oscillations per minute min<sup>-1</sup>
- V* : Sliding velocity mm/s
- L*<sub>h</sub> : Life in hours h

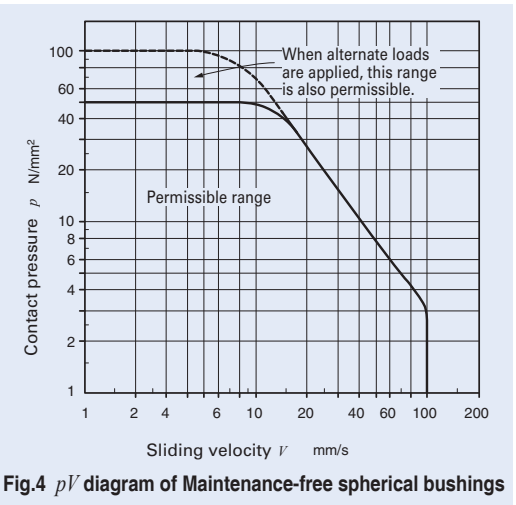


Fig.4 *pV* diagram of Maintenance-free spherical bushings

Table 14 Load directional factor *b*<sub>1</sub> (Maintenance-free)

| Load direction                                | Constant | Alternate          |
|-----------------------------------------------|----------|--------------------|
| Load directional factor <i>b</i> <sub>1</sub> | 1        | 0.2 <sup>(1)</sup> |

Note<sup>(1)</sup> This value is applicable when the load changes comparatively slowly. When the load changes rapidly, please consult IKO, as the factor degrades sharply.

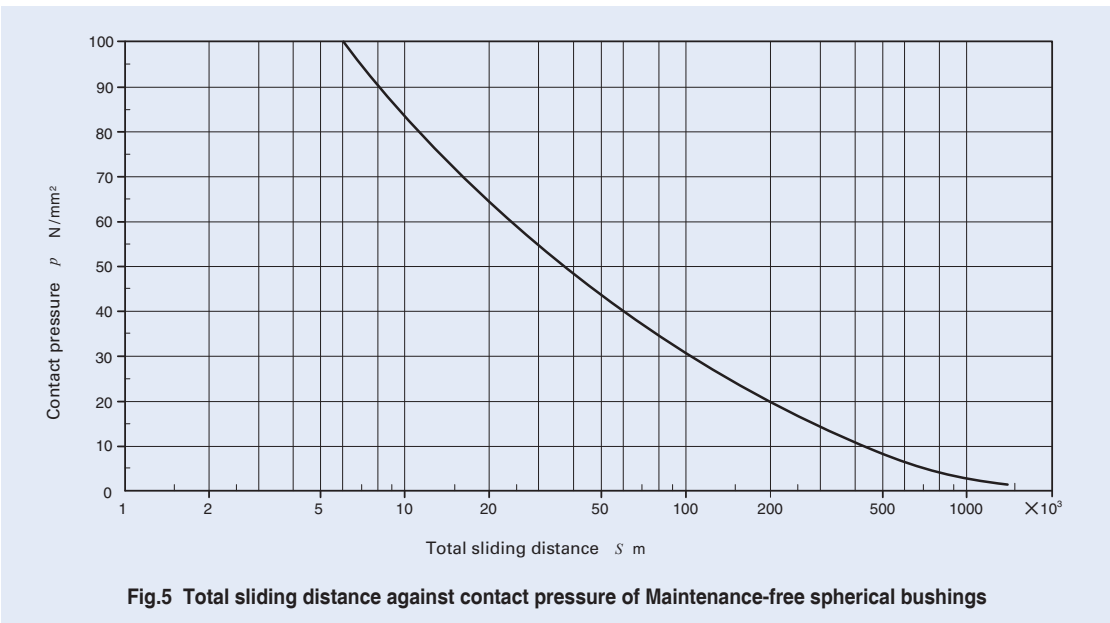


Fig.5 Total sliding distance against contact pressure of Maintenance-free spherical bushings

■ Lubrication

Steel-on-steel Spherical Bushings require periodic grease lubrication as a general rule. During initial operation, it is recommended to shorten the lubrication interval. Lithium soap based grease (NLGI consistency No.2) containing molybdenum disulfide (MoS2) is widely used as the lubrication grease. For Maintenance-free Spherical Bushings, lubrication is not required. However, supplying lithium soap based grease before operation can extend the life of the Spherical Bushing. Also, to protect the bearing from foreign substances and corrosion, it is effective to fill the area around the bearing with grease.

■ Oil Hole

The number of oil holes on inner and outer rings is shown in Table 15.

Table 15 Number of oil holes on inner and outer rings

| Bushing type                        |               |                  | Number of oil holes on inner and outer rings |
|-------------------------------------|---------------|------------------|----------------------------------------------|
| Steel-on-steel Spherical Bushings   | Metric series | GE...E           | 0                                            |
|                                     |               | GE...G           |                                              |
|                                     |               | SB, SB...A       | 2                                            |
|                                     |               | GE...ES, GE...GS |                                              |
|                                     | Inch series   | SBB              | 2                                            |
| Maintenance-free Spherical Bushings | Metric series | GE...EC          | 0                                            |

Remark Types with oil holes are also provided with oil grooves on inner and outer rings.

Operating Temperature Range

The operating temperature range for Spherical Bushings with seals is -30°C~+80°C.  
The maximum allowable temperature for Spherical Bushings without seals is +180 °C for the steel-on-steel type and +150 °C for the maintenance-free type.

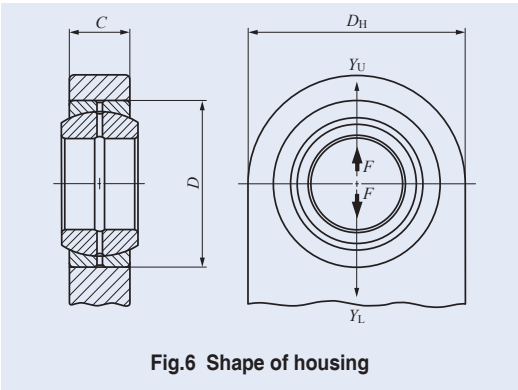
Precautions for Use

Design of shaft

When the load is large, sliding may occur between the shaft and the inner ring bore of bushing. For such cases, it is necessary to prepare the shaft with a hardness of 58HRC or greater and surface roughness of 0.8 μmR<sub>a</sub> or less.  
Furthermore, attention must be paid to the strength of shaft because the shear and/or bending stresses in the shaft may surpass the allowable values even when the load is below the static load capacity of Spherical Bushings.

Design of housing

The housing should have sufficient rigidity to avoid harmful deformation under load.  
When the housing shown in Fig.6 is used, it should be designed with sufficient strength as follows.



① When the load acts in the Y<sub>L</sub> direction;  
Select the housing material considering the compressive stress obtained from the following equation.

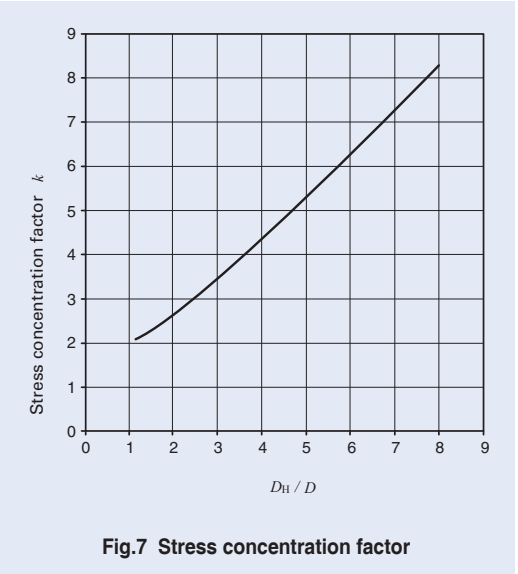
$$\sigma_1 = \frac{F}{CD} \dots\dots\dots (9)$$

where,  $\sigma_1$  : Maximum compressive stress occurring in the housing bore N/mm<sup>2</sup>  
F : Applied load N  
C : Width of outer ring and housing mm  
D : Outside diameter of outer ring mm

② When the load acts in the Yu direction ;  
Select the housing material considering the tensile stress obtained from the following equation.

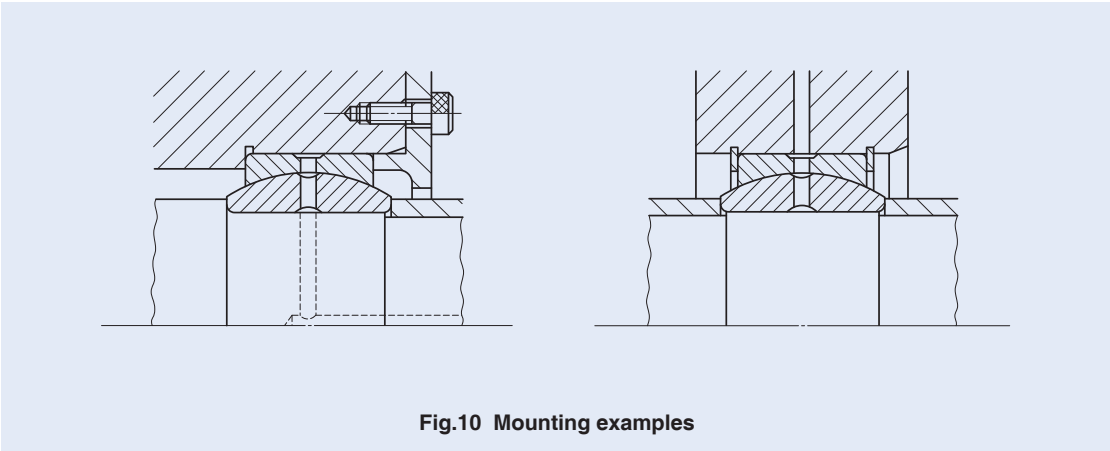
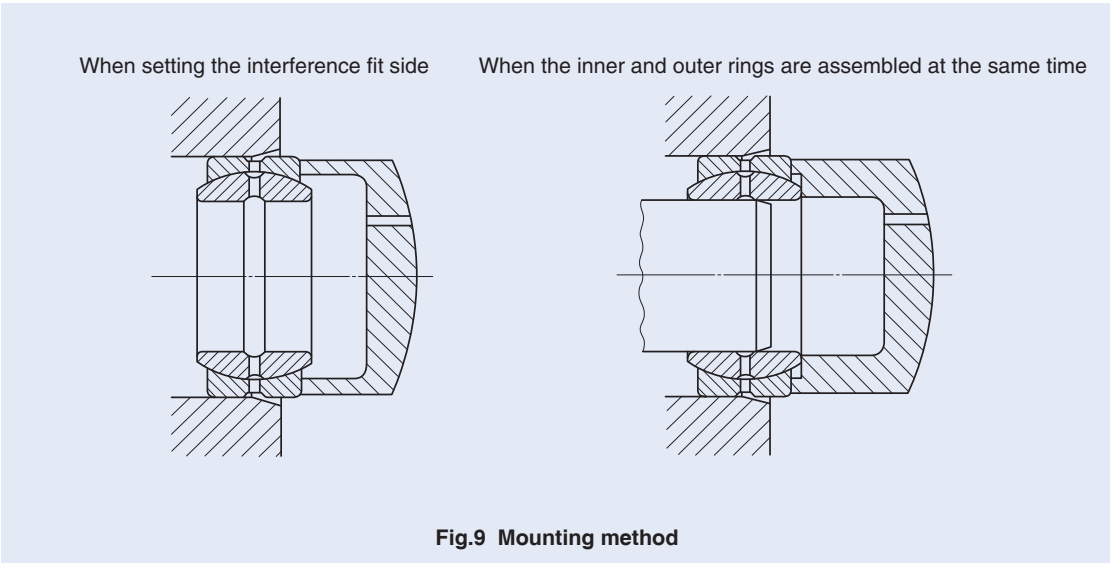
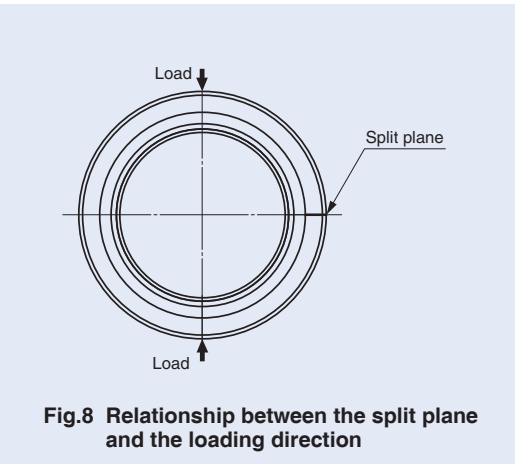
$$\sigma_2 = \frac{F}{C (D_H - D)} k \dots\dots\dots (10)$$

where,  $\sigma_2$  : Maximum tensile stress occurring in the housing bore N/mm<sup>2</sup>  
F : Applied load N  
C : Width of outer ring and housing mm  
D<sub>H</sub> : Outside diameter of housing mm  
D : Outside diameter of outer ring mm  
k : Stress concentration factor (Refer to Fig.7.)



Mounting

- ① When mounting Spherical Bushings, pay attention to the location of the split plane of the outer ring. Set the split plane at right angles to the direction of load to avoid the application of load to the split plane as shown in Fig. 8.
- ② The shoulder dimensions of shaft and housing are shown in the dimension tables.



SPHERICAL BUSHINGS

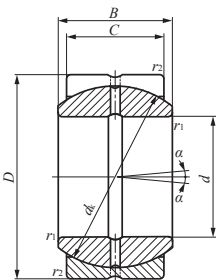
Steel-on-steel Spherical Bushings



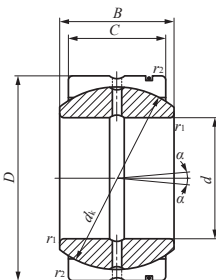
Shaft dia. 12 – 100mm

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |          |          |          |                      |                                            | Permissible<br>tilting angle<br>degree<br><i>a</i> |
|------------------|-----------------------|-------------|----------------------|---------------------------|----------|----------|----------|----------------------|--------------------------------------------|----------------------------------------------------|
|                  |                       |             |                      | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>d<sub>k</sub></i> | <i>r<sub>s</sub></i> <sup>(1)</sup><br>min |                                                    |
| 12               | SB 12A                | SB 122211   | 0.019                | 12                        | 22       | 11       | 9        | 18                   | 0.3                                        | 7                                                  |
| 15               | SB 15A                | SB 152613   | 0.028                | 15                        | 26       | 13       | 11       | 22                   | 0.3                                        | 6                                                  |
| 20               | SB 20A                | SB 203216   | 0.053                | 20                        | 32       | 16       | 14       | 28                   | 0.3                                        | 4                                                  |
| 22               | SB 22A                | SB 223719   | 0.085                | 22                        | 37       | 19       | 16       | 32                   | 0.3                                        | 6                                                  |
| 25               | SB 25A                | SB 254221   | 0.116                | 25                        | 42       | 21       | 18       | 36                   | 0.3                                        | 5                                                  |
| 30               | SB 30A                | SB 305027   | 0.225                | 30                        | 50       | 27       | 23       | 45                   | 0.6                                        | 6                                                  |
| 35               | SB 35A                | SB 355530   | 0.300                | 35                        | 55       | 30       | 26       | 50                   | 0.6                                        | 5                                                  |
| 40               | SB 40A                | SB 406233   | 0.375                | 40                        | 62       | 33       | 28       | 55                   | 0.6                                        | 6                                                  |
| 45               | SB 45A                | SB 457236   | 0.600                | 45                        | 72       | 36       | 31       | 62                   | 0.6                                        | 5                                                  |
| 50               | SB 50A                | SB 508042   | 0.870                | 50                        | 80       | 42       | 36       | 72                   | 0.6                                        | 5                                                  |
| 55               | SB 55A                | SB 559047   | 1.26                 | 55                        | 90       | 47       | 40       | 80                   | 0.6                                        | 5                                                  |
| 60               | SB 60A                | SB 6010053  | 1.70                 | 60                        | 100      | 53       | 45       | 90                   | 0.6                                        | 6                                                  |
| 65               | SB 65A                | SB 6510555  | 2.05                 | 65                        | 105      | 55       | 47       | 94                   | 0.6                                        | 5                                                  |
| 70               | SB 70A                | SB 7011058  | 2.22                 | 70                        | 110      | 58       | 50       | 100                  | 0.6                                        | 5                                                  |
| 75               | SB 75A                | SB 7512064  | 3.02                 | 75                        | 120      | 64       | 55       | 110                  | 0.6                                        | 5                                                  |
| 80               | SB 80A                | SB 8013070  | 3.98                 | 80                        | 130      | 70       | 60       | 120                  | 0.6                                        | 5                                                  |
| 85               | SB 85A                | SB 8513574  | 4.29                 | 85                        | 135      | 74       | 63       | 125                  | 0.6                                        | 6                                                  |
| 90               | SB 90A                | SB 9014076  | 4.71                 | 90                        | 140      | 76       | 65       | 130                  | 0.6                                        | 5                                                  |
| 95               | SB 95A                | SB 9515082  | 6.05                 | 95                        | 150      | 82       | 70       | 140                  | 0.6                                        | 5                                                  |
| 100              | SB 100A               | SB 10016088 | 7.42                 | 100                       | 160      | 88       | 75       | 150                  | 1                                          | 5                                                  |

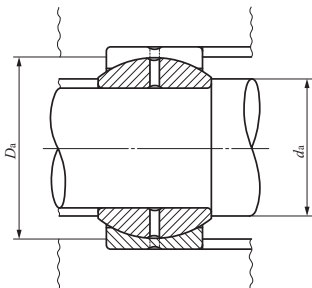
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions *r*<sub>1</sub> and *r*<sub>2</sub>  
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of *d<sub>a</sub>*.  
Remarks1. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
2. No grease is prepacked. Perform proper lubrication.



SB...A



SB



| Mounting dimensions<br>mm |                     |                      |      | Dynamic load<br>capacity<br><i>C<sub>d</sub></i> | Static load<br>capacity<br><i>C<sub>s</sub></i> |
|---------------------------|---------------------|----------------------|------|--------------------------------------------------|-------------------------------------------------|
| <i>d<sub>a</sub></i>      |                     | <i>D<sub>a</sub></i> |      | <i>C<sub>d</sub></i><br>N                        | <i>C<sub>s</sub></i><br>N                       |
| Min.                      | Max. <sup>(2)</sup> | Max.                 | Min. |                                                  |                                                 |
| 14                        | 14                  | 19.5                 | 17   | 15 900                                           | 95 300                                          |
| 17.5                      | 17.5                | 23.5                 | 21   | 23 700                                           | 142 000                                         |
| 22.5                      | 23                  | 29.5                 | 26   | 38 400                                           | 231 000                                         |
| 24.5                      | 25.5                | 34.5                 | 30   | 50 200                                           | 301 000                                         |
| 27.5                      | 29                  | 39.5                 | 34   | 63 500                                           | 381 000                                         |
| 34.5                      | 36                  | 45.5                 | 42   | 101 000                                          | 609 000                                         |
| 39.5                      | 40                  | 50.5                 | 46.5 | 127 000                                          | 765 000                                         |
| 44                        | 44                  | 57.5                 | 51.5 | 151 000                                          | 906 000                                         |
| 49.5                      | 50.5                | 67.5                 | 58   | 188 000                                          | 1 130 000                                       |
| 54.5                      | 58.5                | 75.5                 | 67   | 254 000                                          | 1 530 000                                       |
| 59.5                      | 64.5                | 85.5                 | 74.5 | 314 000                                          | 1 880 000                                       |
| 64.5                      | 72.5                | 95.5                 | 83.5 | 397 000                                          | 2 380 000                                       |
| 69.5                      | 76                  | 100.5                | 87   | 433 000                                          | 2 600 000                                       |
| 74.5                      | 81.5                | 105.5                | 93   | 490 000                                          | 2 940 000                                       |
| 79.5                      | 89.5                | 115.5                | 102  | 593 000                                          | 3 560 000                                       |
| 84.5                      | 97.5                | 125.5                | 112  | 706 000                                          | 4 240 000                                       |
| 89.5                      | 100.5               | 130.5                | 116  | 772 000                                          | 4 630 000                                       |
| 94.5                      | 105.5               | 135.5                | 121  | 829 000                                          | 4 970 000                                       |
| 99.5                      | 113.5               | 145.5                | 130  | 961 000                                          | 5 770 000                                       |
| 105.5                     | 121.5               | 154.5                | 139  | 1 100 000                                        | 6 620 000                                       |

SPHERICAL BUSHINGS

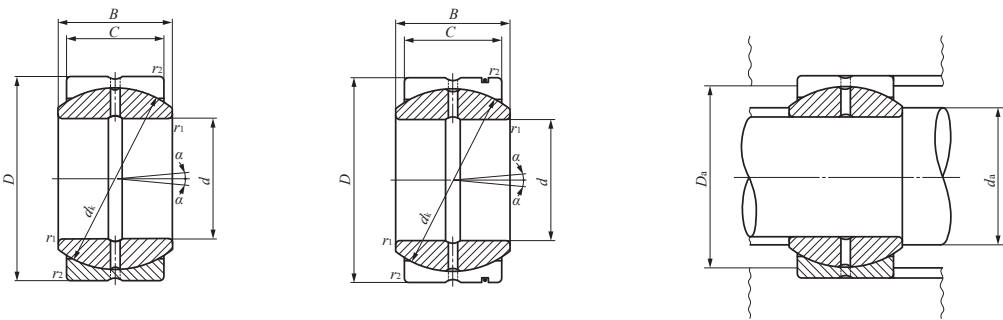
Steel-on-steel Spherical Bushings



Shaft dia. 110 – 150mm

| Shaft dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |          |          |          |                      |                                            | Permissible<br>tilting angle<br>degree<br><i>a</i> |
|------------------|-----------------------|--------------|----------------------|---------------------------|----------|----------|----------|----------------------|--------------------------------------------|----------------------------------------------------|
|                  |                       |              |                      | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>d<sub>k</sub></i> | <i>r<sub>s</sub></i> <sup>(1)</sup><br>min |                                                    |
| 110              | SB 110A               | SB 11017093  | 8.55                 | 110                       | 170      | 93       | 80       | 160                  | 1                                          | 5                                                  |
| 115              | SB 115A               | SB 11518098  | 10.3                 | 115                       | 180      | 98       | 85       | 165                  | 1                                          | 5                                                  |
| 120              | SB 120A               | SB 120190105 | 12.4                 | 120                       | 190      | 105      | 90       | 175                  | 1                                          | 5                                                  |
| 130              | SB 130A               | SB 130200110 | 13.8                 | 130                       | 200      | 110      | 95       | 185                  | 1                                          | 5                                                  |
| 150              | SB 150A               | SB 150220120 | 17.0                 | 150                       | 220      | 120      | 105      | 205                  | 1                                          | 5                                                  |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions *r*<sub>1</sub> and *r*<sub>2</sub>  
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of *d*<sub>a</sub>.  
Remarks1. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
2. No grease is prepacked. Perform proper lubrication.



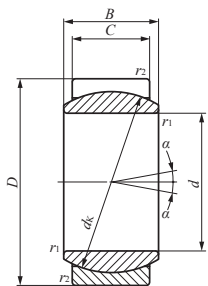
SB...A

SB

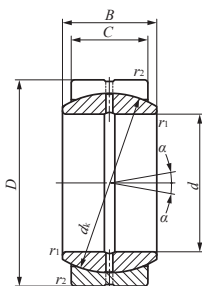
| Mounting dimensions<br>mm    |                                             |                              |                              | Dynamic load<br>capacity<br><i>C<sub>d</sub></i><br>N | Static load<br>capacity<br><i>C<sub>s</sub></i><br>N |
|------------------------------|---------------------------------------------|------------------------------|------------------------------|-------------------------------------------------------|------------------------------------------------------|
| <i>d<sub>a</sub></i><br>Min. | <i>d<sub>a</sub></i><br>Max. <sup>(2)</sup> | <i>D<sub>a</sub></i><br>Max. | <i>D<sub>a</sub></i><br>Min. |                                                       |                                                      |
| 115.5                        | 130                                         | 164.5                        | 149                          | 1 260 000                                             | 7 530 000                                            |
| 120.5                        | 132.5                                       | 174.5                        | 152                          | 1 380 000                                             | 8 250 000                                            |
| 125.5                        | 140                                         | 184.5                        | 162                          | 1 540 000                                             | 9 270 000                                            |
| 135.5                        | 148.5                                       | 194.5                        | 171                          | 1 720 000                                             | 10 300 000                                           |
| 155.5                        | 166                                         | 214.5                        | 189                          | 2 110 000                                             | 12 700 000                                           |

SPHERICAL BUSHINGS

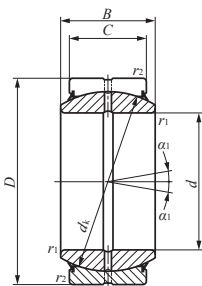
Steel-on-steel Spherical Bushings



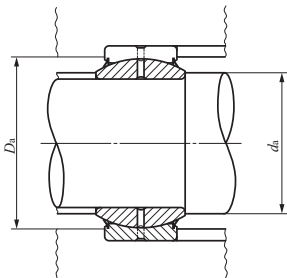
GE...E



GE...ES



GE...ES-2RS



Shaft dia. 4 – 100mm

| Shaft dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |     |    |    |                |                                    |                                    | Permissible<br>tilting angle<br>degree |                |
|------------------|-----------------------|--------------|----------------------|---------------------------|-----|----|----|----------------|------------------------------------|------------------------------------|----------------------------------------|----------------|
|                  | Without seals         | With seals   |                      | d                         | D   | B  | C  | d <sub>k</sub> | r <sub>1s min</sub> <sup>(1)</sup> | r <sub>2s min</sub> <sup>(1)</sup> | α                                      | α <sub>1</sub> |
| 4                | GE 4E                 | —            | 0.003                | 4                         | 12  | 5  | 3  | 8              | 0.3                                | 0.3                                | 16                                     | —              |
| 5                | GE 5E                 | —            | 0.004                | 5                         | 14  | 6  | 4  | 10             | 0.3                                | 0.3                                | 13                                     | —              |
| 6                | GE 6E                 | —            | 0.004                | 6                         | 14  | 6  | 4  | 10             | 0.3                                | 0.3                                | 13                                     | —              |
| 8                | GE 8E                 | —            | 0.008                | 8                         | 16  | 8  | 5  | 13             | 0.3                                | 0.3                                | 15                                     | —              |
| 10               | GE 10E                | —            | 0.012                | 10                        | 19  | 9  | 6  | 16             | 0.3                                | 0.3                                | 12                                     | —              |
| 12               | GE 12E                | —            | 0.017                | 12                        | 22  | 10 | 7  | 18             | 0.3                                | 0.3                                | 11                                     | —              |
| 15               | GE 15ES               | GE 15ES-2RS  | 0.032                | 15                        | 26  | 12 | 9  | 22             | 0.3                                | 0.3                                | 8                                      | 5              |
| 17               | GE 17ES               | GE 17ES-2RS  | 0.049                | 17                        | 30  | 14 | 10 | 25             | 0.3                                | 0.3                                | 10                                     | 7              |
| 20               | GE 20ES               | GE 20ES-2RS  | 0.065                | 20                        | 35  | 16 | 12 | 29             | 0.3                                | 0.3                                | 9                                      | 6              |
| 25               | GE 25ES               | GE 25ES-2RS  | 0.115                | 25                        | 42  | 20 | 16 | 35.5           | 0.6                                | 0.6                                | 7                                      | 4              |
| 30               | GE 30ES               | GE 30ES-2RS  | 0.160                | 30                        | 47  | 22 | 18 | 40.7           | 0.6                                | 0.6                                | 6                                      | 4              |
| 35               | GE 35ES               | GE 35ES-2RS  | 0.258                | 35                        | 55  | 25 | 20 | 47             | 0.6                                | 1                                  | 6                                      | 4              |
| 40               | GE 40ES               | GE 40ES-2RS  | 0.315                | 40                        | 62  | 28 | 22 | 53             | 0.6                                | 1                                  | 7                                      | 4              |
| 45               | GE 45ES               | GE 45ES-2RS  | 0.413                | 45                        | 68  | 32 | 25 | 60             | 0.6                                | 1                                  | 7                                      | 4              |
| 50               | GE 50ES               | GE 50ES-2RS  | 0.560                | 50                        | 75  | 35 | 28 | 66             | 0.6                                | 1                                  | 6                                      | 4              |
| 60               | GE 60ES               | GE 60ES-2RS  | 1.10                 | 60                        | 90  | 44 | 36 | 80             | 1                                  | 1                                  | 6                                      | 3              |
| 70               | GE 70ES               | GE 70ES-2RS  | 1.54                 | 70                        | 105 | 49 | 40 | 92             | 1                                  | 1                                  | 6                                      | 4              |
| 80               | GE 80ES               | GE 80ES-2RS  | 2.29                 | 80                        | 120 | 55 | 45 | 105            | 1                                  | 1                                  | 6                                      | 4              |
| 90               | GE 90ES               | GE 90ES-2RS  | 2.82                 | 90                        | 130 | 60 | 50 | 115            | 1                                  | 1                                  | 5                                      | 3              |
| 100              | GE 100ES              | GE 100ES-2RS | 4.43                 | 100                       | 150 | 70 | 55 | 130            | 1                                  | 1                                  | 7                                      | 5              |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions  $r_1$  and  $r_2$   
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of  $d_a$ .  
Remarks1. GE...E has no oil hole. Others are provided with an oil groove and two oil holes on the inner ring and outer ring, respectively.  
2. No grease is prepacked. Perform proper lubrication.

| Mounting dimensions<br>mm |                              |               |      | Dynamic load<br>capacity<br>$C_d$<br>N | Static load<br>capacity<br>$C_s$<br>N |
|---------------------------|------------------------------|---------------|------|----------------------------------------|---------------------------------------|
| Min.                      | $d_a$<br>Max. <sup>(2)</sup> | $D_a$<br>Max. | Min. |                                        |                                       |
| 6                         | 6                            | 9.5           | 8    | 2 350                                  | 14 100                                |
| 7.5                       | 8                            | 11.5          | 10   | 3 920                                  | 23 500                                |
| 8                         | 8                            | 11.5          | 10   | 3 920                                  | 23 500                                |
| 10                        | 10                           | 13.5          | 13   | 6 370                                  | 38 200                                |
| 12.5                      | 13                           | 16.5          | 15.5 | 9 410                                  | 56 500                                |
| 14.5                      | 15                           | 19.5          | 17   | 12 400                                 | 74 100                                |
| 17.5                      | 18                           | 23.5          | 22.5 | 19 400                                 | 117 000                               |
| 19.5                      | 20.5                         | 27.5          | 26   | 24 500                                 | 147 000                               |
| 22.5                      | 24                           | 32.5          | 30.5 | 34 100                                 | 205 000                               |
| 29                        | 29                           | 37.5          | 37   | 55 700                                 | 334 000                               |
| 34                        | 34                           | 42.5          | 41.5 | 71 800                                 | 431 000                               |
| 39.5                      | 39.5                         | 49.5          | 48   | 92 200                                 | 553 000                               |
| 44.5                      | 45                           | 56.5          | 54.5 | 114 000                                | 686 000                               |
| 49.5                      | 50.5                         | 62.5          | 60   | 147 000                                | 883 000                               |
| 54.5                      | 56                           | 69.5          | 66   | 181 000                                | 1 090 000                             |
| 65.5                      | 66.5                         | 84.5          | 79   | 282 000                                | 1 690 000                             |
| 75.5                      | 77.5                         | 99.5          | 91   | 361 000                                | 2 170 000                             |
| 85.5                      | 89                           | 114.5         | 103  | 463 000                                | 2 780 000                             |
| 95.5                      | 98                           | 124.5         | 112  | 564 000                                | 3 380 000                             |
| 105.5                     | 109.5                        | 144.5         | 127  | 701 000                                | 4 210 000                             |

SPHERICAL BUSHINGS

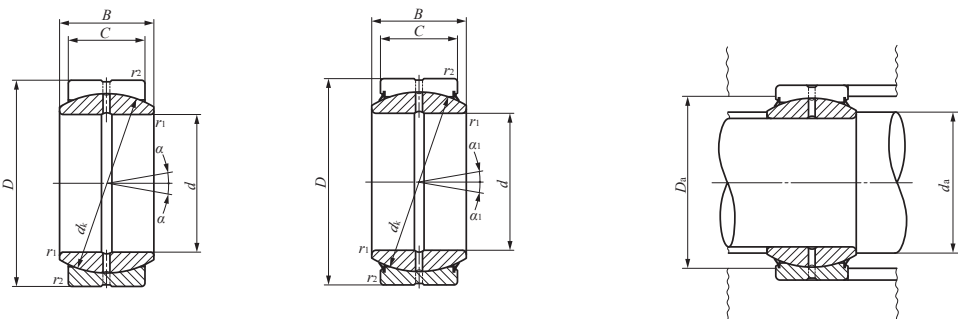
Steel-on-steel Spherical Bushings



Shaft dia. 110 – 300mm

| Shaft dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |          |          |          |                      |                                           |                                           | Permissible<br>tilting angle<br>degree |                       |
|------------------|-----------------------|--------------|----------------------|---------------------------|----------|----------|----------|----------------------|-------------------------------------------|-------------------------------------------|----------------------------------------|-----------------------|
|                  | Without seals         | With seals   |                      | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>d<sub>k</sub></i> | <i>r</i> <sub>1s min</sub> <sup>(1)</sup> | <i>r</i> <sub>2s min</sub> <sup>(1)</sup> | <i>α</i>                               | <i>α</i> <sub>1</sub> |
| 110              | GE 110ES              | GE 110ES-2RS | 4.94                 | 110                       | 160      | 70       | 55       | 140                  | 1                                         | 1                                         | 6                                      | 4                     |
| 120              | GE 120ES              | GE 120ES-2RS | 8.12                 | 120                       | 180      | 85       | 70       | 160                  | 1                                         | 1                                         | 6                                      | 4                     |
| 140              | GE 140ES              | GE 140ES-2RS | 11.4                 | 140                       | 210      | 90       | 70       | 180                  | 1                                         | 1                                         | 7                                      | 5                     |
| 160              | GE 160ES              | GE 160ES-2RS | 14.4                 | 160                       | 230      | 105      | 80       | 200                  | 1                                         | 1                                         | 8                                      | 6                     |
| 180              | GE 180ES              | GE 180ES-2RS | 18.9                 | 180                       | 260      | 105      | 80       | 225                  | 1.1                                       | 1.1                                       | 6                                      | 5                     |
| 200              | GE 200ES              | GE 200ES-2RS | 28.1                 | 200                       | 290      | 130      | 100      | 250                  | 1.1                                       | 1.1                                       | 7                                      | 6                     |
| 220              | GE 220ES              | GE 220ES-2RS | 36.1                 | 220                       | 320      | 135      | 100      | 275                  | 1.1                                       | 1.1                                       | 8                                      | 6                     |
| 240              | GE 240ES              | GE 240ES-2RS | 40.4                 | 240                       | 340      | 140      | 100      | 300                  | 1.1                                       | 1.1                                       | 8                                      | 6                     |
| 260              | GE 260ES              | GE 260ES-2RS | 52.0                 | 260                       | 370      | 150      | 110      | 325                  | 1.1                                       | 1.1                                       | 7                                      | 6                     |
| 280              | GE 280ES              | GE 280ES-2RS | 66.0                 | 280                       | 400      | 155      | 120      | 350                  | 1.1                                       | 1.1                                       | 6                                      | 5                     |
| 300              | GE 300ES              | GE 300ES-2RS | 76.0                 | 300                       | 430      | 165      | 120      | 375                  | 1.1                                       | 1.1                                       | 7                                      | 6                     |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions *r*<sub>1</sub> and *r*<sub>2</sub>  
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of *d<sub>a</sub>*.  
Remarks1. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
2. No grease is prepacked. Perform proper lubrication.



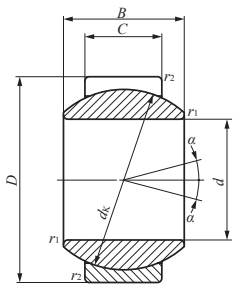
GE...ES

GE...ES-2RS

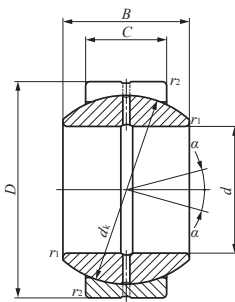
| Mounting dimensions<br>mm |                     |                      |      | Dynamic load<br>capacity | Static load<br>capacity |
|---------------------------|---------------------|----------------------|------|--------------------------|-------------------------|
| <i>d<sub>a</sub></i>      |                     | <i>D<sub>a</sub></i> |      | <i>C<sub>d</sub></i>     | <i>C<sub>s</sub></i>    |
| Min.                      | Max. <sup>(2)</sup> | Max.                 | Min. | N                        | N                       |
| 115.5                     | 121                 | 154.5                | 138  | 755 000                  | 4 530 000               |
| 125.5                     | 135.5               | 174.5                | 154  | 1 100 000                | 6 590 000               |
| 145.5                     | 155.5               | 204.5                | 176  | 1 240 000                | 7 410 000               |
| 165.5                     | 170                 | 224.5                | 195  | 1 570 000                | 9 410 000               |
| 187                       | 199                 | 253                  | 221  | 1 770 000                | 10 600 000              |
| 207                       | 213.5               | 283                  | 244  | 2 450 000                | 14 700 000              |
| 227                       | 239.5               | 313                  | 269  | 2 700 000                | 16 200 000              |
| 247                       | 265                 | 333                  | 296  | 2 940 000                | 17 700 000              |
| 267                       | 288                 | 363                  | 320  | 3 510 000                | 21 000 000              |
| 287                       | 313.5               | 393                  | 345  | 4 120 000                | 24 700 000              |
| 307                       | 336.5               | 423                  | 371  | 4 410 000                | 26 500 000              |

SPHERICAL BUSHINGS

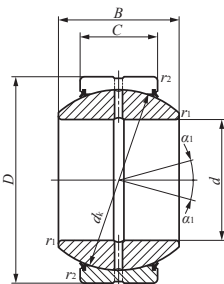
Steel-on-steel Spherical Bushings



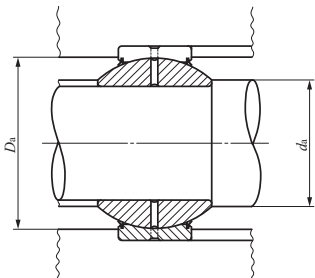
GE...G



GE...GS



GE...GS-2RS



Shaft dia. 6 – 120mm

| Shaft dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |     |     |    |      |                        |                        | Permissible<br>tilting angle<br>degree |    |
|------------------|-----------------------|--------------|----------------------|---------------------------|-----|-----|----|------|------------------------|------------------------|----------------------------------------|----|
|                  | Without seals         | With seals   |                      | d                         | D   | B   | C  | dk   | r1s min <sup>(1)</sup> | r2s min <sup>(1)</sup> | α                                      | α1 |
| 6                | GE 6G                 | —            | 0.010                | 6                         | 16  | 9   | 5  | 13   | 0.3                    | 0.3                    | 21                                     | —  |
| 8                | GE 8G                 | —            | 0.015                | 8                         | 19  | 11  | 6  | 16   | 0.3                    | 0.3                    | 21                                     | —  |
| 10               | GE 10G                | —            | 0.022                | 10                        | 22  | 12  | 7  | 18   | 0.3                    | 0.3                    | 18                                     | —  |
| 12               | GE 12G                | —            | 0.041                | 12                        | 26  | 15  | 9  | 22   | 0.3                    | 0.3                    | 18                                     | —  |
| 15               | GE 15GS               | GE 15GS-2RS  | 0.059                | 15                        | 30  | 16  | 10 | 25   | 0.3                    | 0.3                    | 16                                     | 13 |
| 17               | GE 17GS               | GE 17GS-2RS  | 0.083                | 17                        | 35  | 20  | 12 | 29   | 0.3                    | 0.3                    | 19                                     | 16 |
| 20               | GE 20GS               | GE 20GS-2RS  | 0.155                | 20                        | 42  | 25  | 16 | 35.5 | 0.3                    | 0.6                    | 17                                     | 16 |
| 25               | GE 25GS               | GE 25GS-2RS  | 0.215                | 25                        | 47  | 28  | 18 | 40.7 | 0.6                    | 0.6                    | 17                                     | 15 |
| 30               | GE 30GS               | GE 30GS-2RS  | 0.330                | 30                        | 55  | 32  | 20 | 47   | 0.6                    | 1                      | 17                                     | 16 |
| 35               | GE 35GS               | GE 35GS-2RS  | 0.400                | 35                        | 62  | 35  | 22 | 53   | 0.6                    | 1                      | 16                                     | 15 |
| 40               | GE 40GS               | GE 40GS-2RS  | 0.515                | 40                        | 68  | 40  | 25 | 60   | 0.6                    | 1                      | 17                                     | 14 |
| 45               | GE 45GS               | GE 45GS-2RS  | 0.660                | 45                        | 75  | 43  | 28 | 66   | 0.6                    | 1                      | 15                                     | 13 |
| 50               | GE 50GS               | GE 50GS-2RS  | 1.50                 | 50                        | 90  | 56  | 36 | 80   | 0.6                    | 1                      | 17                                     | 16 |
| 60               | GE 60GS               | GE 60GS-2RS  | 2.05                 | 60                        | 105 | 63  | 40 | 92   | 1                      | 1                      | 17                                     | 15 |
| 70               | GE 70GS               | GE 70GS-2RS  | 3.00                 | 70                        | 120 | 70  | 45 | 105  | 1                      | 1                      | 16                                     | 14 |
| 80               | GE 80GS               | GE 80GS-2RS  | 3.60                 | 80                        | 130 | 75  | 50 | 115  | 1                      | 1                      | 14                                     | 13 |
| 90               | GE 90GS               | GE 90GS-2RS  | 5.41                 | 90                        | 150 | 85  | 55 | 130  | 1                      | 1                      | 15                                     | 14 |
| 100              | GE 100GS              | GE 100GS-2RS | 6.15                 | 100                       | 160 | 85  | 55 | 140  | 1                      | 1                      | 14                                     | 12 |
| 110              | GE 110GS              | GE 110GS-2RS | 9.70                 | 110                       | 180 | 100 | 70 | 160  | 1                      | 1                      | 12                                     | 11 |
| 120              | GE 120GS              | GE 120GS-2RS | 15.5                 | 120                       | 210 | 115 | 70 | 180  | 1                      | 1                      | 16                                     | 15 |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions  $r_1$  and  $r_2$   
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of  $d_a$ .  
Remarks1. GE...G has no oil hole. Others are provided with an oil groove and two oil holes on the inner ring and outer ring, respectively.  
2. No grease is prepacked. Perform proper lubrication.

| Mounting dimensions<br>mm |                     |       |      | Dynamic load<br>capacity | Static load<br>capacity |
|---------------------------|---------------------|-------|------|--------------------------|-------------------------|
| $d_a$                     |                     | $D_a$ |      | $C_d$                    | $C_s$                   |
| Min.                      | Max. <sup>(2)</sup> | Max.  | Min. | N                        | N                       |
| 8.5                       | 9                   | 13.5  | 13   | 6 370                    | 38 200                  |
| 10.5                      | 11.5                | 16.5  | 15.5 | 9 410                    | 56 500                  |
| 12.5                      | 13                  | 19.5  | 17   | 12 400                   | 74 100                  |
| 14.5                      | 16                  | 23.5  | 21   | 19 400                   | 117 000                 |
| 17.5                      | 19                  | 27.5  | 26   | 24 500                   | 147 000                 |
| 19.5                      | 21                  | 32.5  | 30.5 | 34 100                   | 205 000                 |
| 22.5                      | 25                  | 37.5  | 37   | 55 700                   | 334 000                 |
| 29.5                      | 29.5                | 42.5  | 41.5 | 71 800                   | 431 000                 |
| 34                        | 34                  | 49.5  | 48   | 92 200                   | 553 000                 |
| 39.5                      | 39.5                | 56.5  | 54.5 | 114 000                  | 686 000                 |
| 44.5                      | 44.5                | 62.5  | 60   | 147 000                  | 883 000                 |
| 49.5                      | 50                  | 69.5  | 66   | 181 000                  | 1 090 000               |
| 54.5                      | 57                  | 84.5  | 79   | 282 000                  | 1 690 000               |
| 65.5                      | 67                  | 99.5  | 91   | 361 000                  | 2 170 000               |
| 75.5                      | 78                  | 114.5 | 103  | 463 000                  | 2 780 000               |
| 85.5                      | 87                  | 124.5 | 112  | 564 000                  | 3 380 000               |
| 95.5                      | 98                  | 144.5 | 127  | 701 000                  | 4 210 000               |
| 105.5                     | 111                 | 154.5 | 138  | 755 000                  | 4 530 000               |
| 115.5                     | 124.5               | 174.5 | 154  | 1 100 000                | 6 590 000               |
| 125.5                     | 138.5               | 204.5 | 176  | 1 240 000                | 7 410 000               |

SPHERICAL BUSHINGS

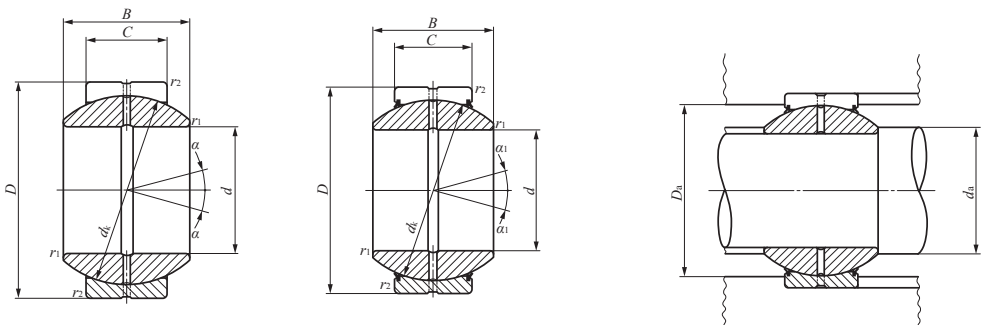
Steel-on-steel Spherical Bushings



Shaft dia. 140 – 280mm

| Shaft dia.<br>mm | Identification number |              | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |          |          |          |                      |                                          |                                          | Permissible<br>tilting angle<br>degree |                      |
|------------------|-----------------------|--------------|----------------------|---------------------------|----------|----------|----------|----------------------|------------------------------------------|------------------------------------------|----------------------------------------|----------------------|
|                  | Without seals         | With seals   |                      | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>d<sub>k</sub></i> | <i>r<sub>1s</sub></i> min <sup>(1)</sup> | <i>r<sub>2s</sub></i> min <sup>(1)</sup> | <i>α</i>                               | <i>α<sub>1</sub></i> |
| 140              | GE 140GS              | GE 140GS-2RS | 19.2                 | 140                       | 230      | 130      | 80       | 200                  | 1                                        | 1                                        | 16                                     | 15                   |
| 160              | GE 160GS              | GE 160GS-2RS | 25.4                 | 160                       | 260      | 135      | 80       | 225                  | 1                                        | 1.1                                      | 16                                     | 14                   |
| 180              | GE 180GS              | GE 180GS-2RS | 34.7                 | 180                       | 290      | 155      | 100      | 250                  | 1.1                                      | 1.1                                      | 14                                     | 13                   |
| 200              | GE 200GS              | GE 200GS-2RS | 43.8                 | 200                       | 320      | 165      | 100      | 275                  | 1.1                                      | 1.1                                      | 15                                     | 14                   |
| 220              | GE 220GS              | GE 220GS-2RS | 51.3                 | 220                       | 340      | 175      | 100      | 300                  | 1.1                                      | 1.1                                      | 16                                     | 14                   |
| 240              | GE 240GS              | GE 240GS-2RS | 66.1                 | 240                       | 370      | 190      | 110      | 325                  | 1.1                                      | 1.1                                      | 15                                     | 14                   |
| 260              | GE 260GS              | GE 260GS-2RS | 81.8                 | 260                       | 400      | 205      | 120      | 350                  | 1.1                                      | 1.1                                      | 15                                     | 14                   |
| 280              | GE 280GS              | GE 280GS-2RS | 97.4                 | 280                       | 430      | 210      | 120      | 375                  | 1.1                                      | 1.1                                      | 15                                     | 14                   |

Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions *r<sub>1</sub>* and *r<sub>2</sub>*  
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of *d<sub>a</sub>*.  
Remarks1. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
2. No grease is prepacked. Perform proper lubrication.



GE ... GS

GE ... GS-2RS

| Mounting dimensions<br>mm |                     |                      |      | Dynamic load<br>capacity | Static load<br>capacity |
|---------------------------|---------------------|----------------------|------|--------------------------|-------------------------|
| <i>d<sub>a</sub></i>      |                     | <i>D<sub>a</sub></i> |      | <i>C<sub>d</sub></i>     | <i>C<sub>s</sub></i>    |
| Min.                      | Max. <sup>(2)</sup> | Max.                 | Min. | N                        | N                       |
| 145.5                     | 152                 | 224.5                | 195  | 1 570 000                | 9 410 000               |
| 165.5                     | 180                 | 253                  | 221  | 1 770 000                | 10 600 000              |
| 187                       | 196                 | 283                  | 244  | 2 450 000                | 14 700 000              |
| 207                       | 220                 | 313                  | 269  | 2 700 000                | 16 200 000              |
| 227                       | 243.5               | 333                  | 296  | 2 940 000                | 17 700 000              |
| 247                       | 263.5               | 363                  | 320  | 3 510 000                | 21 000 000              |
| 267                       | 283.5               | 393                  | 345  | 4 120 000                | 24 700 000              |
| 287                       | 310.5               | 423                  | 371  | 4 410 000                | 26 500 000              |

SPHERICAL BUSHINGS

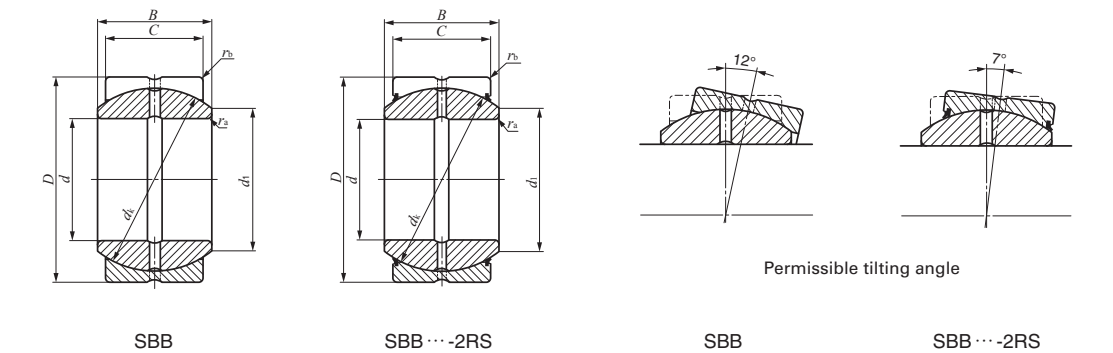
Steel-on-steel Spherical Bushings **Inch Series**



Shaft dia. 12.700 — 63.500mm

| Shaft dia.<br>mm<br>(inch) | Identification number |            | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm(inch) |                   |              |              |
|----------------------------|-----------------------|------------|----------------------|---------------------------------|-------------------|--------------|--------------|
|                            | Without seal          | With seals |                      | <i>d</i>                        | <i>D</i>          | <i>B</i>     | <i>C</i>     |
| 12.700<br>(1/2)            | SBB 8                 | —          | 0.020                | 12.700 (1/2)                    | 22.225 (7/8)      | 11.10( .437) | 9.52( .375)  |
| 15.875<br>(5/8)            | SBB 10                | —          | 0.036                | 15.875 (5/8)                    | 26.988 (1 1/16)   | 13.89( .547) | 11.91( .469) |
| 19.050<br>(3/4)            | SBB 12                | SBB 12-2RS | 0.057                | 19.050 (3/4)                    | 31.750 (1 1/4)    | 16.66( .656) | 14.27( .562) |
| 22.225<br>(7/8)            | SBB 14                | SBB 14-2RS | 0.088                | 22.225 (7/8)                    | 36.512 (1 7/16)   | 19.43( .765) | 16.66( .656) |
| 25.400<br>(1)              | SBB 16                | SBB 16-2RS | 0.125                | 25.400 (1 )                     | 41.275 (1 5/8)    | 22.22( .875) | 19.05( .750) |
| 31.750<br>(1 1/4)          | SBB 20                | SBB 20-2RS | 0.234                | 31.750 (1 1/4)                  | 50.800 (2 )       | 27.76(1.093) | 23.80( .937) |
| 34.925<br>(1 3/8)          | SBB 22                | SBB 22-2RS | 0.349                | 34.925 (1 3/8)                  | 55.562 (2 3/16)   | 30.15(1.187) | 26.19(1.031) |
| 38.100<br>(1 1/2)          | SBB 24                | SBB 24-2RS | 0.424                | 38.100 (1 1/2)                  | 61.912 (2 7/16)   | 33.32(1.312) | 28.58(1.125) |
| 44.450<br>(1 3/4)          | SBB 28                | SBB 28-2RS | 0.649                | 44.450 (1 3/4)                  | 71.438 (2 13/16)  | 38.89(1.531) | 33.32(1.312) |
| 50.800<br>(2)              | SBB 32                | SBB 32-2RS | 0.939                | 50.800 (2 )                     | 80.962 (3 3/16)   | 44.45(1.750) | 38.10(1.500) |
| 57.150<br>(2 1/4)          | SBB 36                | SBB 36-2RS | 1.32                 | 57.150 (2 1/4)                  | 90.488 (3 9/16)   | 50.01(1.969) | 42.85(1.687) |
| 63.500<br>(2 1/2)          | SBB 40                | SBB 40-2RS | 1.85                 | 63.500 (2 1/2)                  | 100.012 (3 15/16) | 55.55(2.187) | 47.62(1.875) |

Note(1) Maximum allowable corner radius of the shaft or housing  
Remarks1. The value with mark \* is applicable to types without seals. For types with seals, the value is 0.4 mm.  
2. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
3. No grease is prepacked. Perform proper lubrication.



| <i>d<sub>k</sub></i> | Radial internal clearance | Mounting dimensions<br>mm |                                                      |                                                      | Dynamic load capacity     | Static load capacity      |
|----------------------|---------------------------|---------------------------|------------------------------------------------------|------------------------------------------------------|---------------------------|---------------------------|
|                      | mm<br>Min./Max.           | <i>d</i> <sub>1</sub>     | <sup>(1)</sup><br><i>r</i> <sub>as max</sub><br>Max. | <sup>(1)</sup><br><i>r</i> <sub>bs max</sub><br>Max. | <i>C<sub>d</sub></i><br>N | <i>C<sub>s</sub></i><br>N |
| 18 ( .709)           | 0.05 / 0.15               | 14.0                      | 0.2                                                  | 0.6                                                  | 16 800                    | 101 000                   |
| 23 ( .906)           | 0.05 / 0.15               | 17.9                      | 0.2                                                  | 0.8                                                  | 26 900                    | 161 000                   |
| 27.5(1.083)          | 0.08 / 0.18               | 21.4                      | 0.6                                                  | *0.8                                                 | 38 500                    | 231 000                   |
| 32 (1.260)           | 0.08 / 0.18               | 25.0                      | 0.6                                                  | *0.8                                                 | 52 300                    | 314 000                   |
| 36 (1.417)           | 0.08 / 0.18               | 28.0                      | 0.6                                                  | *0.8                                                 | 67 300                    | 404 000                   |
| 45 (1.772)           | 0.08 / 0.18               | 35.1                      | 0.6                                                  | 0.8                                                  | 105 000                   | 630 000                   |
| 49 (1.929)           | 0.08 / 0.18               | 38.5                      | 0.6                                                  | 0.8                                                  | 126 000                   | 755 000                   |
| 55 (2.165)           | 0.08 / 0.18               | 43.3                      | 0.6                                                  | 0.8                                                  | 154 000                   | 925 000                   |
| 64 (2.520)           | 0.08 / 0.18               | 50.4                      | 0.6                                                  | 0.8                                                  | 209 000                   | 1 250 000                 |
| 73 (2.874)           | 0.08 / 0.18               | 57.6                      | 0.6                                                  | 0.8                                                  | 273 000                   | 1 640 000                 |
| 82 (3.228)           | 0.10 / 0.20               | 64.9                      | 0.6                                                  | 0.8                                                  | 345 000                   | 2 070 000                 |
| 91 (3.583)           | 0.10 / 0.20               | 72.0                      | 0.6                                                  | 0.8                                                  | 425 000                   | 2 550 000                 |

SPHERICAL BUSHINGS

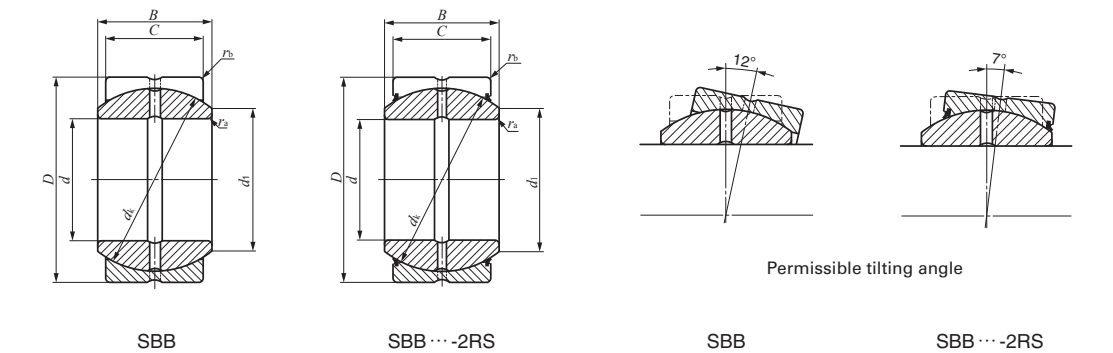
Steel-on-steel Spherical Bushings **Inch Series**



Shaft dia. 69.850 — 152.400mm

| Shaft dia.<br>mm<br>(inch) | Identification number |            | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm(inch) |              |               |               |
|----------------------------|-----------------------|------------|----------------------|---------------------------------|--------------|---------------|---------------|
|                            | Without seal          | With seals |                      | <i>d</i>                        | <i>D</i>     | <i>B</i>      | <i>C</i>      |
| 69.850<br>(2¾)             | SBB 44                | SBB 44-2RS | 2.44                 | 69.850 (2¾)                     | 111.125 (4¾) | 61.11(2.406)  | 52.37(2.062)  |
| 76.200<br>(3)              | SBB 48                | SBB 48-2RS | 3.12                 | 76.200 (3 )                     | 120.650 (4¾) | 66.68(2.625)  | 57.15(2.250)  |
| 82.550<br>(3¼)             | SBB 52                | SBB 52-2RS | 3.92                 | 82.550 (3¼)                     | 130.175 (5¼) | 72.24(2.844)  | 61.90(2.437)  |
| 88.900<br>(3½)             | SBB 56                | SBB 56-2RS | 4.83                 | 88.900 (3½)                     | 139.700 (5½) | 77.77(3.062)  | 66.68(2.625)  |
| 95.250<br>(3¾)             | SBB 60                | SBB 60-2RS | 5.87                 | 95.250 (3¾)                     | 149.225 (5¾) | 83.34(3.281)  | 71.42(2.812)  |
| 101.600<br>(4)             | SBB 64                | SBB 64-2RS | 7.07                 | 101.600 (4 )                    | 158.750 (6¼) | 88.90(3.500)  | 76.20(3.000)  |
| 107.950<br>(4¼)            | SBB 68                | SBB 68-2RS | 8.46                 | 107.950 (4¼)                    | 168.275 (6½) | 94.46(3.719)  | 80.95(3.187)  |
| 114.300<br>(4½)            | SBB 72                | SBB 72-2RS | 9.94                 | 114.300 (4½)                    | 177.800 (7 ) | 100.00(3.937) | 85.72(3.375)  |
| 120.650<br>(4¾)            | SBB 76                | SBB 76-2RS | 11.6                 | 120.650 (4¾)                    | 187.325 (7¾) | 105.56(4.156) | 90.47(3.562)  |
| 127.000<br>(5)             | SBB 80                | SBB 80-2RS | 13.5                 | 127.000 (5 )                    | 196.850 (7¾) | 111.12(4.375) | 95.25(3.750)  |
| 152.400<br>(6)             | SBB 96                | SBB 96-2RS | 17.6                 | 152.400 (6 )                    | 222.250 (8¾) | 120.65(4.750) | 104.78(4.125) |

Note(1) Maximum allowable corner radius of the shaft or housing  
Remarks1. The inner ring and the outer ring have an oil groove and two oil holes, respectively.  
2. No grease is prepacked. Perform proper lubrication.



| <i>d<sub>k</sub></i> | Radial internal clearance | Mounting dimensions<br>mm |                                                      |                                                      | Dynamic load capacity     | Static load capacity      |
|----------------------|---------------------------|---------------------------|------------------------------------------------------|------------------------------------------------------|---------------------------|---------------------------|
|                      | mm<br>Min./Max.           | <i>d</i> <sub>1</sub>     | <sup>(1)</sup><br><i>r</i> <sub>as max</sub><br>Max. | <sup>(1)</sup><br><i>r</i> <sub>bs max</sub><br>Max. | <i>C<sub>d</sub></i><br>N | <i>C<sub>s</sub></i><br>N |
| 100(3.937)           | 0.10 / 0.20               | 79.0                      | 0.6                                                  | 0.8                                                  | 514 000                   | 3 080 000                 |
| 110(4.331)           | 0.10 / 0.20               | 86.5                      | 0.6                                                  | 0.8                                                  | 616 000                   | 3 700 000                 |
| 119(4.685)           | 0.13 / 0.23               | 94.1                      | 0.6                                                  | 0.8                                                  | 722 000                   | 4 330 000                 |
| 128(5.039)           | 0.13 / 0.23               | 101.6                     | 0.6                                                  | 0.8                                                  | 837 000                   | 5 020 000                 |
| 137(5.394)           | 0.13 / 0.23               | 108.4                     | 0.6                                                  | 0.8                                                  | 960 000                   | 5 760 000                 |
| 146(5.748)           | 0.13 / 0.23               | 115.8                     | 0.6                                                  | 0.8                                                  | 1 090 000                 | 6 550 000                 |
| 155(6.102)           | 0.13 / 0.23               | 122.6                     | 0.8                                                  | 1.1                                                  | 1 230 000                 | 7 380 000                 |
| 164(6.457)           | 0.13 / 0.23               | 129.8                     | 0.8                                                  | 1.1                                                  | 1 380 000                 | 8 270 000                 |
| 173(6.811)           | 0.13 / 0.23               | 136.8                     | 0.8                                                  | 1.1                                                  | 1 530 000                 | 9 210 000                 |
| 183(7.205)           | 0.13 / 0.23               | 144.9                     | 0.8                                                  | 1.1                                                  | 1 710 000                 | 10 300 000                |
| 207(8.150)           | 0.13 / 0.23               | 167.5                     | 0.8                                                  | 1.1                                                  | 2 130 000                 | 12 800 000                |

SPHERICAL BUSHINGS

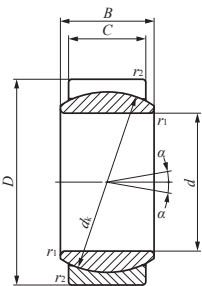
Maintenance-free Spherical Bushings



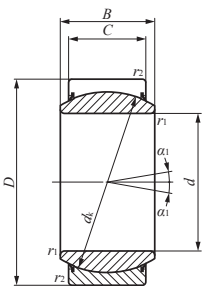
Shaft dia. 15 – 70mm

| Shaft dia.<br>mm | Identification number |             | Mass<br>(Ref.)<br>kg | Boundary dimensions<br>mm |          |          |          |                      |                                          |                                          | Permissible<br>tilting angle<br>degree |                      |
|------------------|-----------------------|-------------|----------------------|---------------------------|----------|----------|----------|----------------------|------------------------------------------|------------------------------------------|----------------------------------------|----------------------|
|                  | Without seals         | With seals  |                      | <i>d</i>                  | <i>D</i> | <i>B</i> | <i>C</i> | <i>d<sub>k</sub></i> | <i>r<sub>1s</sub></i> min <sup>(1)</sup> | <i>r<sub>2s</sub></i> min <sup>(1)</sup> | <i>α</i>                               | <i>α<sub>1</sub></i> |
| 15               | GE 15EC               | —           | 0.032                | 15                        | 26       | 12       | 9        | 22                   | 0.3                                      | 0.3                                      | 8                                      | —                    |
| 17               | GE 17EC               | —           | 0.049                | 17                        | 30       | 14       | 10       | 25                   | 0.3                                      | 0.3                                      | 10                                     | —                    |
| 20               | GE 20EC               | —           | 0.065                | 20                        | 35       | 16       | 12       | 29                   | 0.3                                      | 0.3                                      | 9                                      | —                    |
| 25               | GE 25EC               | —           | 0.115                | 25                        | 42       | 20       | 16       | 35.5                 | 0.6                                      | 0.6                                      | 7                                      | —                    |
| 30               | GE 30EC               | GE 30EC-2RS | 0.160                | 30                        | 47       | 22       | 18       | 40.7                 | 0.6                                      | 0.6                                      | 6                                      | 4                    |
| 35               | —                     | GE 35EC-2RS | 0.258                | 35                        | 55       | 25       | 20       | 47                   | 0.6                                      | 1                                        | —                                      | 4                    |
| 40               | —                     | GE 40EC-2RS | 0.315                | 40                        | 62       | 28       | 22       | 53                   | 0.6                                      | 1                                        | —                                      | 4                    |
| 45               | —                     | GE 45EC-2RS | 0.413                | 45                        | 68       | 32       | 25       | 60                   | 0.6                                      | 1                                        | —                                      | 4                    |
| 50               | —                     | GE 50EC-2RS | 0.560                | 50                        | 75       | 35       | 28       | 66                   | 0.6                                      | 1                                        | —                                      | 4                    |
| 60               | —                     | GE 60EC-2RS | 1.10                 | 60                        | 90       | 44       | 36       | 80                   | 1                                        | 1                                        | —                                      | 3                    |
| 70               | —                     | GE 70EC-2RS | 1.54                 | 70                        | 105      | 49       | 40       | 92                   | 1                                        | 1                                        | —                                      | 4                    |

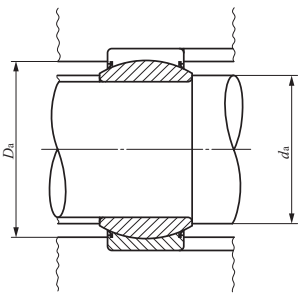
Notes<sup>(1)</sup> Minimum allowable value of chamfer dimensions *r*<sub>1</sub> and *r*<sub>2</sub>  
<sup>(2)</sup> When Spherical Bushings are used with full tilting angle, the shaft shoulder dimension must be less than the maximum value of *d<sub>a</sub>*.  
Remark No oil hole is provided.



GE...EC



GE...EC-2RS



| Mounting dimensions<br>mm |                     |                      |      | Dynamic load<br>capacity | Static load<br>capacity |
|---------------------------|---------------------|----------------------|------|--------------------------|-------------------------|
| <i>d<sub>a</sub></i>      |                     | <i>D<sub>a</sub></i> |      | <i>C<sub>d</sub></i>     | <i>C<sub>s</sub></i>    |
| Min.                      | Max. <sup>(2)</sup> | Max.                 | Min. | N                        | N                       |
| 17.5                      | 18                  | 23.5                 | 21.5 | 19 400                   | 48 500                  |
| 19.5                      | 20.5                | 27.5                 | 24.5 | 24 500                   | 61 300                  |
| 22.5                      | 24                  | 32.5                 | 28   | 34 100                   | 85 300                  |
| 29                        | 29                  | 37.5                 | 34   | 55 700                   | 139 000                 |
| 34                        | 34                  | 42.5                 | 41.5 | 71 800                   | 180 000                 |
| 39.5                      | 39.5                | 49.5                 | 48   | 92 200                   | 230 000                 |
| 44.5                      | 45                  | 56.5                 | 54.5 | 114 000                  | 286 000                 |
| 49.5                      | 50.5                | 62.5                 | 60   | 147 000                  | 368 000                 |
| 54.5                      | 56                  | 69.5                 | 66   | 181 000                  | 453 000                 |
| 65.5                      | 66.5                | 84.5                 | 79   | 282 000                  | 706 000                 |
| 75.5                      | 77.5                | 99.5                 | 91   | 361 000                  | 902 000                 |

# PILLOBALLS

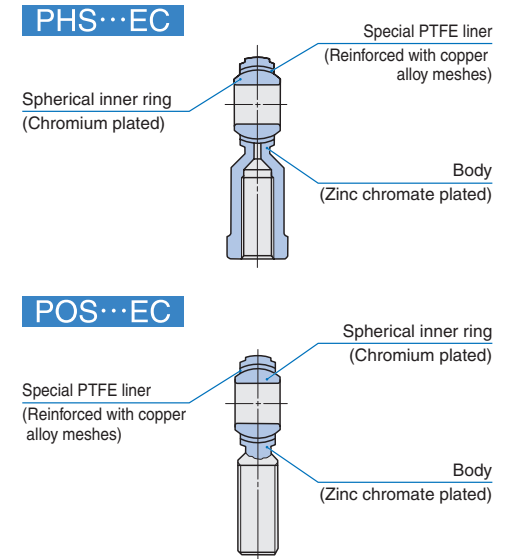
- PILLOBALL Spherical Bushings - Insert Type
- PILLOBALL Rod Ends - Insert Type
- PILLOBALL Rod Ends - Die-cast Type
- PILLOBALL Rod Ends - Maintenance-free Type



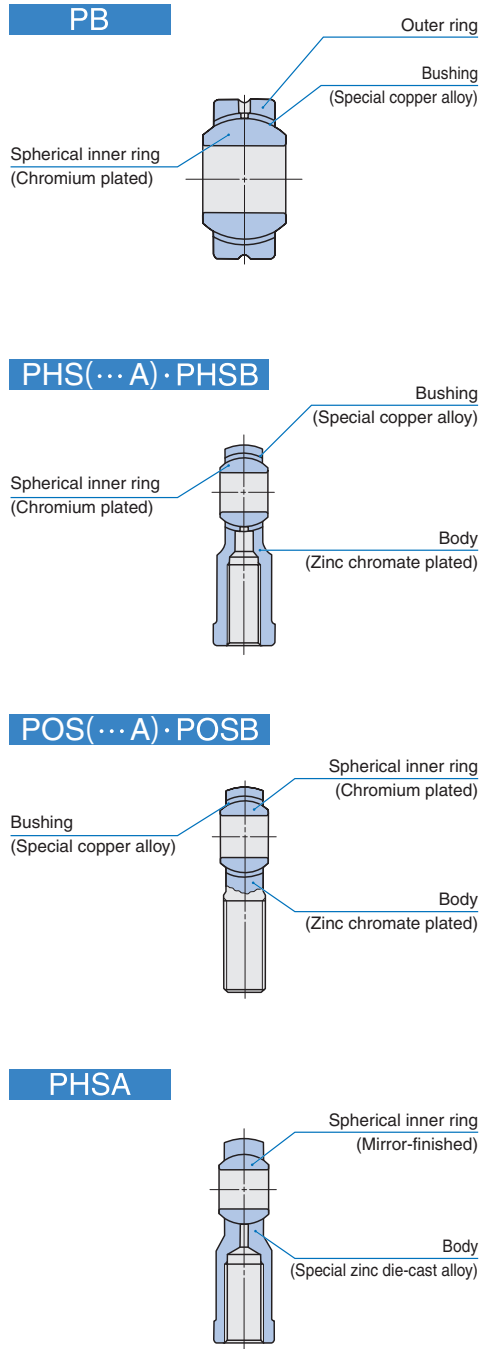
## Structure and Features

IKO PILLOBALLs are compact self-aligning spherical bushings that can support a large radial load and a bi-directional axial load at the same time. These bushings are classified by sliding surface types, namely, insert type, die-cast type and maintenance-free type. In the insert type, a spherical inner ring makes contact with the special copper alloy bushing with superior run-in properties. In the die-cast type, a spherical inner ring makes direct contact with the bore surface of the body of special zinc die-cast alloy. In the maintenance-free type, a spherical inner ring makes contact with the special PTFE liner of maintenance-free type. Thus, a smooth rotational and oscillatory motion can be achieved with superior anti-wear and loading properties in each type. PILLOBALL Rod Ends have either a female thread in the body or a male thread on the body, and they can be easily assembled onto machines. PILLOBALLs are used in control and link mechanisms in machine tools, textile machines, packaging machines, etc. The maintenance-free type is especially suitable for loading in one direction and is the best choice for machines in which oil must be avoided such as food processing machines, or machines which cannot be re-lubricated.

### Structures of maintenance-free type PILLOBALLs



### Structures of lubrication type PILLOBALLs



K  
PB  
PHS  
PHSB  
POS  
POSB  
PHSA

Types

In PILLOBALLs, the types shown in Table 1 are available.

Table 1 Type

| Type          | Lubrication type   |                  | Maintenance-free type |                           |
|---------------|--------------------|------------------|-----------------------|---------------------------|
|               | Spherical Bushings | Rod end          | Rod end               |                           |
|               |                    | female thread    | male thread           | female thread male thread |
| Insert type   | PB                 | PHS(···A) · PHSB | POS(···A) · POSB      | PHS···EC POS···EC         |
| Die-cast type | —                  | PHSA             | —                     |                           |

Lubrication Type PILLOBALL Spherical Bushings Insert Type PB

This type has superior anti-wear properties and high rigidity. It consists of a spherical inner ring, an outer ring, and a bushing of special copper alloy with superior run-in properties inserted in between. The spherical surface of the inner ring is chromium plated after heat treatment and grinding. This type is assembled with a shaft and a housing.

When especially large radial and/or axial loads are applied, Spherical Bushings with molybdenum disulfide (MoS<sub>2</sub>) treated inner and outer rings are recommended. (See page K1.)

Lubrication Type PILLOBALL Rod Ends Insert Type PHS(···A), POS(···A), PHSB and POSB

This type has superior wear-resistant and corrosion-resistant properties as well as high rigidity. It consists of a spherical inner ring of which the spherical surface is chromium plated after heat treatment and grinding, a body with a zinc chromate plated outer surface, and an inserted bushing of special copper alloy having superior run-in properties. PHS, which has a female thread in the body, and POS, which has a male thread on the body, are available. For PHS and POS sizes 5 to 18, an A is appended after the dimensions as a model code.

Lubrication Type PILLOBALL Rod Ends Die-cast Type PHSA

The spherical inner ring of this type is mirror-finished after heat treatment and is built in a body of special zinc die-cast alloy. The sliding surfaces of the inner ring and body are in close contact with each other. Thus, this type is an economical rod end with superior anti-wear and loading properties.

Maintenance-free Type PILLOBALL Rod Ends PHS···EC, POS···EC

This type has superior anti-corrosion properties as the

body is zinc chromate treated and the spherical inner ring is chromium plated on the sphere surface after heat treatment and grinding.

A special PTFE liner, reinforced with copper alloy meshes, which is superior in anti-wear properties with little creep deformation is used for lining on the sliding surface of the body, and this type is maintenance-free.

PHS···EC, which has a female thread in the body, and POS···EC, which has a male thread on the body, are available.

Identification number

The identification number of PILLOBALLs consists of a model code, a size and any supplemental codes as shown in the examples.

**Examples of identification number**

**Example 1**

Model code

Size

Supplemental code

PHSB10NP

Type

Bore diameter (10/16"=15.875mm)

With grease nipple<sup>(1)</sup>  
Flash type:NP  
Zerk type :NF

**Example 2**

Model code

Size

Supplemental code

PHS10EC L

Type

Bore diameter (10mm)

Left hand thread<sup>(2)</sup>

**Example 3**

Model code

Size

PB10

Type

Bore diameter (10mm)

Notes<sup>(1)</sup> Shapes of grease nipple are shown in Fig.1. In case of no indication of grease nipple type, grease nipple is not prepared.

<sup>(2)</sup> Right hand thread is indicated with no code.

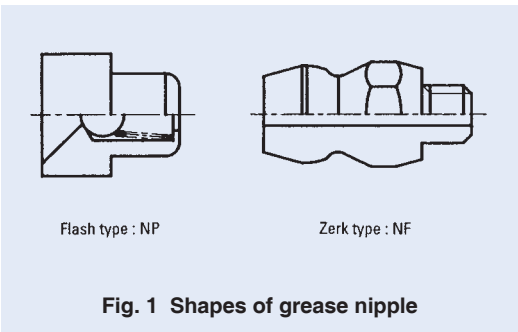


Fig. 1 Shapes of grease nipple

Accuracy

The accuracy of PILLOBALLs is shown in Tables 2 and 3. The maximum radial internal clearance of the insert type is 0.035 mm.

Table 2 Tolerance unit: mm

| Type                                           | Dimension                  | Dimension symbol      | Tolerance          |
|------------------------------------------------|----------------------------|-----------------------|--------------------|
| PB                                             | Bore dia. of inner ring    | <i>d</i>              | H7                 |
|                                                | Outside dia. of outer ring | <i>D</i>              | h6                 |
|                                                | Width of inner ring        | <i>B</i>              | 0<br>− 0.1         |
|                                                | Width of outer ring        | <i>C</i>              | ± 0.1              |
| PHS(···A)<br>POS(···A)<br>PHS···EC<br>POS···EC | Bore dia. of inner ring    | <i>d</i>              | H7                 |
|                                                | Width of inner ring        | <i>B</i>              | 0<br>− 0.1         |
|                                                |                            |                       |                    |
| PHSB<br>POSB                                   | Bore dia. of inner ring    | <i>d</i>              | + 0.038<br>− 0.013 |
|                                                | Width of inner ring        | <i>B</i> <sub>1</sub> | 0<br>− 0.127       |
| PHSA                                           | Bore dia. of inner ring    | <i>d</i>              | + 0.063<br>− 0.012 |
|                                                | Width of inner ring        | <i>B</i>              | See Table 3.       |

Table 3 Tolerance of width *B* of inner ring of PHSA type unit: mm

| <i>d</i>                        |       | $\Delta_{Bs}$                          |       |
|---------------------------------|-------|----------------------------------------|-------|
| Nominal bore dia. of inner ring |       | Deviation of a single inner ring width |       |
| Over                            | Incl. | High                                   | Low   |
| —                               | 14    | 0                                      | − 0.2 |
| 14                              | 20    | 0                                      | − 0.3 |
| 20                              | 22    | 0                                      | − 0.4 |

Fit

Recommended fits for PILLOBALLs are shown in Table 4.

Table 4 Recommended fits

| Condition                           | Tolerance class |                             |
|-------------------------------------|-----------------|-----------------------------|
|                                     | Shaft           | Housing bore <sup>(1)</sup> |
| Normal operation                    | h7              | H7                          |
| Directionally indeterminate loading | n6, p6          | N7                          |

Note<sup>(1)</sup> This is applicable to PILLOBALL Spherical Bushings, Insert type.

Selection of PILLOBALL

Load capacities of PILLOBALLs are determined based on the allowable contact pressure on sliding surfaces and the strength of body for each type. Thus, a suitable type and size should be selected based on the dynamic load capacity *C<sub>d</sub>* and static load capacity *C<sub>s</sub>* shown in the dimension tables.

Load capacity

① Dynamic load capacity

The dynamic load capacity *C<sub>d</sub>* is obtained on the basis of the contact pressure on the sliding surface. The dynamic load capacity is used for calculating the life.

The dynamic load capacity considering temperature increase is obtained from the following equation using the temperature factor, which is a correction factor for the effect of PILLOBALL temperature.

$$C_{dt} = f_t C_d \dots\dots\dots (1)$$

where, *C<sub>dt</sub>* : Dynamic load capacity considering temperature increase, N

*f<sub>t</sub>* : Temperature factor (Refer to Table 5.)

*C<sub>d</sub>* : Dynamic load capacity, N (Refer to the dimension tables.)

Table 5 Temperature factor *f<sub>t</sub>*

| Type                                     | Temperature °C |              |               |                |                |                |
|------------------------------------------|----------------|--------------|---------------|----------------|----------------|----------------|
|                                          | − 30<br>+ 80   | + 80<br>+ 90 | + 90<br>+ 100 | + 100<br>+ 120 | + 120<br>+ 150 | + 150<br>+ 180 |
| PB<br>PHS(···A), POS(···A)<br>PHSB, POSB | 1              | 1            | 1             | 1              | 1              | 0.7            |
| PHS···EC<br>POS···EC                     | 1              | 1            | 0.9           | 0.75           | 0.55           | —              |

② Static load capacity

The static load capacity *C<sub>s</sub>* is the maximum static load that can be applied on the PILLOBALL without breaking the inner or outer ring of the PILLOBALL Spherical Bushing (or the inner ring or body of the PILLOBALL Rod End), and without causing severe permanent deformation that will make the PILLOBALL unusable.

Maximum Operating Load

The recommended value of bushing load is obtained by multiplying the dynamic load capacity  $C_d$  by a numerical factor, which differs depending on the bushing type and load condition. For PILLOBALL Rod Ends, the static load capacity  $C_s$  must also be considered in determining the applicable bushing load. Table 6 shows the guidelines for maximum operating load of PILLOBALLS. When axial loads are added in addition to radial loads, bending stress occurs in the body. Pay attention to this bending stress.

Table 6 Maximum operating load

| Type                             | Load direction |               |
|----------------------------------|----------------|---------------|
|                                  | Constant       | Alternate     |
| PB                               | $\leq 0.3C_d$  | $\leq 0.6C_d$ |
| PHS(---A), POS(---A), PHSB, POSB | $\leq 0.3C_d$  | $\leq 0.2C_s$ |
| PHSA                             | $\leq 0.16C_s$ |               |
| PHS---EC, POS---EC               | $\leq 0.3C_s$  | $\leq 0.2C_s$ |

Remark  $C_d$  is the dynamic load capacity and  $C_s$  is the static load capacity.

Equivalent radial load

PILLOBALLS can take radial and axial loads at the same time. When the magnitude and direction of loads are constant, the equivalent radial load can be obtained by the following equation.

$$P = F_r + YF_a \dots\dots\dots (2)$$

where,  $P$  : Equivalent radial load, N  
 $F_r$  : Radial load, N  
 $F_a$  : Axial load, N  
 $Y$  : Axial load factor (Refer to Table 7.)

Table 7 Axial load factor  $Y$

| Type                               | $F_a/F_r$ | 0.1 | 0.2 | 0.3 | 0.4      | 0.5 | > 0.5    |
|------------------------------------|-----------|-----|-----|-----|----------|-----|----------|
| PB                                 |           | 1   | 2   | 3   | 4        | 5   | Unusable |
| PHS(---A), POS(---A)<br>PHSB, POSB |           | 1   | 2   | 3   | 4        | 5   | Unusable |
| PHS---EC<br>POS---EC               |           | 1   | 2   | 3   | Unusable |     |          |

Life

The life of PILLOBALLS is defined as the total number of oscillating motions during which the PILLOBALLS can be operated without failure or malfunction due to wear, increase in internal clearance, increase in sliding torque and operating temperature, etc.

As the actual life is affected by many factors such as the material of the sliding surface, the magnitude and direction of load, lubrication, sliding velocity, etc., the calculated life can be used as a measure of expected service life.

① Life of lubrication type PILLOBALLS  
 $PB \cdot PHS(---A) \cdot POS(---A) \cdot PHSB \cdot POSB$

[1] Confirmation of  $pV$  value  
Before attempting to calculate the life, make sure that the operating conditions are within the permissible range by referring to the  $pV$  diagram in Fig.2. When the operating conditions are out of the permissible range, please consult IKO.  
The contact pressure  $p$  and the sliding velocity  $V$  are obtained from the following equations.

$$p = \frac{50P}{C_{dt}} \dots\dots\dots (3)$$

$$V = 5.82 \times 10^{-4} d_k \beta f \dots\dots\dots (4)$$

where,  $p$  : Contact pressure, N/mm<sup>2</sup>  
 $P$  : Equivalent radial load, N  
(Refer to equation (2).)  
 $C_{dt}$  : Dynamic load capacity considering temperature increase, N  
(Refer to equation (1).)  
 $V$  : Sliding velocity, mm/s  
 $d_k$  : Sphere diameter, mm  
(Refer to the dimensional tables.)  
 $2\beta$  : Oscillating angle degrees (Refer to Fig.3.)  
when  $\beta < 5^\circ$ ,  $\beta = 5$   
when rotating,  $\beta = 90$   
 $f$  : Number of oscillations per minute, min<sup>-1</sup>

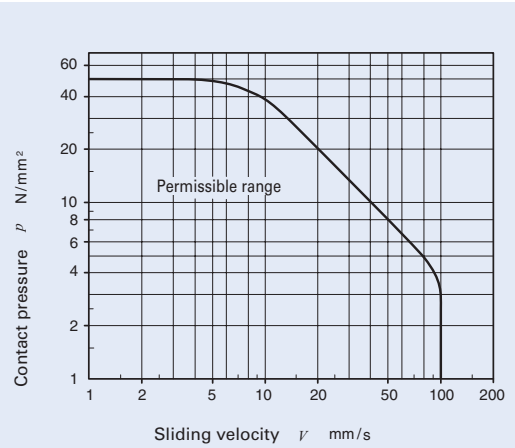


Fig. 2  $pV$  diagram of lubrication type PILLOBALLS

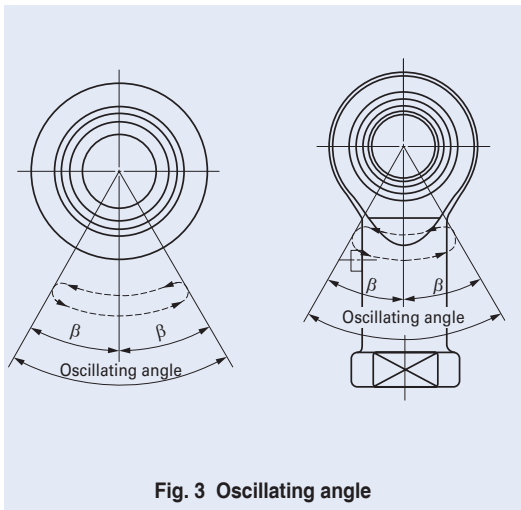


Fig. 3 Oscillating angle

[2] Life calculation  
The life of lubrication type PILLOBALLS can be calculated by the following equations.

$$G = \frac{3.18b_1b_2b_3}{\sqrt{d_k \beta}} \left( \frac{C_{dt}}{P} \right)^2 \times 10^5 \dots\dots\dots (5)$$

$$L_h = \frac{G}{60f} \dots\dots\dots (6)$$

where,  $G$  : Life (Total number of oscillations)  
 $b_1$  : Load directional factor (Refer to Table 8.)  
 $b_2$  : Lubrication factor (Refer to Table 8.)  
 $b_3$  : Sliding velocity factor (Refer to Fig. 4.)  
 $C_{dt}$  : Dynamic load capacity considering temperature increase, N  
(Refer to equation (1).)  
 $P$  : Equivalent radial load, N  
(Refer to equation (2).)  
 $L_h$  : Life in hours, h  
 $f$  : Number of oscillations per minute, min<sup>-1</sup>

Table 8 Load directional factor  $b_1$  and lubrication factor  $b_2$  for lubrication type PILLOBALLS

| Load directional factor $b_1$ |           | Lubrication factor $b_2$ |         |
|-------------------------------|-----------|--------------------------|---------|
| Load direction                |           | Periodical lubrication   |         |
| Constant                      | Alternate | None                     | Regular |
| 1                             | 5         | 1                        | 15      |

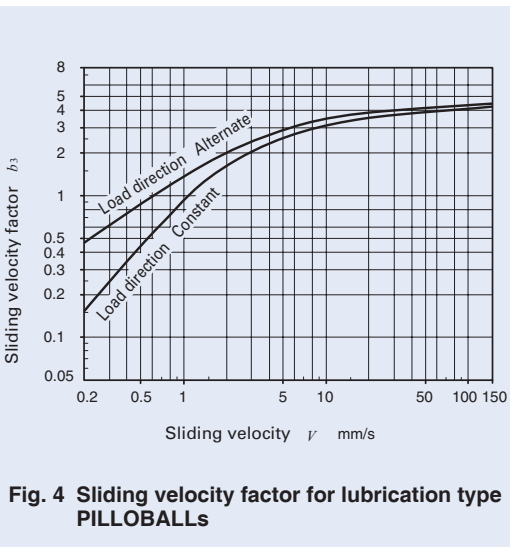


Fig. 4 Sliding velocity factor for lubrication type PILLOBALLS

② Life of maintenance-free type PILLOBALLS PHS---EC · POS---EC

[1] Confirmation of  $pV$  value  
Before attempting to calculate the life, make sure that the operating conditions are within the permissible range by referring to the  $pV$  diagram in Fig.5. When the operating conditions are out of the permissible range, please consult IKO.  
The contact pressure  $p$  and sliding velocity  $V$  are obtained from equations (3) and (4) on page K6.

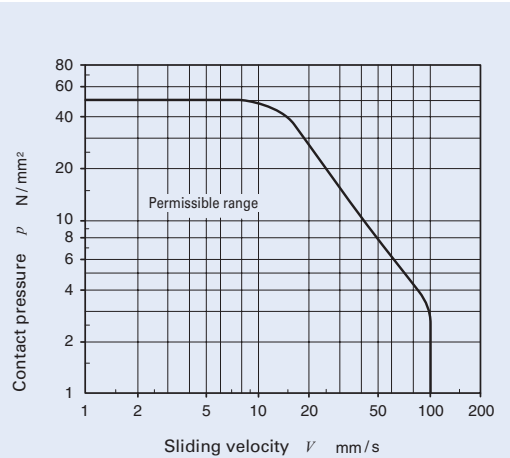


Fig. 5  $pV$  diagram for maintenance-free type PILLOBALL Rod Ends

[2] Life calculation  
The life of maintenance-free type PILLOBALL Rod Ends is obtained from the total sliding distance *S* which is given in Fig.5 for the contact pressure *p* obtained from equation (3).  
The total number of oscillations and life in hours can be obtained from the following equations.

$$G = 16.67 \times b_1 \times \frac{Sf}{V} \dots\dots\dots(7)$$

$$L_h = \frac{G}{60f} \dots\dots\dots(8)$$

where, *G* : Life (Total number of oscillations)  
*b*<sub>1</sub> : Load directional factor (Refer to Table 9.)  
*S* : Total sliding distance m  
*f* : Number of oscillations per minute min<sup>-1</sup>  
*V* : Sliding velocity mm/s  
*L*<sub>h</sub> : Life in hours h

Table 9 Load directional factor for maintenance-free type PILLOBALLs *b*<sub>1</sub>

| Load direction                                | Constant | Alternate          |
|-----------------------------------------------|----------|--------------------|
| Load directional factor <i>b</i> <sub>1</sub> | 1        | 0.2 <sup>(1)</sup> |

Note<sup>(1)</sup> This value is applicable when the load changes comparatively slowly. When the load changes rapidly, please consult IKO, as the factor decreases sharply.

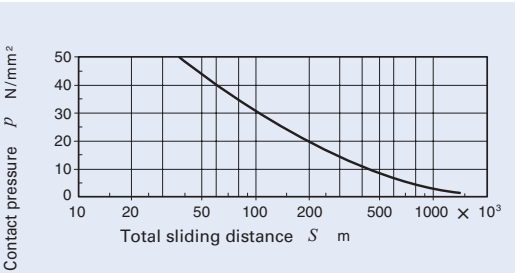


Fig. 6 Contact pressure and total sliding distance for maintenance-free type PILLOBALL Rod Ends

Lubrication

Maintenance-free type PILLOBALL Rod Ends have a sliding surface lined with a self-lubricating lining. Therefore, they can be used without lubrication. Lubrication type PILLOBALLs are not provided with prepacked grease. Perform proper lubrication for use. Operating without lubrication will increase the wear of the sliding contact surfaces and cause seizure.

Oil Hole and Grease Nipple

Table 10 shows the specifications of oil hole and grease nipple on the outer ring or body. Further, lubrication nozzle models compatible with the grease nipple are shown in Table 11.  
For PILLOBALLs without an oil hole and grease nipple, apply grease directly on the spherical surface.

Table 10 Specifications of oil hole and grease nipple

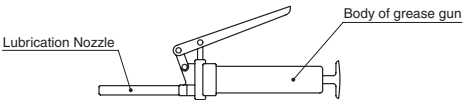
| Type             | Bore diameter of inner ring <i>d</i> mm | Specification           |
|------------------|-----------------------------------------|-------------------------|
|                  |                                         |                         |
| PB               |                                         | 1 oil hole + oil groove |
| PHS(…A)          | <i>d</i> ≤ 4                            | None                    |
|                  | 4 < <i>d</i>                            | With grease nipple      |
| POS(…A)          | <i>d</i> ≤ 4                            | None                    |
|                  | 4 < <i>d</i> ≤ 6                        | 1 oil hole              |
|                  | 6 < <i>d</i>                            | With grease nipple      |
| PHSB · POSB      |                                         | None <sup>(1)</sup>     |
| PHSA             |                                         | With grease nipple      |
| PHS… EC, POS… EC |                                         | None                    |

Note<sup>(1)</sup> Grease Nipple is available for size 4 or larger with supplemental code.

Table 11 Types and Dimension of Lubrication Nozzles

| Type    | Dimension |
|---------|-----------|
| A-5126T |           |
| A-5120R |           |
| B-5120R |           |

Remark HSP-3(Yamada Corporation)can be used for them.  
The above nozzles can be attached on the standard grease gun shown below.



Operating Temperature Range

The maximum allowable temperature for Lubrication type PILLOBALLs is +180°C for the insert type and +80°C for the die-cast type.  
The maximum allowable temperature for Maintenance-free type PILLOBALL Rod Ends is +150°C.

Precautions for Use

① Tightening depth  
The recommended tightening depth of the screw into the PILLOBALL Rod End body is shown below.  
Insert type and maintenance-free type: 1.25 times the nominal thread dia. or more.  
Die-cast type: 2 times the nominal thread dia. or more.

② Allowable tilting angle  
The allowable tilting angle differs depending on the mounting structure as shown in Table 12 and Table 13.

Table 12 Allowable tilting angle

unit: degree

| <i>d</i><br>Bore diameter<br>mm | PB <sup>(1)</sup> , PHS(…A), POS(…A)<br>PHS… EC, POS… EC |                       | PHSA                  |                       |
|---------------------------------|----------------------------------------------------------|-----------------------|-----------------------|-----------------------|
|                                 | <i>α</i> <sub>1</sub>                                    | <i>α</i> <sub>2</sub> | <i>α</i> <sub>1</sub> | <i>α</i> <sub>2</sub> |
| 3                               | 7                                                        | 13                    | —                     | —                     |
| 4                               | 7                                                        | 13                    | —                     | —                     |
| 5                               | 8                                                        | 13                    | 7                     | 13                    |
| 6                               | 8                                                        | 13                    | 7                     | 13                    |
| 8                               | 8                                                        | 14                    | 8                     | 14                    |
| 10                              | 8                                                        | 14                    | 8                     | 14                    |
| 12                              | 8                                                        | 13                    | 8                     | 13                    |
| 14                              | 10                                                       | 16                    | 9                     | 16                    |
| 16                              | 9                                                        | 15                    | 9                     | 15                    |
| 18                              | 9                                                        | 15                    | 9                     | 15                    |
| 20                              | 9                                                        | 15                    | 9                     | 15                    |
| 22                              | 10                                                       | 15                    | 9                     | 15                    |
| 25                              | 9                                                        | 15                    | —                     | —                     |
| 28                              | 9                                                        | 15                    | —                     | —                     |
| 30                              | 10                                                       | 17                    | —                     | —                     |

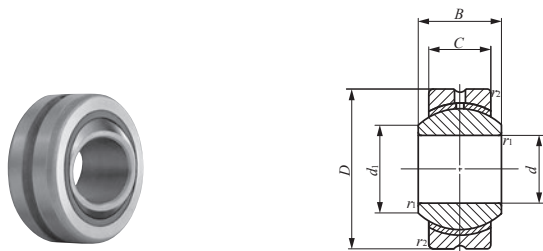
Note<sup>(1)</sup> In the case of the PB series, *α*<sub>2</sub> is applicable in general.

Table 13 Allowable tilting angle for inch series

| With female thread | With male thread | <i>α</i> <sub>1</sub> | <i>α</i> <sub>2</sub> |
|--------------------|------------------|-----------------------|-----------------------|
| PHSB 2             | POSB 2           | 8                     | 16                    |
| PHSB 2.5           | POSB 2.5         | 7                     | 12                    |
| PHSB 3             | POSB 3           | 6                     | 10                    |
| PHSB 4             | POSB 4           | 7                     | 13                    |
| PHSB 5             | POSB 5           | 6                     | 10                    |
| PHSB 6             | POSB 6           | 6                     | 11                    |
| PHSB 7             | POSB 7           | 7                     | 11                    |
| PHSB 8             | POSB 8           | 6                     | 9                     |
| PHSB 10            | POSB 10          | 7                     | 11                    |
| PHSB 12            | POSB 12          | 6                     | 10                    |
| PHSB 16            | POSB 16          | 7                     | 14                    |

PILLOBALL

Lubrication Type PILLOBALL Spherical Bushings **Insert Type**

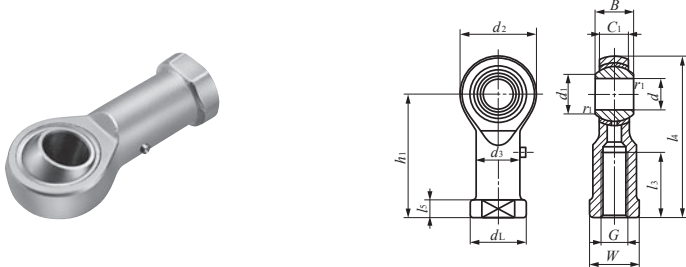


PB

| Identification number | Mass (Ref.)<br>g | Boundary dimensions mm |     |      |     |       |                   |                                | Dynamic load capacity<br>$C_d$<br>N | Static load capacity<br>$C_s$<br>N |
|-----------------------|------------------|------------------------|-----|------|-----|-------|-------------------|--------------------------------|-------------------------------------|------------------------------------|
|                       |                  | $d$                    | $D$ | $C$  | $B$ | $d_1$ | $r_{s\min}^{(1)}$ | Ball dia.<br>mm<br>(inch)      |                                     |                                    |
| PB 5                  | 8.5              | 5                      | 16  | 6    | 8   | 7.7   | 0.2               | 11.112<br>( $\frac{7}{16}$ )   | 3 270                               | 7 850                              |
| PB 6                  | 13               | 6                      | 18  | 6.75 | 9   | 9     | 0.2               | 12.700<br>( $\frac{1}{2}$ )    | 4 200                               | 10 100                             |
| PB 8                  | 24               | 8                      | 22  | 9    | 12  | 10.4  | 0.2               | 15.875<br>( $\frac{5}{8}$ )    | 7 010                               | 16 800                             |
| PB 10                 | 39               | 10                     | 26  | 10.5 | 14  | 12.9  | 0.2               | 19.050<br>( $\frac{3}{4}$ )    | 9 810                               | 23 500                             |
| PB 12                 | 58               | 12                     | 30  | 12   | 16  | 15.4  | 0.2               | 22.225<br>( $\frac{7}{8}$ )    | 13 100                              | 31 400                             |
| PB 14                 | 84               | 14                     | 34  | 13.5 | 19  | 16.9  | 0.3               | 25.400<br>(1)                  | 16 800                              | 40 400                             |
| PB 16                 | 111              | 16                     | 38  | 15   | 21  | 19.4  | 0.3               | 28.575<br>( $1\frac{1}{8}$ )   | 21 000                              | 50 400                             |
| PB 18                 | 160              | 18                     | 42  | 16.5 | 23  | 21.9  | 0.3               | 31.750<br>( $1\frac{1}{4}$ )   | 25 700                              | 61 600                             |
| PB 20                 | 210              | 20                     | 46  | 18   | 25  | 24.4  | 0.3               | 34.925<br>( $1\frac{3}{8}$ )   | 30 800                              | 74 000                             |
| PB 22                 | 265              | 22                     | 50  | 20   | 28  | 25.8  | 0.3               | 38.100<br>( $1\frac{1}{2}$ )   | 37 400                              | 89 700                             |
| PB 25                 | 390              | 25                     | 56  | 22   | 31  | 29.6  | 0.6               | 42.862<br>( $1\frac{11}{16}$ ) | 46 200                              | 111 000                            |
| PB 28                 | 410              | 28                     | 62  | 25   | 35  | 32.3  | 0.6               | 47.625<br>( $1\frac{7}{8}$ )   | 58 400                              | 140 000                            |
| PB 30                 | 610              | 30                     | 66  | 25   | 37  | 34.8  | 0.6               | 50.800<br>(2)                  | 62 300                              | 149 000                            |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimensions  $r_1$  and  $r_2$   
Remarks1. The outer ring has an oil groove and an oil hole.  
2. No grease is prepacked. Perform proper lubrication.

Lubrication Type PILLOBALL Rod Ends **Insert Type/With Female Thread**



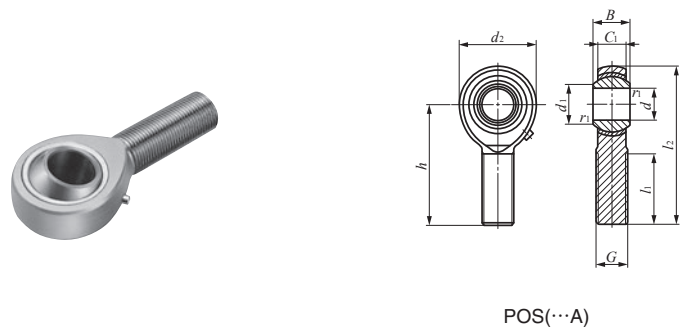
PHS(…A)

| Identification<br>number | Mass<br>(Ref.)<br><br>g | Boundary dimensions   mm |               |       |       |     |       |       |       |       |       |     |       |       |                   |                                | Dynamic load<br>capacity<br><br>$C_d$ | Static load<br>capacity<br><br>$C_s$ |
|--------------------------|-------------------------|--------------------------|---------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-------------------|--------------------------------|---------------------------------------|--------------------------------------|
|                          |                         | $d$                      | Thread<br>$G$ | $d_2$ | $C_1$ | $B$ | $d_1$ | $l_4$ | $h_1$ | $l_3$ | $l_5$ | $W$ | $d_3$ | $d_L$ | $r_{1smin}^{(1)}$ | Ball dia.<br>mm<br>(inch)      | N                                     | N                                    |
|                          |                         |                          |               |       |       |     |       |       |       |       |       |     |       |       |                   |                                |                                       |                                      |
| PHS 3                    | 5.7                     | 3                        | M 3×0.5       | 12    | 4.5   | 6   | 5.2   | 27    | 21    | 10    | 3     | 5.5 | 5     | 6.5   | 0.2               | 7.938<br>( $\frac{5}{16}$ )    | 1 750                                 | 3 670                                |
| PHS 4                    | 11.9                    | 4                        | M 4×0.7       | 14    | 5.3   | 7   | 6.5   | 31    | 24    | 12    | 4     | 8   | 8     | 9.5   | 0.2               | 9.525<br>( $\frac{3}{8}$ )     | 2 480                                 | 4 680                                |
| PHS 5A                   | 16.5                    | 5                        | M 5×0.8       | 16    | 6     | 8   | 7.7   | 35    | 27    | 14    | 4     | 9   | 9     | 11    | 0.2               | 11.112<br>( $\frac{7}{16}$ )   | 3 270                                 | 5 730                                |
| PHS 6A                   | 25                      | 6                        | M 6×1         | 18    | 6.75  | 9   | 9     | 39    | 30    | 14    | 5     | 11  | 10    | 13    | 0.2               | 12.700<br>( $\frac{1}{2}$ )    | 4 200                                 | 6 910                                |
| PHS 8A                   | 43                      | 8                        | M 8×1.25      | 22    | 9     | 12  | 10.4  | 47    | 36    | 17    | 5     | 14  | 12.5  | 16    | 0.2               | 15.875<br>( $\frac{5}{8}$ )    | 7 010                                 | 10 200                               |
| PHS 10A                  | 72                      | 10                       | M10×1.5       | 26    | 10.5  | 14  | 12.9  | 56    | 43    | 21    | 6.5   | 17  | 15    | 19    | 0.2               | 19.050<br>( $\frac{3}{4}$ )    | 9 810                                 | 13 300                               |
| PHS 12A                  | 107                     | 12                       | M12×1.75      | 30    | 12    | 16  | 15.4  | 65    | 50    | 24    | 6.5   | 19  | 17.5  | 22    | 0.2               | 22.225<br>( $\frac{7}{8}$ )    | 13 100                                | 16 900                               |
| PHS 14A                  | 160                     | 14                       | M14×2         | 34    | 13.5  | 19  | 16.9  | 74    | 57    | 27    | 8     | 22  | 20    | 25    | 0.2               | 25.400<br>( 1 )                | 16 800                                | 20 900                               |
| PHS 16A                  | 210                     | 16                       | M16×2         | 38    | 15    | 21  | 19.4  | 83    | 64    | 33    | 8     | 22  | 22    | 27    | 0.2               | 28.575<br>( $1\frac{1}{8}$ )   | 21 000                                | 25 400                               |
| PHS 18A                  | 295                     | 18                       | M18×1.5       | 42    | 16.5  | 23  | 21.9  | 92    | 71    | 36    | 10    | 27  | 25    | 31    | 0.2               | 31.750<br>( $1\frac{1}{4}$ )   | 25 700                                | 30 200                               |
| PHS 20                   | 380                     | 20                       | M20×1.5       | 46    | 18    | 25  | 24.4  | 100   | 77    | 40    | 10    | 30  | 27.5  | 34    | 0.2               | 34.925<br>( $1\frac{3}{8}$ )   | 30 800                                | 35 500                               |
| PHS 22                   | 490                     | 22                       | M22×1.5       | 50    | 20    | 28  | 25.8  | 109   | 84    | 43    | 12    | 32  | 30    | 37    | 0.2               | 38.100<br>( $1\frac{1}{2}$ )   | 37 400                                | 41 700                               |
| PHS 25                   | 750                     | 25                       | M24×2         | 60    | 22    | 31  | 29.6  | 124   | 94    | 48    | 12    | 36  | 33.5  | 42    | 0.6               | 42.862<br>( $1\frac{11}{16}$ ) | 46 200                                | 72 700                               |
| PHS 28                   | 950                     | 28                       | M27×2         | 66    | 25    | 35  | 32.3  | 136   | 103   | 53    | 12    | 41  | 37    | 46    | 0.6               | 47.625<br>( $1\frac{7}{8}$ )   | 58 400                                | 87 000                               |
| PHS 30                   | 1 130                   | 30                       | M30×2         | 70    | 25    | 37  | 34.8  | 145   | 110   | 56    | 15    | 41  | 40    | 50    | 0.6               | 50.800<br>( 2 )                | 62 300                                | 92 200                               |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r_1$   
Remarks1. Neither oil hole nor grease nipple is provided for PHS with an inner ring bore diameter  $d$  of 4 mm or less.  
For others, a grease nipple is provided on the body.  
2. No grease is prepacked. Perform proper lubrication.  
3. When a metric fine thread specification for inner ring bore deameter  $d$  of 8 mm to 14 mm is required, please contact IKO.

PILLOBALL

Lubrication Type PILLOBALL Rod Ends **Insert Type/With Male Thread**



| Identification number | Mass (Ref.)<br>g | Boundary dimensions mm |             |                |                |    |                |                |     |                |                                    |                           | Dynamic load capacity<br>C <sub>d</sub><br>N | Static load capacity<br>C <sub>s</sub><br>N |
|-----------------------|------------------|------------------------|-------------|----------------|----------------|----|----------------|----------------|-----|----------------|------------------------------------|---------------------------|----------------------------------------------|---------------------------------------------|
|                       |                  | d                      | Thread<br>G | d <sub>2</sub> | C <sub>1</sub> | B  | d <sub>1</sub> | l <sub>2</sub> | h   | l <sub>1</sub> | r <sub>1s min</sub> <sup>(1)</sup> | Ball dia.<br>mm<br>(inch) |                                              |                                             |
| POS 3                 | 5.0              | 3                      | M 3×0.5     | 12             | 4.5            | 6  | 5.2            | 33             | 27  | 15             | 0.2                                | 7.938<br>( 5/16 )         | 1 750                                        | 1 220                                       |
| POS 4                 | 8.1              | 4                      | M 4×0.7     | 14             | 5.3            | 7  | 6.5            | 37             | 30  | 17             | 0.2                                | 9.525<br>( 3/8 )          | 2 480                                        | 2 060                                       |
| POS 5A                | 12.5             | 5                      | M 5×0.8     | 16             | 6              | 8  | 7.7            | 41             | 33  | 20             | 0.2                                | 11.112<br>( 7/16 )        | 3 270                                        | 3 340                                       |
| POS 6A                | 19               | 6                      | M 6×1       | 18             | 6.75           | 9  | 9              | 45             | 36  | 22             | 0.2                                | 12.700<br>( 1/2 )         | 4 200                                        | 4 730                                       |
| POS 8A                | 32               | 8                      | M 8×1.25    | 22             | 9              | 12 | 10.4           | 53             | 42  | 25             | 0.2                                | 15.875<br>( 5/8 )         | 7 010                                        | 8 640                                       |
| POS 10A               | 54               | 10                     | M10×1.5     | 26             | 10.5           | 14 | 12.9           | 61             | 48  | 29             | 0.2                                | 19.050<br>( 3/4 )         | 9 810                                        | 13 300                                      |
| POS 12A               | 85               | 12                     | M12×1.75    | 30             | 12             | 16 | 15.4           | 69             | 54  | 33             | 0.2                                | 22.225<br>( 7/8 )         | 13 100                                       | 16 900                                      |
| POS 14A               | 126              | 14                     | M14×2       | 34             | 13.5           | 19 | 16.9           | 77             | 60  | 36             | 0.2                                | 25.400<br>( 1 )           | 16 800                                       | 20 900                                      |
| POS 16A               | 185              | 16                     | M16×2       | 38             | 15             | 21 | 19.4           | 85             | 66  | 40             | 0.2                                | 28.575<br>( 1 1/8 )       | 21 000                                       | 25 400                                      |
| POS 18A               | 260              | 18                     | M18×1.5     | 42             | 16.5           | 23 | 21.9           | 93             | 72  | 44             | 0.2                                | 31.750<br>( 1 1/4 )       | 25 700                                       | 30 200                                      |
| POS 20                | 340              | 20                     | M20×1.5     | 46             | 18             | 25 | 24.4           | 101            | 78  | 47             | 0.2                                | 34.925<br>( 1 3/8 )       | 30 800                                       | 35 500                                      |
| POS 22                | 435              | 22                     | M22×1.5     | 50             | 20             | 28 | 25.8           | 109            | 84  | 51             | 0.2                                | 38.100<br>( 1 1/2 )       | 37 400                                       | 41 700                                      |
| POS 25                | 650              | 25                     | M24×2       | 60             | 22             | 31 | 29.6           | 124            | 94  | 57             | 0.6                                | 42.862<br>( 1 11/16 )     | 46 200                                       | 72 700                                      |
| POS 28                | 875              | 28                     | M27×2       | 66             | 25             | 35 | 32.3           | 136            | 103 | 62             | 0.6                                | 47.625<br>( 1 7/8 )       | 58 400                                       | 87 000                                      |
| POS 30                | 1 070            | 30                     | M30×2       | 70             | 25             | 37 | 34.8           | 145            | 110 | 66             | 0.6                                | 50.800<br>( 2 )           | 62 300                                       | 92 200                                      |

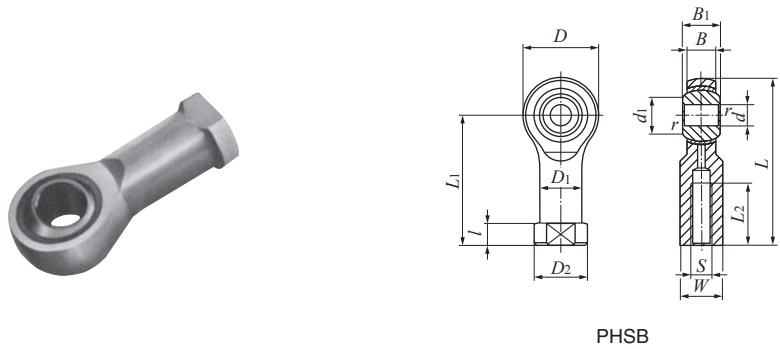
Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r_1$

Remarks1. Neither oil hole nor grease nipple is provided for POS with an inner ring bore diameter  $d$  of 4 mm or less.  
For those with an inner ring bore diameter  $d$  of 5 to 6 mm, an oil hole is provided on the body. For others, a grease nipple is provided on the body.

2. No grease is prepacked. Perform proper lubrication.

3. When a metric fine thread specification for inner ring bore deameter  $d$  of 8 mm to 14 mm is required, please contact IKO.

Inch series PILLOBALL Rod Ends **Insert Type/With Female Thread**



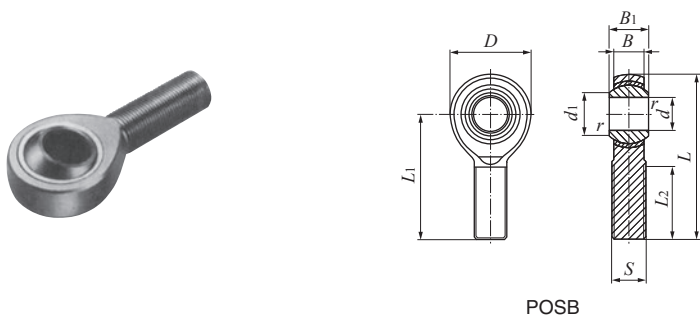
| Identification number | Mass (Ref.)<br>g | Boundary dimensions<br>mm(inch) |                           |                  |                  |                  |                  |                   |                 |                   |                  |                  |                  |                  |                  |                               | Dynamic load capacity<br>$C_d$<br>N | Static load capacity<br>$C_s$<br>N |
|-----------------------|------------------|---------------------------------|---------------------------|------------------|------------------|------------------|------------------|-------------------|-----------------|-------------------|------------------|------------------|------------------|------------------|------------------|-------------------------------|-------------------------------------|------------------------------------|
|                       |                  | $d$                             | Thread<br>$S$<br>class 3B | $D$              | $B$              | $B_1$            | $d_1$            | $L$               | $l$             | $L_1$             | $L_2$            | $W$              | $D_1$            | $D_2$            | $r_{smin}^{(1)}$ | Ball dia.<br>mm<br>(inch)     |                                     |                                    |
| PHSB 2                | 6.8              | 3.175<br>(.1250)                | -32UNC<br>(.1380)         | 11.91<br>(.469)  | 4.75<br>(.187)   | 6.35<br>(.250)   | 4.75<br>(.187)   | 26.57<br>(1.046)  | 4.75<br>(.187)  | 20.62<br>(.812)   | 9.53<br>(.375)   | 6.35<br>(.250)   | 6.35<br>(.250)   | 7.92<br>(.312)   | 0.3<br>(.012)    | 7.938<br>( $\frac{5}{16}$ )   | 1 850                               | 5 840                              |
| PHSB 2.5              | 11               | 3.967<br>(.1562)                | -32UNC<br>(.1640)         | 14.27<br>(.562)  | 5.56<br>(.219)   | 7.14<br>(.281)   | 6.32<br>(.249)   | 29.36<br>(1.156)  | 4.75<br>(.187)  | 22.23<br>(.875)   | 9.53<br>(.375)   | 7.14<br>(.281)   | 7.14<br>(.281)   | 8.74<br>(.344)   | 0.3<br>(.012)    | 9.525<br>( $\frac{3}{8}$ )    | 2 600                               | 8 210                              |
| PHSB 3                | 14               | 4.826<br>(.1900)                | -32UNF<br>(.1900)         | 15.88<br>(.625)  | 6.35<br>(.250)   | 7.92<br>(.312)   | 7.77<br>(.306)   | 34.93<br>(1.375)  | 4.75<br>(.187)  | 26.97<br>(1.062)  | 14.27<br>(.562)  | 7.92<br>(.312)   | 7.92<br>(.312)   | 10.31<br>(.406)  | 0.3<br>(.012)    | 11.112<br>( $\frac{7}{16}$ )  | 3 460                               | 9 090                              |
| PHSB 4                | 23               | 6.350<br>(.2500)                | -28UNF<br>(.2500)         | 19.05<br>(.750)  | 7.14<br>(.281)   | 9.53<br>(.375)   | 9.02<br>(.355)   | 42.85<br>(1.687)  | 4.75<br>(.187)  | 33.32<br>(1.312)  | 19.05<br>(.750)  | 9.53<br>(.375)   | 9.53<br>(.375)   | 11.89<br>(.468)  | 0.5<br>(.020)    | 13.097<br>( $\frac{33}{64}$ ) | 4 590                               | 13 200                             |
| PHSB 5                | 36               | 7.938<br>(.3125)                | -24UNF<br>(.3125)         | 22.23<br>(.875)  | 8.74<br>(.344)   | 11.10<br>(.437)  | 11.35<br>(.447)  | 46.02<br>(1.812)  | 4.75<br>(.187)  | 34.93<br>(1.375)  | 19.05<br>(.750)  | 11.10<br>(.437)  | 11.10<br>(.437)  | 12.70<br>(.500)  | 0.5<br>(.020)    | 15.875<br>( $\frac{5}{8}$ )   | 6 800                               | 16 500                             |
| PHSB 6                | 59               | 9.525<br>(.3750)                | -24UNF<br>(.3750)         | 25.40<br>(1.000) | 10.31<br>(.406)  | 12.70<br>(.500)  | 13.13<br>(.517)  | 53.98<br>(2.125)  | 6.35<br>(.250)  | 41.28<br>(1.625)  | 23.80<br>(.937)  | 14.27<br>(.562)  | 14.27<br>(.562)  | 17.45<br>(.687)  | 0.5<br>(.020)    | 18.256<br>( $\frac{23}{32}$ ) | 9 230                               | 21 600                             |
| PHSB 7                | 82               | 11.112<br>(.4375)               | -20UNF<br>(.4375)         | 28.58<br>(1.125) | 11.10<br>(.437)  | 14.27<br>(.562)  | 14.88<br>(.586)  | 60.33<br>(2.375)  | 6.35<br>(.250)  | 46.02<br>(1.812)  | 26.97<br>(1.062) | 15.88<br>(.625)  | 15.88<br>(.625)  | 19.05<br>(.750)  | 0.5<br>(.020)    | 20.638<br>( $\frac{13}{16}$ ) | 11 200                              | 26 100                             |
| PHSB 8                | 132              | 12.700<br>(.5000)               | -20UNF<br>(.5000)         | 33.32<br>(1.312) | 12.70<br>(.500)  | 15.88<br>(.625)  | 17.73<br>(.698)  | 70.64<br>(2.781)  | 6.35<br>(.250)  | 53.98<br>(2.125)  | 30.15<br>(1.187) | 19.05<br>(.750)  | 19.05<br>(.750)  | 22.23<br>(.875)  | 0.5<br>(.020)    | 23.812<br>( $\frac{15}{16}$ ) | 14 800                              | 36 200                             |
| PHSB 10               | 191              | 15.875<br>(.6250)               | -18UNF<br>(.6250)         | 38.10<br>(1.500) | 14.27<br>(.562)  | 19.05<br>(.750)  | 21.31<br>(.839)  | 82.55<br>(3.250)  | 7.92<br>(.312)  | 63.50<br>(2.500)  | 38.10<br>(1.500) | 22.23<br>(.875)  | 22.23<br>(.875)  | 25.40<br>(1.000) | 0.5<br>(.020)    | 28.575<br>(1 $\frac{1}{8}$ )  | 20 000                              | 39 300                             |
| PHSB 12               | 286              | 19.050<br>(.7500)               | -16UNF<br>(.7500)         | 44.45<br>(1.750) | 17.45<br>(.687)  | 22.23<br>(.875)  | 24.84<br>(.978)  | 95.25<br>(3.750)  | 7.92<br>(.312)  | 73.03<br>(2.875)  | 44.45<br>(1.750) | 25.40<br>(1.000) | 25.40<br>(1.000) | 28.58<br>(1.125) | 0.5<br>(.020)    | 33.338<br>(1 $\frac{5}{16}$ ) | 28 500                              | 55 000                             |
| PHSB 16               | 998              | 25.400<br>(1.0000)              | -12UNF<br>(1.2500)        | 69.85<br>(2.750) | 25.40<br>(1.000) | 34.93<br>(1.375) | 32.23<br>(1.269) | 139.70<br>(5.500) | 11.07<br>(.436) | 104.78<br>(4.125) | 53.98<br>(2.125) | 38.10<br>(1.500) | 38.10<br>(1.500) | 44.45<br>(1.750) | 0.5<br>(.020)    | 47.625<br>(1 $\frac{7}{8}$ )  | 59 300                              | 86 800                             |

Note<sup>(1)</sup>  $r_s$  min stands for minimum allowable value of chamfer  $r$ .

Remark No grease is prepacked. Perform proper lubrication.

PILLOBALL

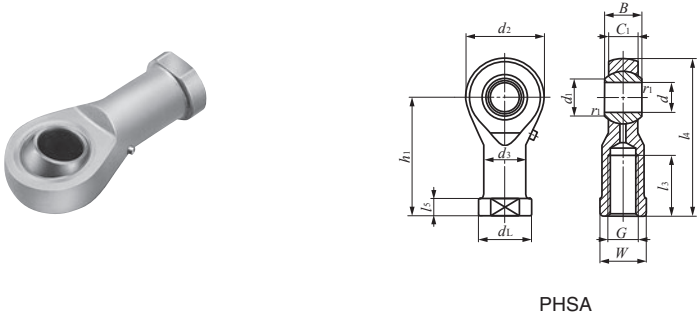
Inch series PILLOBALL Rod Ends **Insert Type/With Male Thread**



| Identification number | Mass (Ref.)<br>g | Boundary dimensions mm(inch) |                                |                  |                  |                      |                      |                   |                      |                      |                                            |                                             | Dynamic load capacity<br><i>C<sub>d</sub></i><br>N | Static load capacity<br><i>C<sub>s</sub></i><br>N |
|-----------------------|------------------|------------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-------------------|----------------------|----------------------|--------------------------------------------|---------------------------------------------|----------------------------------------------------|---------------------------------------------------|
|                       |                  | <i>d</i>                     | Thread<br><i>S</i><br>class 3A | <i>D</i>         | <i>B</i>         | <i>B<sub>1</sub></i> | <i>d<sub>1</sub></i> | <i>L</i>          | <i>L<sub>1</sub></i> | <i>L<sub>2</sub></i> | <i>r<sub>s</sub></i> <sup>(1)</sup><br>min | Ball dia.<br>mm<br>(inch)                   |                                                    |                                                   |
| POSB 2                | 5.4              | 3.175<br>(.1250)             | -32UNC<br>(.1380)              | 11.91<br>(.469)  | 4.75<br>(.187)   | 6.35<br>(.250)       | 4.75<br>(.187)       | 29.77<br>(1.172)  | 23.80<br>(.937)      | 12.70<br>(.500)      | 0.3<br>(.012)                              | 7.938<br>( <sup>5</sup> / <sub>16</sub> )   | 1 850                                              | 2 160                                             |
| POSB 2.5              | 9.1              | 3.967<br>(.1562)             | -32UNC<br>(.1640)              | 14.27<br>(.562)  | 5.56<br>(.219)   | 7.14<br>(.281)       | 6.32<br>(.249)       | 35.71<br>(1.406)  | 28.58<br>(1.125)     | 15.88<br>(.625)      | 0.3<br>(.012)                              | 9.525<br>( <sup>3</sup> / <sub>8</sub> )    | 2 600                                              | 3 370                                             |
| POSB 3                | 14               | 4.826<br>(.1900)             | -32UNF<br>(.1900)              | 15.88<br>(.625)  | 6.35<br>(.250)   | 7.92<br>(.312)       | 7.77<br>(.306)       | 39.70<br>(1.563)  | 31.75<br>(1.250)     | 19.05<br>(.750)      | 0.3<br>(.012)                              | 11.112<br>( <sup>7</sup> / <sub>16</sub> )  | 3 460                                              | 4 850                                             |
| POSB 4                | 23               | 6.350<br>(.2500)             | -28UNF<br>(.2500)              | 19.05<br>(.750)  | 7.14<br>(.281)   | 9.53<br>(.375)       | 9.02<br>(.355)       | 49.20<br>(1.937)  | 39.67<br>(1.562)     | 25.40<br>(1.000)     | 0.5<br>(.020)                              | 13.097<br>( <sup>33</sup> / <sub>64</sub> ) | 4 590                                              | 8 870                                             |
| POSB 5                | 36               | 7.938<br>(.3125)             | -24UNF<br>(.3125)              | 22.23<br>(.875)  | 8.74<br>(.344)   | 11.10<br>(.437)      | 11.35<br>(.447)      | 58.72<br>(2.312)  | 47.63<br>(1.875)     | 31.75<br>(1.250)     | 0.5<br>(.020)                              | 15.875<br>( <sup>5</sup> / <sub>8</sub> )   | 6 800                                              | 14 200                                            |
| POSB 6                | 54               | 9.525<br>(.3750)             | -24UNF<br>(.3750)              | 25.40<br>(1.000) | 10.31<br>(.406)  | 12.70<br>(.500)      | 13.13<br>(.517)      | 61.93<br>(2.438)  | 49.23<br>(1.938)     | 31.75<br>(1.250)     | 0.5<br>(.020)                              | 18.256<br>( <sup>23</sup> / <sub>32</sub> ) | 9 230                                              | 21 600                                            |
| POSB 7                | 77               | 11.112<br>(.4375)            | -20UNF<br>(.4375)              | 28.58<br>(1.125) | 11.10<br>(.437)  | 14.27<br>(.562)      | 14.88<br>(.586)      | 68.28<br>(2.688)  | 53.98<br>(2.125)     | 34.93<br>(1.375)     | 0.5<br>(.020)                              | 20.638<br>( <sup>13</sup> / <sub>16</sub> ) | 11 200                                             | 26 100                                            |
| POSB 8                | 122              | 12.700<br>(.5000)            | -20UNF<br>(.5000)              | 33.32<br>(1.312) | 12.70<br>(.500)  | 15.88<br>(.625)      | 17.73<br>(.698)      | 78.59<br>(3.094)  | 61.93<br>(2.438)     | 38.10<br>(1.500)     | 0.5<br>(.020)                              | 23.812<br>( <sup>15</sup> / <sub>16</sub> ) | 14 800                                             | 36 200                                            |
| POSB 10               | 186              | 15.875<br>(.6250)            | -18UNF<br>(.6250)              | 38.10<br>(1.500) | 14.27<br>(.562)  | 19.05<br>(.750)      | 21.31<br>(.839)      | 85.73<br>(3.375)  | 66.68<br>(2.625)     | 41.28<br>(1.625)     | 0.5<br>(.020)                              | 28.575<br>(1 <sup>1</sup> / <sub>8</sub> )  | 20 000                                             | 39 300                                            |
| POSB 12               | 295              | 19.050<br>(.7500)            | -16UNF<br>(.7500)              | 44.45<br>(1.750) | 17.45<br>(.687)  | 22.23<br>(.875)      | 24.84<br>(.978)      | 95.25<br>(3.750)  | 73.03<br>(2.875)     | 44.45<br>(1.750)     | 0.5<br>(.020)                              | 33.338<br>(1 <sup>3</sup> / <sub>16</sub> ) | 28 500                                             | 55 000                                            |
| POSB 16               | 1 129            | 25.400<br>(1.0000)           | -12UNF<br>(1.2500)             | 69.85<br>(2.750) | 25.40<br>(1.000) | 34.93<br>(1.375)     | 32.23<br>(1.269)     | 139.70<br>(5.500) | 104.78<br>(4.125)    | 53.98<br>(2.125)     | 0.5<br>(.020)                              | 47.625<br>(1 <sup>7</sup> / <sub>8</sub> )  | 59 300                                             | 112 000                                           |

Note<sup>(1)</sup> *r<sub>s</sub>* min stands for minimum allowable value of chamfer *r*.  
Remark No grease is prepacked. Perform proper lubrication.

Lubrication Type PILLOBALL Rod Ends **Die-cast Type/With Female Thread**

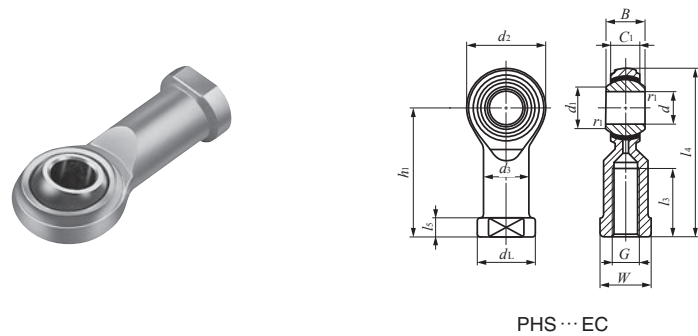


| Identification number | Mass<br>(Ref.) | Boundary dimensions    mm |                    |                       |                       |          |                       |                       |                       |                       |                       |          |                       |                       |                                           |                                            | Static load capacity           |
|-----------------------|----------------|---------------------------|--------------------|-----------------------|-----------------------|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|-----------------------|-----------------------|-------------------------------------------|--------------------------------------------|--------------------------------|
|                       | g              | <i>d</i>                  | Thread<br><i>G</i> | <i>d</i> <sub>2</sub> | <i>C</i> <sub>1</sub> | <i>B</i> | <i>d</i> <sub>1</sub> | <i>l</i> <sub>4</sub> | <i>h</i> <sub>1</sub> | <i>l</i> <sub>3</sub> | <i>l</i> <sub>5</sub> | <i>W</i> | <i>d</i> <sub>3</sub> | <i>d</i> <sub>L</sub> | <i>r</i> <sub>1s min</sub> <sup>(1)</sup> | Ball dia.<br>mm<br>(inch)                  | <i>C</i> <sub>s</sub><br><br>N |
| PHSA 5                | 17             | 5                         | M 5×0.8            | 17                    | 6                     | 8        | 7.7                   | 35.5                  | 27                    | 16                    | 4                     | 9        | 9                     | 11                    | 0.2                                       | 11.112<br>( <sup>7</sup> / <sub>16</sub> ) | 5 470                          |
| PHSA 6                | 25             | 6                         | M 6×1              | 19.5                  | 6.75                  | 9        | 9                     | 39.7                  | 30                    | 16                    | 5                     | 11       | 10                    | 13                    | 0.2                                       | 12.700<br>( <sup>1</sup> / <sub>2</sub> )  | 6 760                          |
| PHSA 8                | 45             | 8                         | M 8×1.25           | 24                    | 9                     | 12       | 10.4                  | 48                    | 36                    | 19                    | 5                     | 14       | 12.5                  | 16                    | 0.2                                       | 15.875<br>( <sup>5</sup> / <sub>8</sub> )  | 10 200                         |
| PHSA 10               | 70             | 10                        | M10×1.5            | 28                    | 10.5                  | 14       | 12.9                  | 57                    | 43                    | 23                    | 6.5                   | 17       | 15                    | 19                    | 0.2                                       | 19.050<br>( <sup>3</sup> / <sub>4</sub> )  | 13 100                         |
| PHSA 12               | 105            | 12                        | M12×1.75           | 32                    | 12                    | 16       | 15.4                  | 66                    | 50                    | 27                    | 6.5                   | 19       | 17.5                  | 22                    | 0.2                                       | 22.225<br>( <sup>7</sup> / <sub>8</sub> )  | 16 400                         |
| PHSA 14               | 155            | 14                        | M14×2              | 36                    | 13.5                  | 19       | 16.9                  | 75                    | 57                    | 30                    | 8                     | 22       | 20                    | 25                    | 0.3                                       | 25.400<br>(1    )                          | 20 000                         |
| PHSA 16               | 190            | 16                        | M16×2              | 40                    | 15                    | 21       | 19.4                  | 84                    | 64                    | 36                    | 8                     | 22       | 22                    | 27                    | 0.3                                       | 28.575<br>(1 <sup>1</sup> / <sub>8</sub> ) | 23 900                         |
| PHSA 18               | 290            | 18                        | M18×1.5            | 45                    | 16.5                  | 23       | 21.9                  | 93.5                  | 71                    | 40                    | 10                    | 27       | 25                    | 31                    | 0.3                                       | 31.750<br>(1 <sup>1</sup> / <sub>4</sub> ) | 28 800                         |
| PHSA 20               | 400            | 20                        | M20×1.5            | 49                    | 18                    | 25       | 24.4                  | 101.5                 | 77                    | 43                    | 10                    | 30       | 27.5                  | 34                    | 0.3                                       | 34.925<br>(1 <sup>3</sup> / <sub>8</sub> ) | 33 400                         |
| PHSA 22               | 500            | 22                        | M22×1.5            | 54                    | 20                    | 28       | 25.8                  | 111                   | 84                    | 47                    | 12                    | 32       | 30                    | 37                    | 0.3                                       | 38.100<br>(1 <sup>1</sup> / <sub>2</sub> ) | 40 400                         |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension *r<sub>1</sub>*.  
Remarks1. A grease nipple is provided on the body.  
2. No grease is prepacked. Perform proper lubrication.  
3. When a metric fine thread specification for inner ring bore deameter *d* of 8 mm to 14 mm is required, please contact IKO.

PILLOBALL

Maintenance-free Type PILLOBALL Rod Ends **With Female Thread**

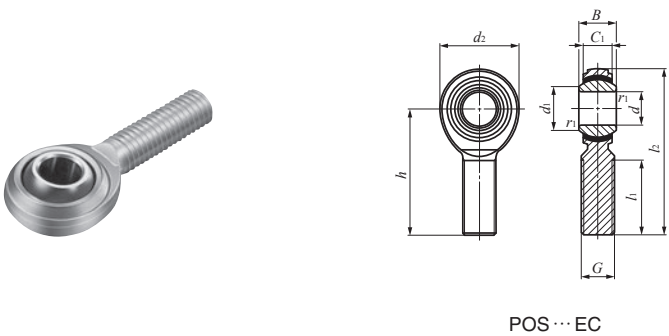


PHS...EC

| Identification number | Mass (Ref.)<br>g | Boundary dimensions mm |               |       |       |     |       |       |       |       |       |     |       |       |                   |                              | Dynamic load capacity<br>$C_d$<br>N | Static load capacity<br>$C_s$<br>N |
|-----------------------|------------------|------------------------|---------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-------------------|------------------------------|-------------------------------------|------------------------------------|
|                       |                  | $d$                    | Thread<br>$G$ | $d_2$ | $C_1$ | $B$ | $d_1$ | $l_4$ | $h_1$ | $l_3$ | $l_5$ | $W$ | $d_3$ | $d_L$ | $r_{1smin}^{(1)}$ | Ball dia.<br>mm<br>(inch)    |                                     |                                    |
| PHS 3EC               | 5.7              | 3                      | M 3×0.5       | 12    | 4.5   | 6   | 5.2   | 27    | 21    | 10    | 3     | 5.5 | 5     | 6.5   | 0.2               | 7.938<br>( $\frac{5}{16}$ )  | 3 500                               | 2 480                              |
| PHS 4EC               | 11.9             | 4                      | M 4×0.7       | 14    | 5.3   | 7   | 6.5   | 31    | 24    | 12    | 4     | 8   | 8     | 9.5   | 0.2               | 9.525<br>( $\frac{3}{8}$ )   | 4 950                               | 3 260                              |
| PHS 5EC               | 16.5             | 5                      | M 5×0.8       | 16    | 6     | 8   | 7.7   | 35    | 27    | 12.5  | 4     | 9   | 9     | 11    | 0.2               | 11.112<br>( $\frac{7}{16}$ ) | 6 540                               | 4 010                              |
| PHS 6EC               | 25               | 6                      | M 6×1         | 18    | 6.75  | 9   | 9     | 39    | 30    | 13.5  | 5     | 11  | 10    | 13    | 0.2               | 12.700<br>( $\frac{1}{2}$ )  | 8 410                               | 4 940                              |
| PHS 8EC               | 43               | 8                      | M 8×1.25      | 22    | 9     | 12  | 10.4  | 47    | 36    | 16    | 5     | 14  | 12.5  | 16    | 0.2               | 15.875<br>( $\frac{5}{8}$ )  | 14 000                              | 7 760                              |
| PHS 10EC              | 72               | 10                     | M10×1.5       | 26    | 10.5  | 14  | 12.9  | 56    | 43    | 19.5  | 6.5   | 17  | 15    | 19    | 0.2               | 19.050<br>( $\frac{3}{4}$ )  | 19 600                              | 10 500                             |
| PHS 12EC              | 107              | 12                     | M12×1.75      | 30    | 12    | 16  | 15.4  | 65    | 50    | 24    | 6.5   | 19  | 17.5  | 22    | 0.2               | 22.225<br>( $\frac{7}{8}$ )  | 26 200                              | 13 700                             |
| PHS 14EC              | 160              | 14                     | M14×2         | 34    | 13.5  | 19  | 16.9  | 74    | 57    | 27    | 8     | 22  | 20    | 25    | 0.2               | 25.400<br>(1)                | 33 600                              | 17 200                             |
| PHS 16EC              | 210              | 16                     | M16×2         | 38    | 15    | 21  | 19.4  | 83    | 64    | 33    | 8     | 22  | 22    | 27    | 0.2               | 28.575<br>(1 $\frac{1}{8}$ ) | 42 000                              | 21 100                             |
| PHS 18EC              | 295              | 18                     | M18×1.5       | 42    | 16.5  | 23  | 21.9  | 92    | 71    | 36    | 10    | 27  | 25    | 31    | 0.2               | 31.750<br>(1 $\frac{1}{4}$ ) | 51 400                              | 25 100                             |
| PHS 20EC              | 380              | 20                     | M20×1.5       | 46    | 18    | 25  | 24.4  | 100   | 77    | 40    | 10    | 30  | 27.5  | 34    | 0.2               | 34.925<br>(1 $\frac{3}{8}$ ) | 61 600                              | 30 000                             |
| PHS 22EC              | 490              | 22                     | M22×1.5       | 50    | 20    | 28  | 25.8  | 109   | 84    | 41    | 12    | 32  | 30    | 37    | 0.2               | 38.100<br>(1 $\frac{1}{2}$ ) | 74 700                              | 36 400                             |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r_1$   
Remarks1. Neither oil hole nor grease nipple is provided.  
2. When a metric fine thread specification for inner ring bore deameter  $d$  of 8 mm to 14 mm is required, please contact IKO.

Maintenance-free Type PILLOBALL Rod Ends **With Male Thread**



POS...EC

| Identification<br>number | Mass<br>(Ref.) | Boundary dimensions    mm |               |       |       |     |       |       |     |       |                   |                              | Dynamic load<br>capacity | Static load<br>capacity |
|--------------------------|----------------|---------------------------|---------------|-------|-------|-----|-------|-------|-----|-------|-------------------|------------------------------|--------------------------|-------------------------|
|                          | g              | $d$                       | Thread<br>$G$ | $d_2$ | $C_1$ | $B$ | $d_1$ | $l_2$ | $h$ | $l_1$ | $r_{1smin}^{(1)}$ | Ball dia.<br>mm<br>(inch)    | $C_d$                    | $C_s$                   |
|                          |                |                           |               |       |       |     |       |       |     |       |                   |                              | N                        | N                       |
| POS 3EC                  | 5.0            | 3                         | M 3×0.5       | 12    | 4.5   | 6   | 5.2   | 33    | 27  | 15    | 0.2               | 7.938<br>( $\frac{5}{16}$ )  | 3 500                    | 1 220                   |
| POS 4EC                  | 8.1            | 4                         | M 4×0.7       | 14    | 5.3   | 7   | 6.5   | 37    | 30  | 17    | 0.2               | 9.525<br>( $\frac{3}{8}$ )   | 4 950                    | 2 060                   |
| POS 5EC                  | 12.5           | 5                         | M 5×0.8       | 16    | 6     | 8   | 7.7   | 41    | 33  | 20    | 0.2               | 11.112<br>( $\frac{7}{16}$ ) | 6 540                    | 3 340                   |
| POS 6EC                  | 19             | 6                         | M 6×1         | 18    | 6.75  | 9   | 9     | 45    | 36  | 22    | 0.2               | 12.700<br>( $\frac{1}{2}$ )  | 8 410                    | 4 730                   |
| POS 8EC                  | 32             | 8                         | M 8×1.25      | 22    | 9     | 12  | 10.4  | 53    | 42  | 25    | 0.2               | 15.875<br>( $\frac{5}{8}$ )  | 14 000                   | 7 760                   |
| POS 10EC                 | 54             | 10                        | M10×1.5       | 26    | 10.5  | 14  | 12.9  | 61    | 48  | 29    | 0.2               | 19.050<br>( $\frac{3}{4}$ )  | 19 600                   | 10 500                  |
| POS 12EC                 | 85             | 12                        | M12×1.75      | 30    | 12    | 16  | 15.4  | 69    | 54  | 33    | 0.2               | 22.225<br>( $\frac{7}{8}$ )  | 26 200                   | 13 700                  |
| POS 14EC                 | 126            | 14                        | M14×2         | 34    | 13.5  | 19  | 16.9  | 77    | 60  | 36    | 0.2               | 25.400<br>(1    )            | 33 600                   | 17 200                  |
| POS 16EC                 | 185            | 16                        | M16×2         | 38    | 15    | 21  | 19.4  | 85    | 66  | 40    | 0.2               | 28.575<br>(1 $\frac{1}{8}$ ) | 42 000                   | 21 100                  |
| POS 18EC                 | 260            | 18                        | M18×1.5       | 42    | 16.5  | 23  | 21.9  | 93    | 72  | 44    | 0.2               | 31.750<br>(1 $\frac{1}{4}$ ) | 51 400                   | 25 100                  |
| POS 20EC                 | 340            | 20                        | M20×1.5       | 46    | 18    | 25  | 24.4  | 101   | 78  | 47    | 0.2               | 34.925<br>(1 $\frac{3}{8}$ ) | 61 600                   | 30 000                  |
| POS 22EC                 | 435            | 22                        | M22×1.5       | 50    | 20    | 28  | 25.8  | 109   | 84  | 51    | 0.2               | 38.100<br>(1 $\frac{1}{2}$ ) | 74 700                   | 36 400                  |

Note<sup>(1)</sup> Minimum allowable value of chamfer dimension  $r_1$   
Remarks1. Neither oil hole nor grease nipple is provided.  
2. When a metric fine thread specification for inner ring bore deameter  $d$  of 8 mm to 14 mm is required, please contact IKO.

# L-BALLS

- L-Balls
- L-Ball Dust Cover



## Structure and Features

IKO L-Balls are self-aligning rod-ends consisting of a special zinc die-cast alloy body and a studded ball which has its axis at right angles to the body. They can perform tilting movement, oscillating movement and rotation with low torque, and transmit power smoothly due to uniform clearance between the sliding surfaces. Their superior wear resistance assures stable accuracy for long periods of time, and maintenance is simple. They are very economical bearings. For these reasons, they are widely used in link mechanisms in automobiles, construction machinery, farm and packaging machines, etc.

## Types

L-Balls are available in various types as shown in Table 1.

Table 1 Type of L-Balls

| Type       | L-Ball |     | L-Ball dust cover |
|------------|--------|-----|-------------------|
| Model code | LHSA   | LHS | PRC               |

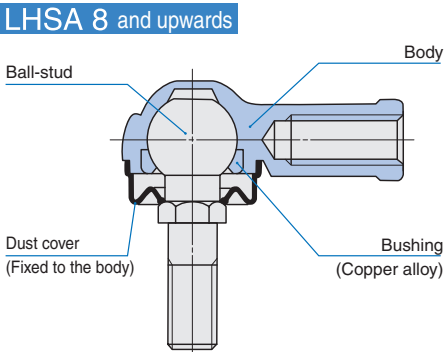
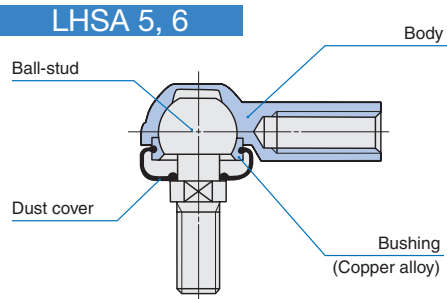
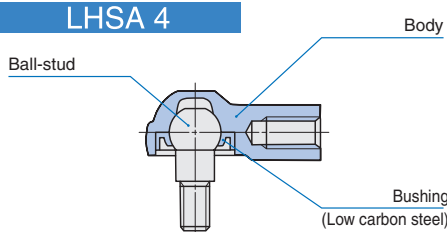
### L-Ball LHSA

These are compact rod-ends in which the spherical part of the ball-stud are held by the special zinc die-cast alloy body. There is a dust cover on the stud side and good quality lithium soap base grease is prepacked. They can be run for long periods of time without re-lubrication and have excellent lubrication and anti-dust properties. As shown in the structural drawing, these rod-ends are classified into 3 types by size. In addition, the ball-studs of LHSA 10 and lower are formed in one solid body, but those of LHSA 12 and higher, which are used under large loads, have the stud friction-welded to a high precision steel ball to give greater resistance to wear.

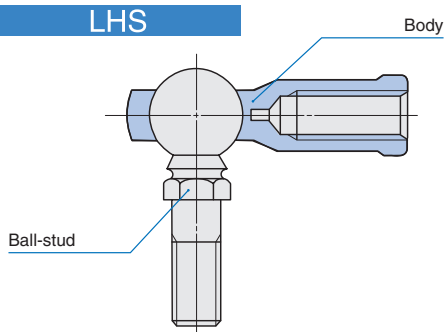
### L-Ball LHS

These rod-ends have a friction-welded ball-stud, and a special zinc die-cast alloy body which houses the spherical surface of the high precision steel ball. There is an almost complete contact across the sliding surfaces, and the uniform clearance guarantees a stable bearing life. An L-Ball dust cover can be attached to these rod-ends. If the rod-ends are lubricated with lithium soap

### Structures of L-Ball LHSA



### Structure of L-Ball LHS



base grease, they have excellent lubrication and anti-dust properties and can run for long periods of time without re-lubrication. When the L-Ball LHS is delivered with a dust cover on request, lithium soap base grease is prepacked.

L-Ball Dust Cover PRC

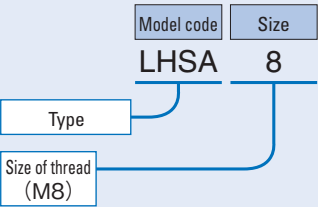
This is for the L-Ball LHS series. It is made of special synthetic rubber which has excellent resistance to oil and ozone. The cover offers very effective dust protection and prevents grease leakage.

Identification Number

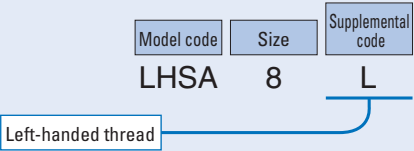
The identification number of L-Balls consists of a model code, a size and any supplemental codes as shown in the examples.

Examples of identification number

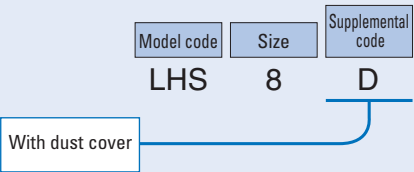
Example 1 (Female thread of the body : In case of right-hand threaded)



Example 2 (Female thread of the body : In case of left threaded)



Example 3 (when a dust cover PRC is attached to LHS)



Accuracy

The accuracy of L-Balls is shown in Table 2.

Table 2 Tolerance

| unit: mm |                  |                           |
|----------|------------------|---------------------------|
| Type     | Dimension symbol | Tolerance                 |
| LHSA     | $\ell_1$         | $\pm 0.5$                 |
|          | $V$              | 0<br>- 0.2 <sup>(1)</sup> |
| LHS      | $\ell_1$         | $\pm 0.4$                 |
|          | $V$              | h9                        |

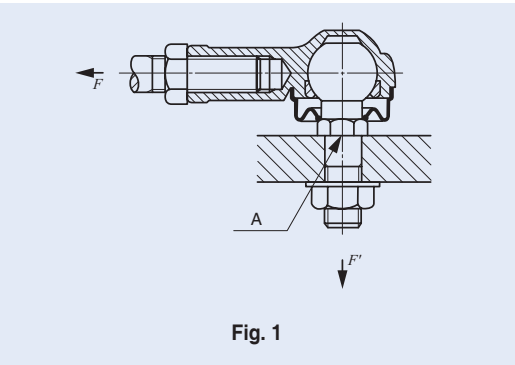
Note<sup>(1)</sup> This dimensional tolerance applies to LHSA 5 and higher.

Selection of L-Balls

The static load capacity and maximum operating load of L-Balls are determined in consideration of the strength of the ball stud and the body. Accordingly, L-Balls are selected on the basis of the static load capacity  $C_s$  shown in the dimension table and the maximum operating load shown in Table 3.

Static load capacity

The static load capacity  $C_s$  shown in the dimension table represents the allowable axial force  $F$  which is determined by the mechanical strength of the ball-stud at the section 'A' under the bending moment due to the force  $F$  as illustrated in Fig. 1. If  $F$  increases beyond the static load capacity, deformation will begin at A, leading to breakage.



Maximum operating load

The strength of the body must also be taken into consideration when L-Balls are operated in a high-temperature or low-temperature atmosphere or receive repetitive loads of long duration or shock loads. A guideline for maximum operating load of L-Balls is shown in Table 3. When the fixing bolt in the main body is fixed and a load is applied in the direction of  $F'$ , the bending stress in the fixing bolt must be taken into consideration.

Table 3 Maximum operating load unit: N

| Identification number | Maximum operating load | Identification number | Maximum operating load |
|-----------------------|------------------------|-----------------------|------------------------|
| LHSA 4                | 840                    | LHS 5                 | 880                    |
| LHSA 5                | 1 180                  | LHS 6                 | 1 080                  |
| LHSA 6                | 1 080                  | LHS 8                 | 1 630                  |
| LHSA 8                | 1 900                  | LHS10                 | 2 100                  |
| LHSA10                | 2 170                  | LHS12                 | 2 620                  |
| LHSA10M               | 2 170                  | LHS14                 | 3 190                  |
| LHSA12                | 2 790                  | LHS16                 | 3 820                  |
| LHSA14                | 3 540                  | LHS18                 | 4 610                  |
| —                     | —                      | LHS20                 | 5 340                  |
| —                     | —                      | LHS22                 | 6 460                  |

Lubrication

LHSA is prepacked with lubricating grease ALVANIA GREASE S2 (Shell Lubricants Japan K.K.). LHS is not provided with prepacked grease. Perform proper lubrication.

Operating LHS without lubrication will increase the wear of the sliding contact surface or cause seizure.

Operating Temperature Range

The maximum allowable temperature for L-Balls is +80°C.

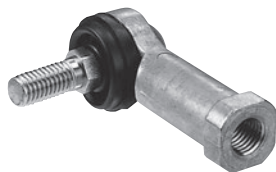
Precautions for Use

1 Tightening depth  
It is recommended that the tightening depth of the screw into the body is more than twice the nominal diameter of thread.

2 Allowable tilting angle  
The allowable tilting angle is shown in Table 4.

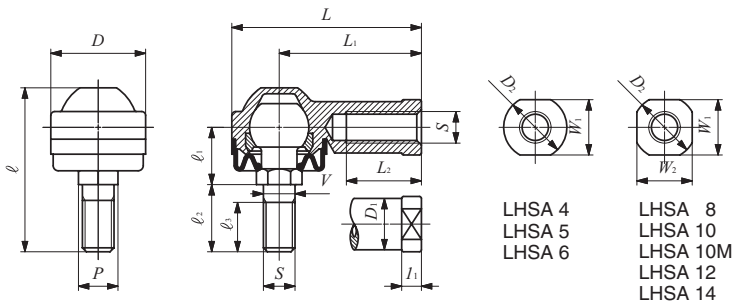
Table 4 Allowable tilting angle unit: degree

| Nominal dia. mm<br>$V$ | LHSA<br>$\alpha$ | LHS<br>$\alpha$ |
|------------------------|------------------|-----------------|
| 4                      | 15               | —               |
| 5                      | 17               | 15              |
| 6                      | 17               | 17              |
| 8                      | 18               | 18              |
| 10                     | 19               | 19              |
| 12                     | 19               | 19              |
| 14                     | 20               | 20              |
| 16                     | —                | 20              |
| 18                     | —                | 21              |
| 20                     | —                | 20              |
| 22                     | —                | 21              |



| Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |          |          |          |                       |                       |                       |                       |                       |                       |                       |          |          |
|-----------------------|---------------------|------------------------|----------|----------|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|----------|
|                       |                     | Thread<br><i>S</i>     | <i>V</i> | <i>D</i> | <i>L</i> | <i>L</i> <sub>1</sub> | <i>L</i> <sub>2</sub> | <i>l</i> <sub>1</sub> | <i>W</i> <sub>1</sub> | <i>W</i> <sub>2</sub> | <i>D</i> <sub>1</sub> | <i>D</i> <sub>2</sub> | <i>ℓ</i> | <i>P</i> |
| LHSA 4                | 11                  | M 4×0.7                | *4       | 14       | 25       | 18                    | 8                     | 4                     | 8                     | —                     | 8                     | 10                    | 19.5     | *5.5     |
| LHSA 5                | 27                  | M 5×0.8                | 5        | 17       | 38.5     | 30                    | 16                    | 5                     | 10                    | —                     | 10                    | 12                    | 32.5     | 8        |
| LHSA 6                | 27                  | M 6×1                  | 6        | 19       | 39.5     | 30                    | 16                    | 5                     | 10                    | —                     | 10                    | 12                    | 32.5     | 8        |
| LHSA 8                | 64                  | M 8×1.25               | 8        | 24       | 48       | 36                    | 19                    | 5                     | 14                    | 14                    | 13                    | 16                    | 41.5     | 10       |
| LHSA 10               | 106                 | M10×1.25               | 10       | 28       | 57       | 43                    | 23                    | 6.5                   | 17                    | 17                    | 15                    | 19                    | 49       | 12       |
| LHSA 10M              | 106                 | M10×1.5                | 10       | 28       | 57       | 43                    | 23                    | 6.5                   | 17                    | 17                    | 15                    | 19                    | 49       | 12       |
| LHSA 12               | 180                 | M12×1.75               | 12       | 34       | 67       | 50                    | 27                    | 6.5                   | 19                    | 19                    | 17.5                  | 22                    | 64       | 14       |
| LHSA 14               | 260                 | M14×2                  | 14       | 38       | 76       | 57                    | 30                    | 8                     | 22                    | 22                    | 20                    | 25                    | 72       | 17       |

Remarks1. The item marked \* is manufactured with a neck diameter of  $\phi 3.4$ . The item marked \* is manufactured with a diameter of  $\phi 5.5$  instead of a width across flats.  
2. Provided with prepacked grease.

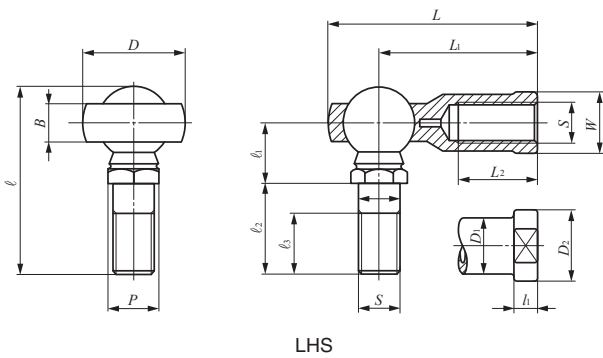


|                       |                       |                       |           | Static load<br>capacity<br><i>C<sub>s</sub></i><br>N |
|-----------------------|-----------------------|-----------------------|-----------|------------------------------------------------------|
| <i>ℓ</i> <sub>1</sub> | <i>ℓ</i> <sub>2</sub> | <i>ℓ</i> <sub>3</sub> | Ball dia. |                                                      |
| 7                     | 7                     | 5                     | 8         | 880                                                  |
| 12                    | 13                    | 10                    | 11.112    | 1 180                                                |
| 12                    | 13                    | 10                    | 11.112    | 1 670                                                |
| 14.5                  | 17                    | 12.5                  | 15        | 4 380                                                |
| 16                    | 21                    | 17                    | 19.05     | 7 400                                                |
| 16                    | 21                    | 17                    | 19.05     | 7 400                                                |
| 20                    | 30                    | 20                    | 22.225    | 9 900                                                |
| 22.5                  | 33.5                  | 22                    | 25.4      | 14 600                                               |



| Identification number | Mass<br>(Ref.)<br>g | Boundary dimensions mm |          |          |          |          |                       |                       |                       |          |                       |                       |          |          |
|-----------------------|---------------------|------------------------|----------|----------|----------|----------|-----------------------|-----------------------|-----------------------|----------|-----------------------|-----------------------|----------|----------|
|                       |                     | Thread<br><i>S</i>     | <i>V</i> | <i>D</i> | <i>B</i> | <i>L</i> | <i>L</i> <sub>1</sub> | <i>L</i> <sub>2</sub> | <i>l</i> <sub>1</sub> | <i>W</i> | <i>D</i> <sub>1</sub> | <i>D</i> <sub>2</sub> | <i>ℓ</i> | <i>P</i> |
| LHS 5                 | 22                  | M 5×0.8                | 5        | 17       | 6        | 35.5     | 27                    | 16                    | 4                     | 9        | 9                     | 11                    | 30.5     | 8        |
| LHS 6                 | 32                  | M 6×1                  | 6        | 19.5     | 6.75     | 39.7     | 30                    | 16                    | 5                     | 11       | 10                    | 13                    | 36.5     | 10       |
| LHS 8                 | 60                  | M 8×1.25               | 8        | 24       | 9        | 48       | 36                    | 19                    | 5                     | 14       | 12.5                  | 16                    | 44       | 11       |
| LHS 10                | 102                 | M10×1.5                | 10       | 28       | 10.5     | 57       | 43                    | 23                    | 6.5                   | 17       | 15                    | 19                    | 52.5     | 13       |
| LHS 12                | 160                 | M12×1.75               | 12       | 32       | 12       | 66       | 50                    | 27                    | 6.5                   | 19       | 17.5                  | 22                    | 61       | 17       |
| LHS 14                | 227                 | M14×2                  | 14       | 36       | 13.5     | 75       | 57                    | 30                    | 8                     | 22       | 20                    | 25                    | 69       | 17       |
| LHS 16                | 300                 | M16×2                  | 16       | 40       | 15       | 84       | 64                    | 36                    | 8                     | 22       | 22                    | 27                    | 74       | 19       |
| LHS 18                | 445                 | M18×1.5                | 18       | 45       | 16.5     | 93.5     | 71                    | 40                    | 10                    | 27       | 25                    | 31                    | 84       | 22       |
| LHS 20                | 580                 | M20×1.5                | 20       | 49       | 18       | 101.5    | 77                    | 43                    | 10                    | 30       | 27.5                  | 34                    | 90.5     | 24       |
| LHS 22                | 765                 | M22×1.5                | 22       | 54       | 20       | 111      | 84                    | 47                    | 12                    | 32       | 30                    | 37                    | 99       | 27       |

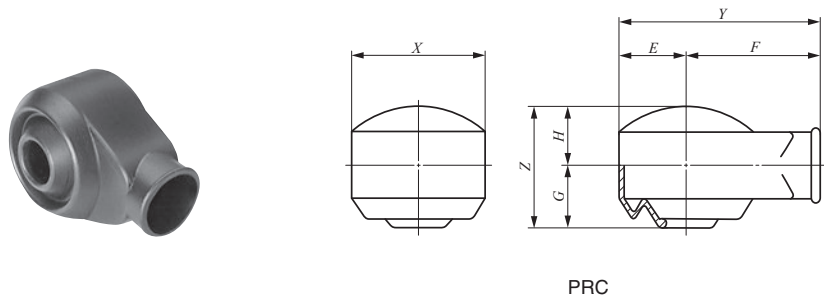
Remark No grease is prepacked. Perform proper lubrication.



|                       |                       |                       |           | Static load<br>capacity<br><i>C</i> <sub>s</sub><br>N |
|-----------------------|-----------------------|-----------------------|-----------|-------------------------------------------------------|
| <i>ℓ</i> <sub>1</sub> | <i>ℓ</i> <sub>2</sub> | <i>ℓ</i> <sub>3</sub> | Ball dia. |                                                       |
| 10                    | 15                    | 11                    | 11.112    | 2 080                                                 |
| 11.5                  | 18.5                  | 14                    | 12.7      | 3 290                                                 |
| 14.5                  | 21.5                  | 15                    | 15.875    | 4 900                                                 |
| 17                    | 26                    | 18                    | 19.05     | 7 640                                                 |
| 20                    | 30                    | 20                    | 22.225    | 12 400                                                |
| 22.5                  | 33.5                  | 22                    | 25.4      | 14 600                                                |
| 24.5                  | 35.5                  | 23                    | 28.575    | 19 500                                                |
| 27.5                  | 40.5                  | 25                    | 31.75     | 25 600                                                |
| 30                    | 43                    | 27                    | 34.925    | 31 600                                                |
| 32.5                  | 47.5                  | 30                    | 38.1      | 39 800                                                |

L-BALL

L-Ball Dust Cover



| Identification number | Boundary dimensions mm |      |      |    |      |      |      |
|-----------------------|------------------------|------|------|----|------|------|------|
|                       | X                      | Y    | E    | F  | Z    | G    | H    |
| PRC 5                 | 20                     | 29   | 10   | 19 | 16   | 8    | 8    |
| PRC 6                 | 22                     | 31   | 11   | 20 | 19   | 9.5  | 9.5  |
| PRC 8                 | 27                     | 38.5 | 13.5 | 25 | 24   | 12   | 12   |
| PRC 10                | 31                     | 45.5 | 15.5 | 30 | 27   | 14   | 13   |
| PRC 12                | 36                     | 53   | 18   | 35 | 32   | 16.5 | 15.5 |
| PRC 14                | 40                     | 60   | 20   | 40 | 36.5 | 19   | 17.5 |
| PRC 16                | 44                     | 68   | 22   | 46 | 40   | 20.5 | 19.5 |
| PRC 18                | 49                     | 74.5 | 24.5 | 50 | 46   | 23.5 | 22.5 |
| PRC 20                | 54                     | 82   | 27   | 55 | 50   | 25.5 | 24.5 |
| PRC 22                | 59                     | 89.5 | 29.5 | 60 | 53.5 | 27.5 | 26   |



K  
LHSA  
LHS

# SUPER FLEXIBLE NOZZLES



## Structure and Features

IKO Super Flexible Nozzle is a compact nozzle for use on a machine tool to supply and spray cutting oil exactly at the required positions.

The angle of the nozzle can be changed easily and freely. Therefore, oil supply can be concentrated upon the working area, and cooling and lubrication can be performed effectively. As a result, cutting resistance is reduced and superior finish is obtained, achieving high machining accuracy. Also, tool life is longer.

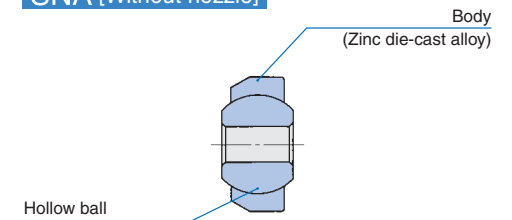
The Super Flexible Nozzle is used in many places such as at the spindle end of Machining Center and at the tool holder of N/C lathe.

The features of Super Flexible Nozzle are as follows.

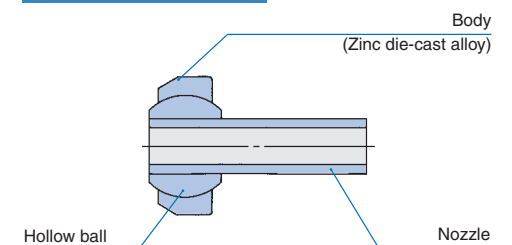
- ❶ A spherical bushing is incorporated to adjust the tilting angle of nozzle easily.
- ❷ The Super Flexible Nozzle is compact in size, and the design on parts around the spindle and tool can be made simple.
- ❸ The nozzle length is short, and winding of cutting chips around the nozzle will not occur.
- ❹ By using a number of Super Flexible Nozzles, cutting oil can be supplied and cutting chips can be removed more effectively.
- ❺ The press fitting type and screw fitting type are available. The press fitting type is economical.

### Structures of Super Flexible Nozzles

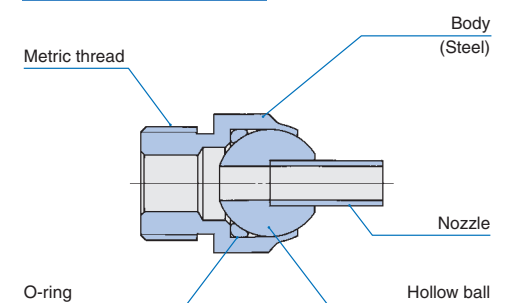
#### SNA [Without nozzle]



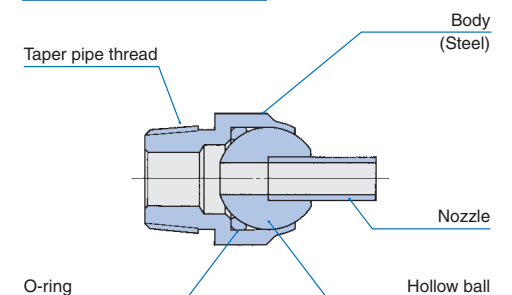
#### SNA [With nozzle]



#### SNM



#### SNPT



Types

Super Flexible Nozzles shown in Table 1 are available.

Table 1 Type of Super Flexible Nozzle

| Type               |                         | Model code |
|--------------------|-------------------------|------------|
| Press fitting type | Without nozzle          | SNA        |
|                    | With nozzle             |            |
| Screw fitting type | With metric threads     | SNM        |
|                    | With taper pipe threads | SNPT       |

Identification Number

The identification number of Super Flexible Nozzle consists of a model code and a size. An example is shown as follows.

Example of identification number

Model code

Size

SNM10-20

Type of nozzle

Nozzle bore or thread size: (M10×1.25)

Dimension from shoulder surface to nozzle top:※ (20mm)

※ In case of press fitting type without nozzle, this dimension is not indicated.

Precautions for Use

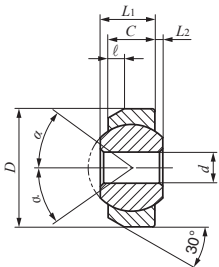
When the press fitting type Super Flexible Nozzle is used, a  $\phi 15$  (H8)  $^{+0.027}_0$  bore for fitting hole must be prepared and fitting is made from the 30° chamfered end of the outer body. In this case, the body portion should be pushed for press fitting. When the screw fitting type Super Flexible Nozzle is used and prevention of oil leakage from the fitting part is required, it is recommended to wind sealing tape on the thread portion or use rubber packing for the shoulder face of the outer body. The direction of lubrication can be adjusted by inserting a screwdriver, etc. in the bore of the nozzle.

Special Specifications

Super Flexible Nozzles with special length are also available. In this case, specify the necessary nozzle length in units of 1 mm, but do not exceed the maximum length shown in the dimension table as "L". Super Flexible Nozzles with curved nozzle end or with special bore diameter are also available. In this case, please contact IKO by preparing a drawing or sketch with necessary specifications.

SUPER FLEXIBLE NOZZLE

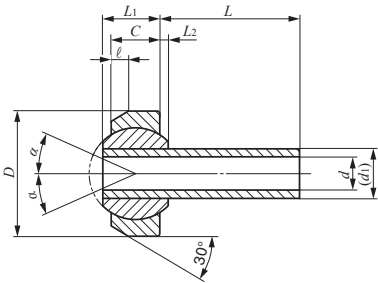
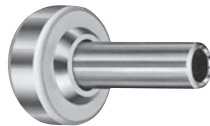
Press Fitting Type Without Nozzle



SNA

| Identification number | Boundary dimensions mm |    |                |                |   |   | Ball dia.     | Allowable tilting angle |
|-----------------------|------------------------|----|----------------|----------------|---|---|---------------|-------------------------|
|                       | d                      | D  | L <sub>1</sub> | L <sub>2</sub> | C | ℓ | mm (inch)     | α degree                |
| SNA 4                 | 4                      | 15 | 7              | 1              | 6 | 2 | 11.112 (7/16) | 36                      |
| SNA 6                 | 6                      |    |                |                |   |   |               | 24                      |

Press Fitting Type With Nozzle



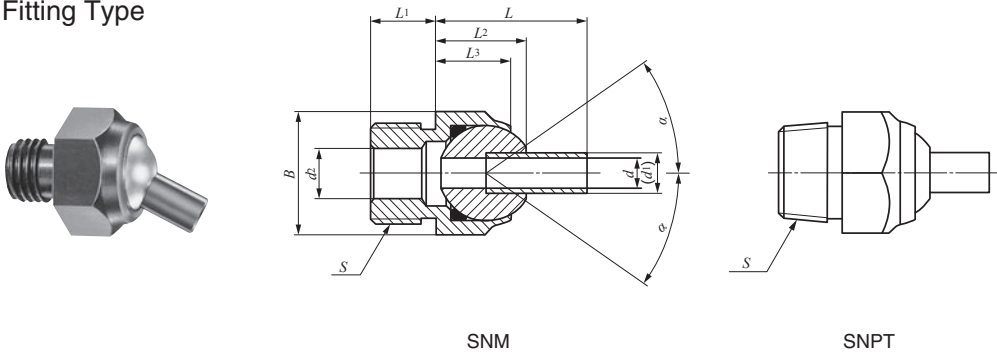
SNA

| Identification number | Boundary dimensions    mm |          |          |    |    |                       |                       |          |          | Ball dia.             | Allowable tilting angle                    |                 |
|-----------------------|---------------------------|----------|----------|----|----|-----------------------|-----------------------|----------|----------|-----------------------|--------------------------------------------|-----------------|
|                       | <i>d</i>                  | <i>D</i> | <i>L</i> |    |    | <i>L</i> <sub>1</sub> | <i>L</i> <sub>2</sub> | <i>C</i> | <i>ℓ</i> | <i>d</i> <sub>1</sub> | mm (inch)                                  | <i>α</i> degree |
| <b>SNA 3-<i>L</i></b> | 3                         | 15       | 6        | 15 | 32 | 7                     | 1                     | 6        | 2        | 6                     | 11.112<br>( <sup>7</sup> / <sub>16</sub> ) | 24              |
| <b>SNA 4-<i>L</i></b> | 4                         |          | 6        | 16 | 40 |                       |                       |          |          |                       |                                            |                 |

K  
SNA  
SNM  
SNPT

SUPER FLEXIBLE NOZZLE

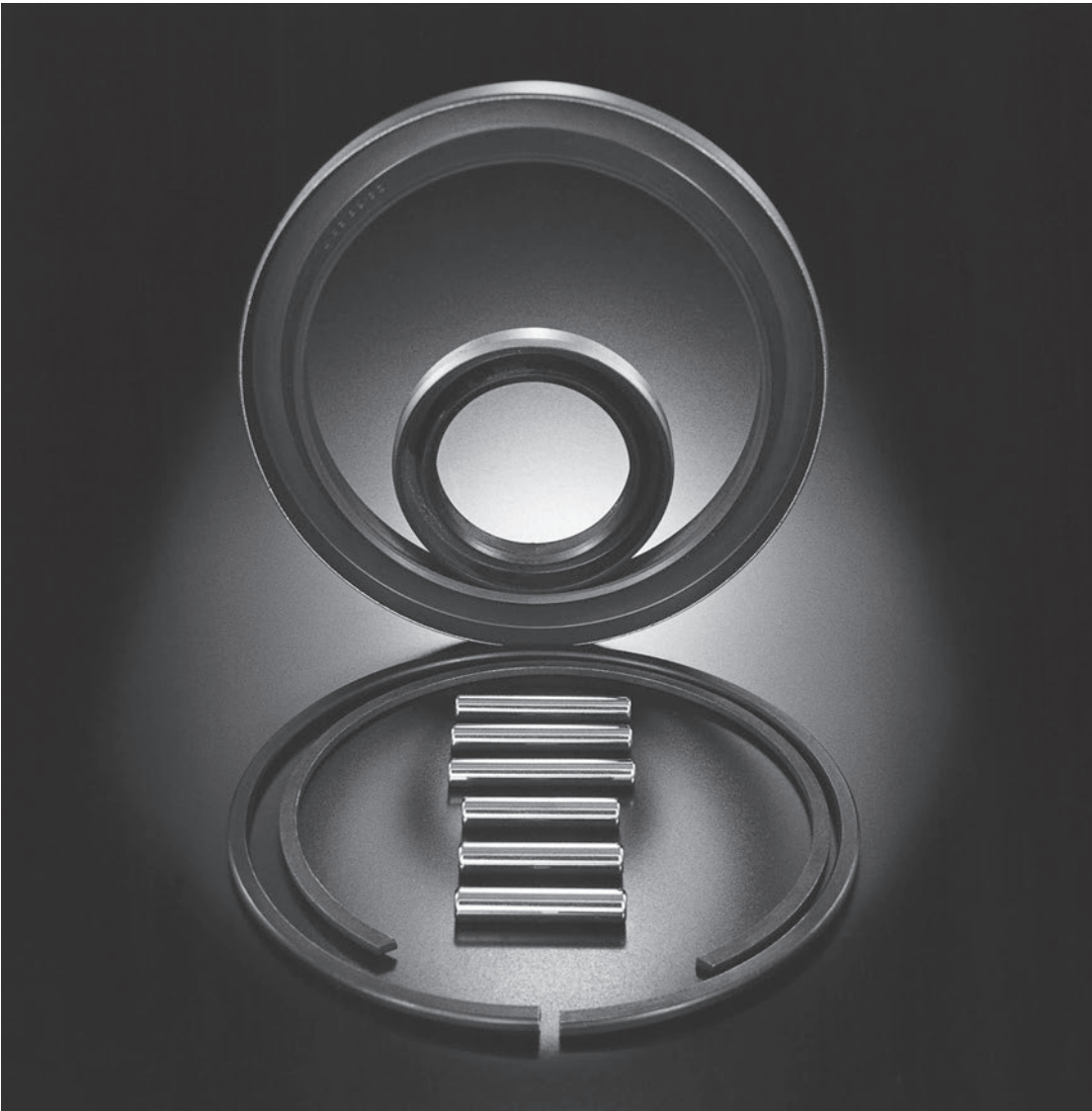
Screw Fitting Type



| Identification<br>number | Boundary dimensions   mm |               |     |       |       |       |       |       |                              |                                   | Ball<br>dia. | Allowable<br>tilting angle |                   |    |
|--------------------------|--------------------------|---------------|-----|-------|-------|-------|-------|-------|------------------------------|-----------------------------------|--------------|----------------------------|-------------------|----|
|                          | $d$                      | Thread<br>$S$ | $L$ | $L_1$ | $L_2$ | $L_3$ | $d_1$ | $d_2$ | Width across<br>flats<br>$B$ | Width across<br>corners<br>(Ref.) | mm<br>(inch) | $\alpha$<br>degree         |                   |    |
| SNM 10-L                 | 4                        | M10×1.25      | 20  | 40    | 60    | 9     | 13    | 10.5  | 6                            | 6                                 | 17           | 19.6                       | 12.700<br>( 1/2 ) | 35 |
| SNPT 1/4-L               |                          | PT 1/4        |     |       |       |       |       |       |                              |                                   |              |                            |                   |    |
| SNM 20-L                 | 6                        | M20×1.5       | 30  | 50    | 70    | 13    | 18    | 15    | 8                            | 10                                | 24           | 27.7                       | 19.050<br>( 3/4 ) |    |
| SNPT 3/8-L               |                          | PT 3/8        |     |       |       |       |       |       |                              |                                   |              |                            |                   |    |
| SNM 24-L                 | 8                        | M24×2.0       | 40  | 60    | 80    | 18    | 23    | 19    | 10                           | 12                                | 32           | 37                         | 25.400<br>( 1 )   |    |
| SNPT 1/2-L               |                          | PT 1/2        |     |       |       |       |       |       |                              |                                   |              |                            |                   |    |

PARTS FOR NEEDLE ROLLER BEARINGS

- Seals for Needle Roller Bearings
- Cir-clips for Needle Roller Bearings
- Needle Rollers



# Seals for Needle Roller Bearings

## Features

IKO Seals for Needle Roller Bearings have a low sectional height and consist of a sheet metal ring and special synthetic rubber.

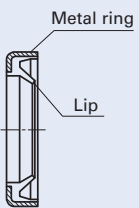
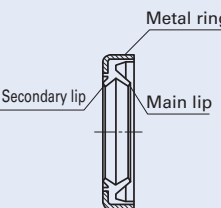
As these seals are manufactured to the same sectional height as IKO Needle Roller Bearings, grease leakage and the penetration of foreign particles can be effectively prevented by fitting them directly to the sides of combinable bearings shown in the dimension table.

When fitting seals to needle roller bearings with inner ring, wide inner rings (see page H2) must be used, as shown in the mounting examples.

## Types

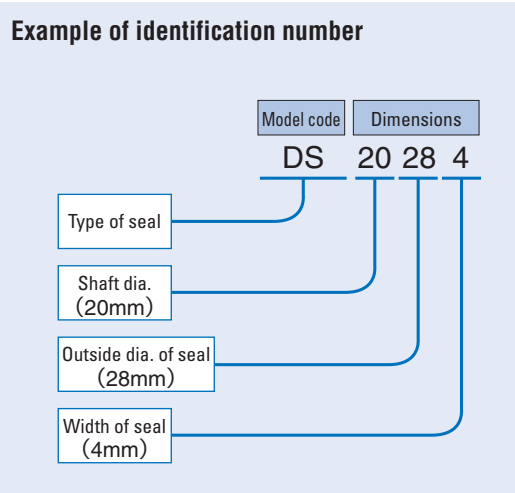
Seals for Needle Roller Bearings are available as shown in Table1.

Table 1 Seal type

| Type       | Single lip                                                                          | Double lips                                                                         |
|------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Structure  |  |  |
| Model code | OS                                                                                  | DS                                                                                  |

## Identification Number

The identification number of Seals for Needle Roller Bearings consists of a model code and dimensions. An example of an identification number is shown as follows.



## Accuracy

Tolerances of Seals for Needle Roller Bearings are based on JIS B 2402-1.

Tolerances of outside diameter and width are based on Tables 2 and 3, respectively.

Table 2 Tolerance of outside diameter unit: mm

| Nominal outside diameter |       | Tolerance |        |
|--------------------------|-------|-----------|--------|
| Over                     | Incl. | High      | Low    |
| —                        | 30    | + 0.09    | + 0.04 |
| 30                       | 50    | + 0.11    | + 0.05 |
| 50                       | 80    | + 0.14    | + 0.06 |
| 80                       | 120   | + 0.17    | + 0.08 |

Table 3 Tolerance of width unit: mm

| Nominal size of width |       | Tolerance |       |
|-----------------------|-------|-----------|-------|
| Over                  | Incl. | High      | Low   |
| —                     | 6     | + 0.2     | — 0.2 |
| 6                     | 10    | + 0.3     | — 0.3 |

## Precautions for Use

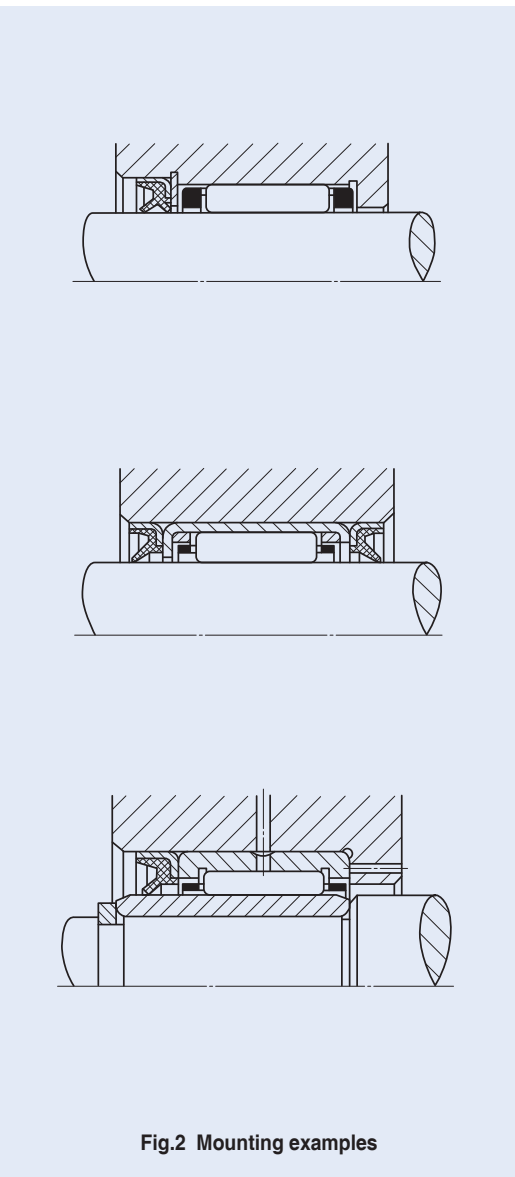
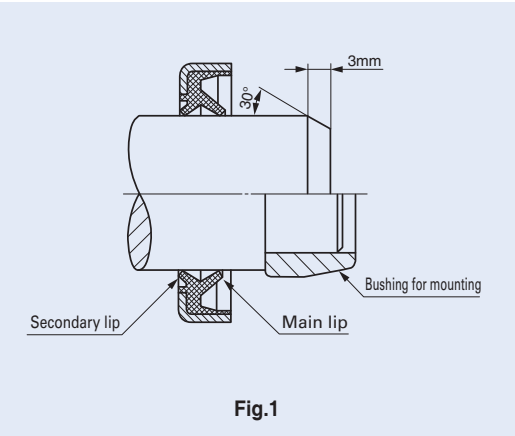
- ❶ For the single lip OS type, the lip has to face inward when using the seal to prevent grease leakage, and outward to prevent the penetration of foreign particles. The DS type of double-lips is effective for prevention of grease leakage and dust penetration. However, when the main purpose is to prevent grease leakage, the main lip should face inward, and when used mainly to prevent dust penetration, it should face outward.
- ❷ The permissible temperature range is -20 ~ +100℃ .
- For use at higher or lower temperatures, a special seal is required. Please contact IKO for further information.
- ❸ The limiting peripheral speed of shaft depends on the conditions of use, but is normally 6 to 8 m/s. Double this speed is possible if the conditions (lubrication, temperature, shaft finish, etc.) are good.

## Mounting

When inserting the shaft, damage to the lip should be prevented by chamfering the end of the shaft, as shown in the upper part of Fig. 1. When this cannot be performed, a mounting bushing should be used, as shown in the lower part of Fig.1.

When press fitting the seal to the housing, do not strike it directly, but fit it gently, using a suitable tool.

To prevent early wear and heat generation at the seal surface, it is necessary to thickly coat the tip of the lip for the OS type, or to fill the space between the two lips for the DS type, with bearing grease.

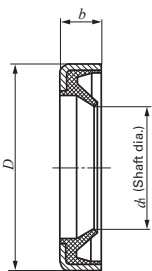


SEALS FOR NEEDLE ROLLER BEARINGS

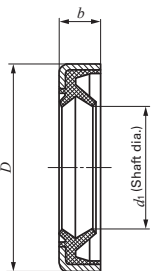


Shaft dia. 6 – 15mm

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |     | Combinable bearings                          |                                   |             |            |
|------------------|-----------------------|-------------|------------------------|----|-----|----------------------------------------------|-----------------------------------|-------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b   | TA···Z YT<br>TLA···Z YTL                     | RNA TR<br>TAF GTR                 | RNAF        | NAX<br>NBX |
| 6                | OS 6102.5             | —           | 6                      | 10 | 2.5 | TLA 69Z                                      | —                                 | —           | —          |
| 7                | OS 7112.5             | —           | 7                      | 11 | 2.5 | TLA 79Z                                      | —                                 | —           | —          |
| 8                | OS 8123               | —           | 8                      | 12 | 3   | TLA 810Z                                     | —                                 | —           | —          |
|                  | OS 8153               | —           | 8                      | 15 | 3   | TA 810Z<br>TA 815Z<br>TA 820Z<br>YT 810      | RNA 496<br>TAF 81512<br>TAF 81516 | RNAF 81510  | —          |
|                  | OS 9133               | —           | 9                      | 13 | 3   | TLA 910Z<br>TLA 912Z                         | —                                 | —           | —          |
|                  | OS 9163               | —           | 9                      | 16 | 3   | TA 912Z<br>TA 916Z<br>YT 912                 | TAF 91612<br>TAF 91616            | —           | —          |
| 10               | OS 10143              | —           | 10                     | 14 | 3   | TLA 1010Z<br>TLA 1012Z<br>TLA 1015Z          | —                                 | —           | —          |
|                  | OS 10173              | —           | 10                     | 17 | 3   | TA 1010Z<br>TA 1012Z<br>TA 1015Z<br>TA 1020Z | TAF 101712<br>TAF 101716          | RNAF 101710 | —          |



OS



DS

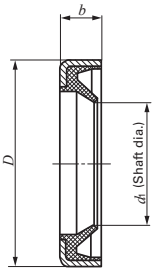
| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                      |                                      |                             |            |
|------------------|-----------------------|-------------|------------------------|----|---|----------------------------------------------------------|--------------------------------------|-----------------------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YT<br>TLA···Z YTL                                 | RNA TR<br>TAF GTR                    | RNAF                        | NAX<br>NBX |
| 12               | OS 12163              | —           | 12                     | 16 | 3 | TLA 1210Z<br>YTL 1210                                    | —                                    | —                           | —          |
|                  | OS 12183              | —           | 12                     | 18 | 3 | TLA 1212Z                                                | —                                    | —                           | —          |
|                  | OS 12193              | —           | 12                     | 19 | 3 | TA 1212Z<br>TA 1215Z<br>TA 1220Z<br>TA 1225Z<br>YT 1212  | TAF 121912<br>TAF 121916             | —                           | —          |
| 13               | OS 13193              | —           | 13                     | 19 | 3 | TLA 1312Z                                                | —                                    | —                           | —          |
| 14               | OS 14203              | DS 14203    | 14                     | 20 | 3 | TLA 1412Z<br>TLA 1416Z                                   | —                                    | —                           | —          |
|                  | OS 14223              | DS 14223    | 14                     | 22 | 3 | TA 1416Z<br>TA 1420Z                                     | RNA 4900<br>TAF 142216<br>TAF 142220 | RNAF 142213<br>RNAFW 142220 | —          |
| 15               | OS 15213              | DS 15213    | 15                     | 21 | 3 | TLA 1512Z<br>TLA 1516Z<br>TLA 1522Z                      | —                                    | —                           | —          |
|                  | OS 15223              | DS 15223    | 15                     | 22 | 3 | TA 1510Z<br>TA 1512Z<br>TA 1515Z<br>TA 1520Z<br>TA 1525Z | —                                    | —                           | —          |
|                  | OS 15235              | DS 15235    | 15                     | 23 | 5 | —                                                        | TAF 152316<br>TAF 152320             | RNAF 152313<br>RNAFW 152320 | —          |

SEALS FOR NEEDLE ROLLER BEARINGS

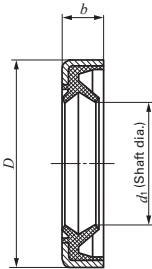


Shaft dia. 16 – 19mm

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                    |                                                  |                             |            |
|------------------|-----------------------|-------------|------------------------|----|---|--------------------------------------------------------|--------------------------------------------------|-----------------------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YT<br>TLA···Z YTL                               | RNA TR<br>TAF GTR                                | RNAF                        | NAX<br>NBX |
| 16               | OS 16223              | DS 16223    | 16                     | 22 | 3 | TLA 1612Z<br>TLA 1616Z<br>TLA 1622Z                    | —                                                | —                           | —          |
|                  | OS 16243              | DS 16243    | 16                     | 24 | 3 | TA 1616Z<br>TA 1620Z                                   | RNA 4901<br>RNA 6901<br>TAF 162416<br>TAF 162420 | RNAF 162413<br>RNAFW 162420 | —          |
|                  | OS 16285              | DS 16285    | 16                     | 28 | 5 | —                                                      | —                                                | RNAF 162812                 | —          |
| 17               | OS 17233              | DS 17233    | 17                     | 23 | 3 | TLA 1712Z                                              | —                                                | —                           | —          |
|                  | OS 17243              | DS 17243    | 17                     | 24 | 3 | TA 1715Z<br>TA 1720Z<br>TA 1725Z<br>YT 1715<br>YT 1725 | —                                                | —                           | —          |
|                  | OS 17253              | DS 17253    | 17                     | 25 | 3 | —                                                      | TAF 172516<br>TAF 172520                         | RNAF 172513<br>RNAFW 172520 | —          |



OS



DS

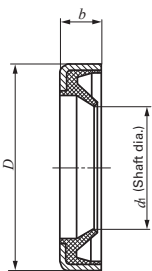
| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                                  |                                       |                             |            |
|------------------|-----------------------|-------------|------------------------|----|---|----------------------------------------------------------------------|---------------------------------------|-----------------------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YT<br>TLA···Z YTL                                             | RNA TR<br>TAF GTR                     | RNAF                        | NAX<br>NBX |
| 18               | OS 18243              | DS 18243    | 18                     | 24 | 3 | TLA 1812Z<br>TLA 1816Z                                               | —                                     | —                           | —          |
|                  | OS 18253              | DS 18253    | 18                     | 25 | 3 | TA 1813Z<br>TA 1815Z<br>TA 1817Z<br>TA 1819Z<br>TA 1820Z<br>TA 1825Z | —                                     | —                           | —          |
|                  | OS 18264              | DS 18264    | 18                     | 26 | 4 | —                                                                    | RNA 49/14<br>TAF 182616<br>TAF 182620 | RNAF 182613<br>RNAFW 182620 | —          |
| 19               | OS 19274              | —           | 19                     | 27 | 4 | TA 1916Z<br>TA 1920Z                                                 | TAF 192716<br>TAF 192720              | —                           | —          |

SEALS FOR NEEDLE ROLLER BEARINGS

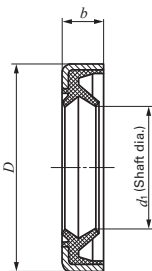


Shaft dia. 20 – 24mm

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                                |                                                  |                             |                      |
|------------------|-----------------------|-------------|------------------------|----|---|--------------------------------------------------------------------|--------------------------------------------------|-----------------------------|----------------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YTL<br>TLA···Z YTL                                          | RNA TR<br>TAF GTR                                | RNAF                        | NAX<br>NBX           |
| 20               | OS 20264              | DS 20264    | 20                     | 26 | 4 | TLA 2012Z<br>TLA 2016Z<br>TLA 2020Z<br>TLA 2030Z                   | —                                                | —                           | —                    |
|                  | OS 20274              | DS 20274    | 20                     | 27 | 4 | TA 2015Z<br>TA 2020Z<br>TA 2025Z<br>TA 2030Z<br>YT 2015<br>YT 2025 | —                                                | —                           | —                    |
|                  | OS 20284              | DS 20284    | 20                     | 28 | 4 | TA 202820Z<br>YT 202820                                            | RNA 4902<br>RNA 6902<br>TAF 202816<br>TAF 202820 | RNAF 202813<br>RNAFW 202826 | —                    |
|                  | OS 20304              | DS 20304    | 20                     | 30 | 4 | —                                                                  | —                                                | —                           | NAX 2030<br>NBX 2030 |
|                  | OS 20324              | DS 20324    | 20                     | 32 | 4 | —                                                                  | —                                                | RNAF 203212<br>RNAFW 203224 | —                    |
|                  | OS 20326              | DS 20326    | 20                     | 32 | 6 | —                                                                  | —                                                | RNAF 203212<br>RNAFW 203224 | —                    |
| 21               | OS 21294              | DS 21294    | 21                     | 29 | 4 | TA 2116Z<br>TA 2120Z<br>YT 2116<br>YT 2120                         | TAF 212916<br>TAF 212920                         | —                           | —                    |



OS



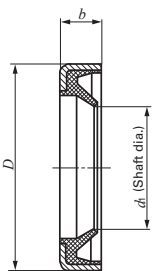
DS

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                      |                                                  |                             |            |
|------------------|-----------------------|-------------|------------------------|----|---|----------------------------------------------------------|--------------------------------------------------|-----------------------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YTL<br>TLA···Z YTL                                | RNA TR<br>TAF GTR                                | RNAF                        | NAX<br>NBX |
| 22               | OS 22284              | DS 22284    | 22                     | 28 | 4 | TLA 2212Z<br>TLA 2216Z<br>TLA 2220Z                      | —                                                | —                           | —          |
|                  | OS 22294              | —           | 22                     | 29 | 4 | TA 2210Z<br>TA 2215Z<br>TA 2220Z<br>TA 2225Z<br>TA 2230Z | —                                                | —                           | —          |
|                  | OS 22304              | DS 22304    | 22                     | 30 | 4 | TA 223016Z<br>TA 223020Z<br>YT 223016<br>YT 223020       | RNA 4903<br>RNA 6903<br>TAF 223016<br>TAF 223020 | RNAF 223013<br>RNAFW 223026 | —          |
| 24               | OS 24314              | DS 24314    | 24                     | 31 | 4 | TA 2420Z<br>TA 2428Z<br>YT 2428                          | —                                                | —                           | —          |
|                  | OS 24324              | DS 24324    | 24                     | 32 | 4 | TA 243216Z<br>TA 243220Z<br>YT 243216<br>YT 243220       | TAF 243216<br>TAF 243220                         | —                           | —          |

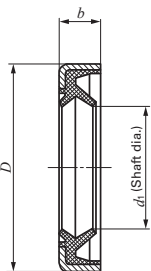


Shaft dia. 25 – 29mm

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                                                                  |                          |                             |                      |
|------------------|-----------------------|-------------|------------------------|----|---|------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------|----------------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YT<br>TLA···Z YTL                                                                             | RNA TR<br>TAF GTR        | RNAF                        | NAX<br>NBX           |
| 25               | OS 25324              | DS 25324    | 25                     | 32 | 4 | TLA 2512Z<br>TLA 2516Z<br>TLA 2520Z<br>TLA 2526Z<br>TLAW 2538Z<br>YTL 2526                           | —                        | —                           | —                    |
|                  | OS 25334              | DS 25334    | 25                     | 33 | 4 | TA 2510Z<br>TA 2515Z<br>TA 2520Z<br>TA 2525Z<br>TA 2530Z<br>YT 2510<br>YT 2515<br>YT 2520<br>YT 2525 | TAF 253316<br>TAF 253320 | —                           | —                    |
|                  | OS 25356              | DS 25356    | 25                     | 35 | 6 | —                                                                                                    | —                        | RNAF 253517<br>RNAFW 253526 | —                    |
|                  | OS 25376              | DS 25376    | 25                     | 37 | 6 | —                                                                                                    | RNA 4904<br>RNA 6904     | RNAF 253716<br>RNAFW 253732 | NAX 2530<br>NBX 2530 |
|                  | OS 26344              | DS 26344    | 26                     | 34 | 4 | TA 2616Z<br>TA 2620Z<br>YT 2616<br>YT 2620                                                           | TAF 263416<br>TAF 263420 | —                           | —                    |
|                  |                       |             |                        |    |   |                                                                                                      |                          |                             |                      |



OS



DS

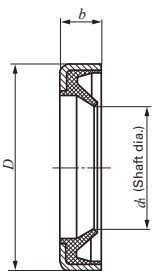
| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings             |                          |                             |            |
|------------------|-----------------------|-------------|------------------------|----|---|---------------------------------|--------------------------|-----------------------------|------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YT<br>TLA···Z YTL        | RNA TR<br>TAF GTR        | RNAF                        | NAX<br>NBX |
| 28               | OS 28354              | DS 28354    | 28                     | 35 | 4 | TLA 2816Z<br>TLA 2820Z          | —                        | —                           | —          |
|                  | OS 28374              | DS 28374    | 28                     | 37 | 4 | TA 2820Z<br>TA 2830Z<br>YT 2820 | TAF 283720<br>TAF 283730 | —                           | —          |
|                  | OS 28396              | DS 28396    | 28                     | 39 | 6 | —                               | RNA 49/22<br>RNA 69/22   | —                           | —          |
|                  | OS 28406              | DS 28406    | 28                     | 40 | 6 | —                               | —                        | RNAF 284016<br>RNAFW 284032 | —          |
|                  | OS 29384              | DS 29384    | 29                     | 38 | 4 | TA 2920Z<br>TA 2930Z<br>YT 2920 | TAF 293820<br>TAF 293830 | —                           | —          |

SEALS FOR NEEDLE ROLLER BEARINGS

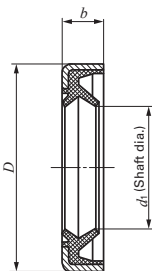


Shaft dia. 30 — 38mm

| Shaft<br>dia.<br>mm | Identification number |             | Boundary<br>dimensions mm |     |     | Combinable bearings                                                         |                                      |                             |                      |
|---------------------|-----------------------|-------------|---------------------------|-----|-----|-----------------------------------------------------------------------------|--------------------------------------|-----------------------------|----------------------|
|                     | Single lip            | Double lips | $d_1$                     | $D$ | $b$ | TA···Z YT                                                                   | RNA TR                               | RNAF                        | NAX<br>NBX           |
|                     |                       |             |                           |     |     | TLA···Z YTL                                                                 | TAF GTR                              |                             |                      |
| 30                  | OS 30374              | DS 30374    | 30                        | 37  | 4   | TLA 3012Z<br>TLA 3016Z<br>TLA 3018Z<br>TLA 3020Z<br>TLA 3026Z<br>TLAW 3038Z | —                                    | —                           | —                    |
|                     | OS 30404              | DS 30404    | 30                        | 40  | 4   | TA 3013Z<br>TA 3015Z<br>TA 3020Z<br>TA 3025Z<br>TA 3030Z                    | TAF 304020<br>TAF 304030             | RNAF 304017<br>RNAFW 304026 | —                    |
|                     | OS 30426              | DS 30426    | 30                        | 42  | 6   | —                                                                           | RNA 4905<br>RNA 6905                 | RNAF 304216<br>RNAFW 304232 | NAX 3030<br>NBX 3030 |
|                     | OS 32424              | DS 32424    | 32                        | 42  | 4   | TA 3220Z<br>TA 3230Z<br>YT 3220                                             | TAF 324220<br>TAF 324230             | —                           | —                    |
| 32                  | OS 32456              | DS 32456    | 32                        | 45  | 6   | —                                                                           | RNA 49/28<br>RNA 69/28<br>GTR 324530 | —                           | —                    |



OS



DS

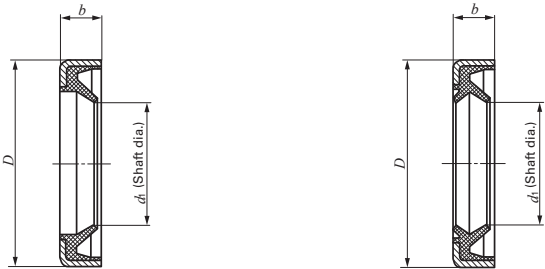
| Shaft<br>dia.<br>mm | Identification number |             | Boundary<br>dimensions mm |     |     | Combinable bearings                                       |                          |                             |                      |
|---------------------|-----------------------|-------------|---------------------------|-----|-----|-----------------------------------------------------------|--------------------------|-----------------------------|----------------------|
|                     | Single lip            | Double lips | $d_1$                     | $D$ | $b$ | TA···Z YT                                                 | RNA TR                   | RNAF                        | NAX<br>NBX           |
|                     |                       |             |                           |     |     | TLA···Z YTL                                               | TAF GTR                  |                             |                      |
| 35                  | OS 35424              | DS 35424    | 35                        | 42  | 4   | TLA 3512Z<br>TLA 3516Z<br>TLA 3520Z                       | —                        | —                           | —                    |
|                     | OS 35454              | DS 35454    | 35                        | 45  | 4   | TA 3512Z<br>TA 3515Z<br>TA 3520Z<br>TA 3525Z<br>TA 3530Z  | TAF 354520<br>TAF 354530 | RNAF 354517<br>RNAFW 354526 | —                    |
|                     | OS 35476              | DS 35476    | 35                        | 47  | 6   | —                                                         | RNA 4906<br>RNA 6906     | RNAF 354716<br>RNAFW 354732 | NAX 3530<br>NBX 3530 |
|                     | OS 37474              | DS 37474    | 37                        | 47  | 4   | TA 3720Z<br>TA 3730Z<br>YT 3720                           | TAF 374720<br>TAF 374730 | —                           | —                    |
| 38                  | OS 38484              | DS 38484    | 38                        | 48  | 4   | TA 3815Z<br>TA 3820Z<br>TA 3825Z<br>TA 3830Z<br>TAW 3845Z | TAF 384820<br>TAF 384830 | —                           | —                    |
|                     | OS 38506              | DS 38506    | 38                        | 50  | 6   | —                                                         | —                        | —                           | —                    |





Shaft dia. 40 — 50mm

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                                            |                          |                             |                      |
|------------------|-----------------------|-------------|------------------------|----|---|--------------------------------------------------------------------------------|--------------------------|-----------------------------|----------------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YTL<br>TLA···Z YTL                                                      | RNA TR<br>TAF GTR        | RNAF                        | NAX<br>NBX           |
| 40               | OS 40474              | DS 40474    | 40                     | 47 | 4 | TLA 4012Z<br>TLA 4016Z<br>TLA 4020Z                                            | —                        | —                           | —                    |
|                  | OS 40504              | DS 40504    | 40                     | 50 | 4 | TA 4015Z<br>TA 4020Z<br>TA 4025Z<br>TA 4030Z<br>TA 4040Z<br>YT 4015<br>YT 4025 | TAF 405020<br>TAF 405030 | RNAF 405017<br>RNAFW 405034 | —                    |
|                  | OS 40526              | DS 40526    | 40                     | 52 | 6 | —                                                                              | RNA 49/32<br>RNA 69/32   | —                           | NAX 4032<br>NBX 4032 |
|                  | OS 40556              | DS 40556    | 40                     | 55 | 6 | —                                                                              | TR 405520<br>GTR 405520  | RNAF 405520<br>RNAFW 405540 | —                    |
|                  | OS 42557              | DS 42557    | 42                     | 55 | 7 | —                                                                              | RNA 4907<br>RNA 6907     | —                           | —                    |



OS

DS

| Shaft dia.<br>mm | Identification number |             | Boundary dimensions mm |    |   | Combinable bearings                                                               |                                                 |                             |                      |
|------------------|-----------------------|-------------|------------------------|----|---|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------|----------------------|
|                  | Single lip            | Double lips | d <sub>1</sub>         | D  | b | TA···Z YTL<br>TLA···Z YTL                                                         | RNA TR<br>TAF GTR                               | RNAF                        | NAX<br>NBX           |
| 45               | OS 45524              | DS 45524    | 45                     | 52 | 4 | TLA 4516Z<br>TLA 4520Z                                                            | —                                               | —                           | —                    |
|                  | OS 45554              | DS 45554    | 45                     | 55 | 4 | TA 4520Z<br>TA 4525Z<br>TA 4530Z<br>TA 4540Z<br>YT 4520<br>YT 4525                | TAF 455520<br>TAF 455530                        | RNAF 455517<br>RNAFW 455534 | —                    |
|                  | OS 45627              | DS 45627    | 45                     | 62 | 7 | —                                                                                 | —                                               | RNAF 456220<br>RNAFW 456240 | —                    |
|                  | OS 48627              | DS 48627    | 48                     | 62 | 7 | —                                                                                 | RNA 4908<br>RNA 6908<br>TR 486230<br>GTR 486230 | —                           | —                    |
|                  | OS 50584              | DS 50584    | 50                     | 58 | 4 | TLA 5020Z<br>TLA 5025Z                                                            | —                                               | —                           | —                    |
| 50               | OS 50624              | DS 50624    | 50                     | 62 | 4 | TA 5012Z<br>TA 5015Z<br>TA 5020Z<br>TA 5025Z<br>TA 5030Z<br>TA 5040Z<br>TAW 5045Z | TAF 506225<br>TAF 506235                        | RNAF 506220<br>RNAFW 506240 | NAX 5035<br>NBX 5035 |
|                  | OS 50657              | DS 50657    | 50                     | 65 | 7 | —                                                                                 | RNA 49/42                                       | RNAF 506520<br>RNAFW 506540 | —                    |
|                  |                       |             |                        |    |   |                                                                                   |                                                 |                             |                      |

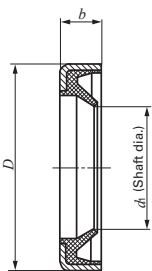
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DS

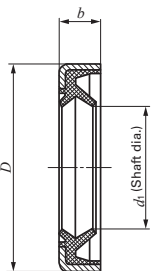


Shaft dia. 52 – 72mm

| Shaft<br>dia.<br><br>mm | Identification number |             | Boundary<br>dimensions   mm |          |          | Combinable bearings                                                            |                          |                               |                      |  |
|-------------------------|-----------------------|-------------|-----------------------------|----------|----------|--------------------------------------------------------------------------------|--------------------------|-------------------------------|----------------------|--|
|                         | Single lip            | Double lips | <i>d</i> <sub>1</sub>       | <i>D</i> | <i>b</i> | TA ··· Z   YT<br>TLA ··· Z   YTL                                               | RNA   TR<br>TAF   GTR    | RNAF                          | NAX<br>NBX           |  |
| 52                      | OS 52687              | DS 52687    | 52                          | 68       | 7        | —                                                                              | RNA   4909<br>RNA   6909 | —                             | —                    |  |
| 55                      | OS 55674              | DS 55674    | 55                          | 67       | 4        | TA   5520Z<br>TA   5525Z<br>TA   5530Z<br>TA   5540Z<br>TAW 5545Z<br>TAW 5550Z | —                        | —                             | —                    |  |
|                         | OS 55687              | DS 55687    | 55                          | 68       | 7        | —                                                                              | TAF 556825<br>TAF 556835 | RNAF   556820<br>RNAFW 556840 | —                    |  |
|                         | OS 55727              | —           | 55                          | 72       | 7        | —                                                                              | —                        | RNAF   557220<br>RNAFW 557240 | —                    |  |
| 58                      | OS 58727              | DS 58727    | 58                          | 72       | 7        | —                                                                              | RNA   4910<br>RNA   6910 | —                             | —                    |  |
| 60                      | OS 60724              | DS 60724    | 60                          | 72       | 4        | TA   6025Z<br>TA   6030Z<br>TA   6040Z<br>TAW 6045Z<br>TAW 6050Z               | TAF 607225<br>TAF 607235 | —                             | NAX 6040<br>NBX 6040 |  |
|                         | OS 60787              | DS 60787    | 60                          | 78       | 7        | —                                                                              | —                        | RNAF   607820<br>RNAFW 607840 | —                    |  |
| 62                      | OS 62744              | DS 62744    | 62                          | 74       | 4        | TA   6212Z                                                                     | —                        | —                             | —                    |  |
| 63                      | OS 63807              | DS 63807    | 63                          | 80       | 7        | —                                                                              | RNA   4911<br>RNA   6911 | —                             | —                    |  |



OS



DS

| Shaft<br>dia.<br><br>mm | Identification number |             | Boundary<br>dimensions   mm |     |     | Combinable bearings                                                                        |                          |                               |            |  |
|-------------------------|-----------------------|-------------|-----------------------------|-----|-----|--------------------------------------------------------------------------------------------|--------------------------|-------------------------------|------------|--|
|                         | Single lip            | Double lips | $d_1$                       | $D$ | $b$ | TA···Z   YT<br>TLA···Z   YTL                                                               | RNA   TR<br>TAF   GTR    | RNAF                          | NAX<br>NBX |  |
| 65                      | OS 65774              | DS 65774    | 65                          | 77  | 4   | TA   6525Z<br>TA   6530Z<br>TAW 6545Z<br>TAW 6550Z                                         | —                        | —                             | —          |  |
|                         | OS 65857              | DS 65857    | 65                          | 85  | 7   | —                                                                                          | —                        | RNAF   658530<br>RNAFW 658560 | —          |  |
| 68                      | OS 68857              | DS 68857    | 68                          | 85  | 7   | —                                                                                          | RNA   4912<br>RNA   6912 | —                             | —          |  |
| 70                      | OS 70824              | DS 70824    | 70                          | 82  | 4   | TA   7025Z<br>TA   7030Z<br>TA   7040Z<br>TAW 7050Z<br>YT   7025<br>YT   7030<br>YT   7040 | —                        | —                             | —          |  |
|                         | OS 70907              | DS 70907    | 70                          | 90  | 7   | —                                                                                          | —                        | RNAF   709030<br>RNAFW 709060 | —          |  |
| 72                      | OS 72907              | DS 72907    | 72                          | 90  | 7   | —                                                                                          | RNA   4913<br>RNA   6913 | —                             |            |  |

# Cir-clips for Needle Roller Bearings

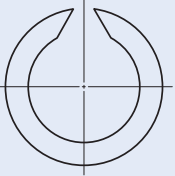
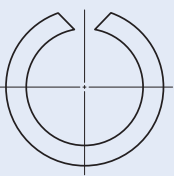
## Features

IKO Cir-clips for Needle Roller Bearings have been specially designed for needle roller bearings on which, in many cases, generally available Cir-clips cannot be used. They have a low sectional height and are very rigid. They are made of spring steel. There are Cir-clips for shafts and for bores, and they are used for positioning to prevent bearing movement in the axial direction.

## Types

Cir-clips for Needle Roller Bearings are available as shown in Table. 1.

Table 1 Type of Cir-clip

| Type       | For shaft                                                                           | For bore                                                                            |
|------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Shape      |  |  |
| Model code | WR                                                                                  | AR                                                                                  |

## Identification number

The identification number of Cir-clips consists of a model code and a size as shown below.

Examples of identification number

**Example 1**

Model code

Size

WR

20

Type of Cir-clip

Shaft dia. (20mm)

**Example 2**

Model code

Size

AR

35

Type of Cir-clip

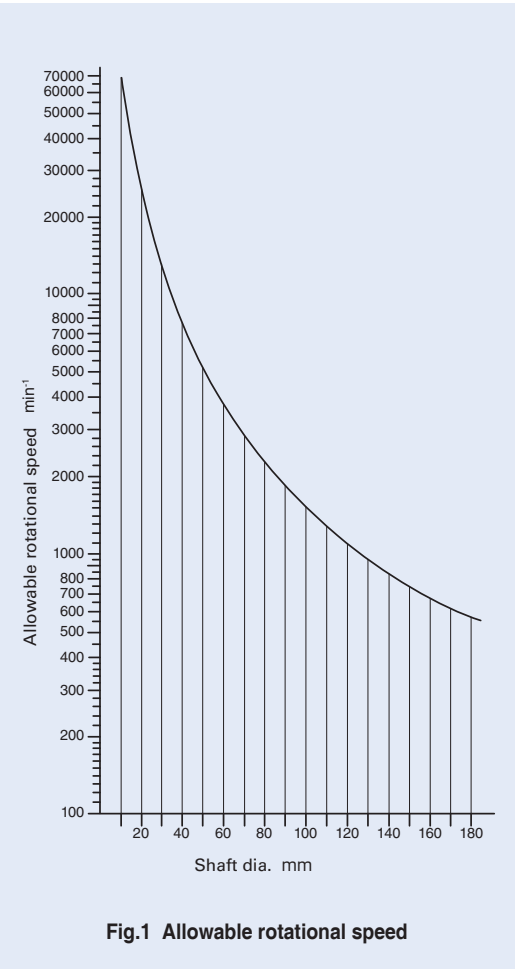
Bore dia. (35mm)

## Allowable Rotational Speed

Cir-clips for Needle Roller Bearings are fixed in the groove with a certain amount of pressure on the bottom of the groove. In the case of Cir-clips for shaft WR type, the centrifugal force causes a decrease in the gripping pressure. Therefore, when using them at high rotational speeds, it is necessary to first check the allowable rotational speed shown in Fig.1.

## Mounting

The mounting dimensions for Cir-clips for Needle Roller Bearings are shown in the dimension table. When using these Cir-clips to restrict the movement of the needle roller cage in the axial direction, it is recommended that a spacer be used between the Cir-clip and the cage. Spacers are not required at low rotational speeds. When it is difficult to reach Cir-clips with dismounting tools and disassembly is difficult, or when the frequency of dismounting is high, it is necessary to consider the use of a retaining ring (JIS B 2804), although they have a higher sectional height.



CIR-CLIPS FOR NEEDLE ROLLER BEARINGS

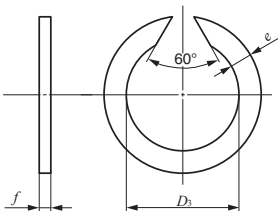
For Shaft



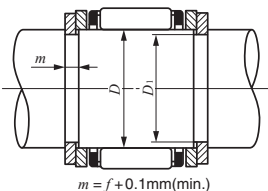
Shaft dia. 4 – 390mm

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Shaft dia.<br><i>D</i> | <i>D</i> <sub>3</sub><br>(Max.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| WR 4                  | 4                      | 3.7                             | 0.8      | 0.5      | 3.8                                  | 0<br>−0.09 |
| WR 5                  | 5                      | 4.7                             | 1        | 0.5      | 4.8                                  |            |
| WR 6                  | 6                      | 5.6                             | 1.1      | 0.7      | 5.7                                  |            |
| WR 7                  | 7                      | 6.5                             | 1.2      | 0.7      | 6.7                                  |            |
| WR 8                  | 8                      | 7.4                             | 1.3      | 1        | 7.6                                  |            |
| WR 9                  | 9                      | 8.4                             | 1.3      | 1        | 8.6                                  | 0<br>−0.11 |
| WR 10                 | 10                     | 9.4                             | 1.3      | 1        | 9.6                                  |            |
| WR 11                 | 11                     | 10.2                            | 1.3      | 1        | 10.5                                 |            |
| WR 12                 | 12                     | 11.2                            | 1.3      | 1        | 11.5                                 |            |
| WR 13                 | 13                     | 12.1                            | 1.3      | 1        | 12.5                                 |            |
| WR 14                 | 14                     | 13.1                            | 1.5      | 1.2      | 13.5                                 | 0<br>−0.13 |
| WR 15                 | 15                     | 14                              | 1.75     | 1.2      | 14.4                                 |            |
| WR 16                 | 16                     | 15                              | 1.75     | 1.2      | 15.4                                 |            |
| WR 17                 | 17                     | 16                              | 1.75     | 1.2      | 16.4                                 |            |
| WR 18                 | 18                     | 17                              | 1.75     | 1.2      | 17.4                                 |            |
| WR 19                 | 19                     | 17.9                            | 1.75     | 1.2      | 18.4                                 | 0<br>−0.16 |
| WR 20                 | 20                     | 18.7                            | 1.75     | 1.2      | 19.2                                 |            |
| WR 21                 | 21                     | 19.7                            | 1.75     | 1.2      | 20.2                                 |            |
| WR 22                 | 22                     | 20.7                            | 1.75     | 1.2      | 21.2                                 |            |
| WR 23                 | 23                     | 21.7                            | 1.75     | 1.2      | 22.2                                 |            |
| WR 24                 | 24                     | 22.5                            | 1.75     | 1.2      | 23                                   | 0<br>−0.25 |
| WR 25                 | 25                     | 23.5                            | 1.75     | 1.2      | 24                                   |            |
| WR 26                 | 26                     | 24.5                            | 1.75     | 1.2      | 25                                   |            |
| WR 28                 | 28                     | 26.5                            | 2.3      | 1.5      | 27                                   |            |
| WR 29                 | 29                     | 27.5                            | 2.3      | 1.5      | 28                                   |            |
| WR 30                 | 30                     | 28.5                            | 2.3      | 1.5      | 29                                   | 0<br>−0.25 |
| WR 32                 | 32                     | 30.2                            | 2.3      | 1.5      | 30.8                                 |            |
| WR 35                 | 35                     | 33.2                            | 2.3      | 1.5      | 33.8                                 |            |
| WR 36                 | 36                     | 34.2                            | 2.3      | 1.5      | 34.8                                 |            |
| WR 37                 | 37                     | 35.2                            | 2.3      | 1.5      | 35.8                                 |            |
| WR 38                 | 38                     | 36.2                            | 2.3      | 1.5      | 36.8                                 | 0<br>−0.25 |
| WR 40                 | 40                     | 37.8                            | 2.3      | 1.5      | 38.5                                 |            |

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Shaft dia.<br><i>D</i> | <i>D</i> <sub>3</sub><br>(Max.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| WR 42                 | 42                     | 39.8                            | 2.3      | 1.5      | 40.5                                 | 0<br>−0.16 |
| WR 43                 | 43                     | 40.8                            | 2.3      | 1.5      | 41.5                                 |            |
| WR 45                 | 45                     | 42.8                            | 2.3      | 1.5      | 43.5                                 |            |
| WR 47                 | 47                     | 44.8                            | 2.3      | 1.5      | 45.5                                 |            |
| WR 50                 | 50                     | 47.8                            | 2.3      | 1.5      | 48.5                                 |            |
| WR 52                 | 52                     | 49.8                            | 2.3      | 1.5      | 50.5                                 | 0<br>−0.19 |
| WR 55                 | 55                     | 52.6                            | 2.3      | 1.5      | 53.5                                 |            |
| WR 60                 | 60                     | 57.6                            | 2.3      | 1.5      | 58.5                                 |            |
| WR 63                 | 63                     | 60.6                            | 2.3      | 1.5      | 61.5                                 |            |
| WR 65                 | 65                     | 62.6                            | 2.3      | 1.5      | 63.5                                 |            |
| WR 68                 | 68                     | 65.4                            | 2.8      | 2        | 66.2                                 | 0<br>−0.22 |
| WR 70                 | 70                     | 67.4                            | 2.8      | 2        | 68.2                                 |            |
| WR 75                 | 75                     | 72.4                            | 2.8      | 2        | 73.2                                 |            |
| WR 80                 | 80                     | 77.4                            | 2.8      | 2        | 78.2                                 |            |
| WR 82                 | 82                     | 79.3                            | 3.4      | 2.5      | 80.2                                 |            |
| WR 85                 | 85                     | 82                              | 3.4      | 2.5      | 83                                   | 0<br>−0.25 |
| WR 90                 | 90                     | 87                              | 3.4      | 2.5      | 88                                   |            |
| WR 95                 | 95                     | 92                              | 3.4      | 2.5      | 93                                   |            |
| WR 100                | 100                    | 97                              | 3.4      | 2.5      | 98                                   |            |
| WR 105                | 105                    | 101.7                           | 3.4      | 2.5      | 102.7                                |            |
| WR 110                | 110                    | 106.7                           | 3.4      | 2.5      | 107.7                                | 0<br>−0.25 |
| WR 115                | 115                    | 111.7                           | 3.4      | 2.5      | 112.7                                |            |
| WR 120                | 120                    | 116.7                           | 3.4      | 2.5      | 117.7                                |            |
| WR 125                | 125                    | 121.7                           | 3.4      | 2.5      | 122.7                                |            |
| WR 130                | 130                    | 126.7                           | 3.4      | 2.5      | 127.7                                |            |
| WR 135                | 135                    | 131.6                           | 4        | 2.5      | 132.4                                | 0<br>−0.25 |
| WR 140                | 140                    | 136.6                           | 4        | 2.5      | 137.4                                |            |
| WR 145                | 145                    | 141.6                           | 4        | 2.5      | 142.4                                |            |
| WR 150                | 150                    | 146.6                           | 4        | 2.5      | 147.4                                |            |
| WR 155                | 155                    | 151.6                           | 4        | 2.5      | 152.4                                |            |
| WR 160                | 160                    | 156.6                           | 4        | 2.5      | 157.4                                | 0<br>−0.25 |
| WR 165                | 165                    | 161.6                           | 4        | 2.5      | 162.4                                |            |



WR

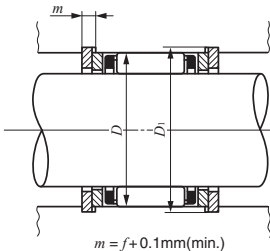
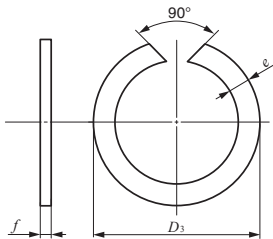
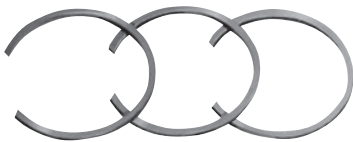


$m = f + 0.1\text{mm}(\text{min.})$

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Shaft dia.<br><i>D</i> | <i>D</i> <sub>3</sub><br>(Max.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| WR 170                | 170                    | 166.6                           | 4        | 2.5      | 167.4                                | 0<br>−0.25 |
| WR 175                | 175                    | 171.6                           | 4        | 2.5      | 172.4                                |            |
| WR 180                | 180                    | 175.6                           | 5        | 3        | 177                                  | 0<br>−0.29 |
| WR 185                | 185                    | 180.6                           | 5        | 3        | 182                                  |            |
| WR 190                | 190                    | 185.6                           | 5        | 3        | 187                                  |            |
| WR 195                | 195                    | 190.6                           | 5        | 3        | 192                                  |            |
| WR 200                | 200                    | 195.6                           | 5        | 3        | 197                                  |            |
| WR 210                | 210                    | 205.6                           | 5        | 3        | 207                                  | 0<br>−0.32 |
| WR 220                | 220                    | 215.6                           | 5        | 3        | 217                                  |            |
| WR 230                | 230                    | 225.6                           | 5        | 3        | 227                                  |            |
| WR 240                | 240                    | 235.6                           | 5        | 3        | 237                                  |            |
| WR 260                | 260                    | 253                             | 7.5      | 4        | 255                                  |            |
| WR 265                | 265                    | 258                             | 7.5      | 4        | 260                                  | 0<br>−0.36 |
| WR 270                | 270                    | 263                             | 7.5      | 4        | 265                                  |            |
| WR 280                | 280                    | 273                             | 7.5      | 4        | 275                                  |            |
| WR 285                | 285                    | 278                             | 7.5      | 4        | 280                                  |            |
| WR 300                | 300                    | 293                             | 7.5      | 4        | 295                                  |            |
| WR 305                | 305                    | 298                             | 7.5      | 4        | 300                                  | 0<br>−0.36 |
| WR 320                | 320                    | 313                             | 7.5      | 4        | 315                                  |            |
| WR 330                | 330                    | 323                             | 7.5      | 4        | 325                                  |            |
| WR 340                | 340                    | 333                             | 7.5      | 4        | 335                                  |            |
| WR 350                | 350                    | 343                             | 7.5      | 4        | 345                                  |            |
| WR 360                | 360                    | 353                             | 7.5      | 4        | 355                                  | 0<br>−0.36 |
| WR 370                | 370                    | 363                             | 7.5      | 4        | 365                                  |            |
| WR 390                | 390                    | 383                             | 7.5      | 4        | 385                                  |            |

CIR-CLIPS FOR NEEDLE ROLLER BEARINGS

For Bore



AR

Bore dia. 7 – 440mm

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Bore dia.<br><i>D</i>  | <i>D</i> <sub>3</sub><br>(Min.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| AR 7                  | 7                      | 7.5                             | 1        | 0.8      | 7.3                                  | +0.09<br>0 |
| AR 8                  | 8                      | 8.5                             | 1        | 0.8      | 8.3                                  |            |
| AR 9                  | 9                      | 9.5                             | 1.1      | 0.8      | 9.3                                  |            |
| AR 10                 | 10                     | 10.6                            | 1.2      | 0.8      | 10.4                                 | +0.11<br>0 |
| AR 11                 | 11                     | 11.6                            | 1.3      | 1        | 11.4                                 |            |
| AR 12                 | 12                     | 12.7                            | 1.3      | 1        | 12.4                                 |            |
| AR 13                 | 13                     | 13.8                            | 1.3      | 1        | 13.5                                 |            |
| AR 14                 | 14                     | 14.8                            | 1.3      | 1        | 14.5                                 |            |
| AR 15                 | 15                     | 15.8                            | 1.3      | 1        | 15.5                                 | +0.13<br>0 |
| AR 16                 | 16                     | 16.8                            | 1.6      | 1.2      | 16.5                                 |            |
| AR 17                 | 17                     | 17.8                            | 1.6      | 1.2      | 17.5                                 |            |
| AR 18                 | 18                     | 18.9                            | 1.75     | 1.2      | 18.5                                 |            |
| AR 19                 | 19                     | 19.9                            | 1.75     | 1.2      | 19.6                                 |            |
| AR 20                 | 20                     | 21                              | 1.75     | 1.2      | 20.6                                 |            |
| AR 21                 | 21                     | 22                              | 1.75     | 1.2      | 21.6                                 |            |
| AR 22                 | 22                     | 23                              | 1.75     | 1.2      | 22.6                                 |            |
| AR 23                 | 23                     | 24                              | 1.75     | 1.2      | 23.6                                 |            |
| AR 24                 | 24                     | 25.2                            | 1.75     | 1.2      | 24.8                                 |            |
| AR 25                 | 25                     | 26.2                            | 1.75     | 1.2      | 25.8                                 | +0.16<br>0 |
| AR 26                 | 26                     | 27.2                            | 1.75     | 1.2      | 26.8                                 |            |
| AR 27                 | 27                     | 28.2                            | 1.75     | 1.2      | 27.8                                 |            |
| AR 28                 | 28                     | 29.2                            | 1.75     | 1.2      | 28.8                                 |            |
| AR 29                 | 29                     | 30.2                            | 1.75     | 1.2      | 29.8                                 |            |
| AR 30                 | 30                     | 31.4                            | 2.3      | 1.5      | 31                                   |            |
| AR 31                 | 31                     | 32.4                            | 2.3      | 1.5      | 32                                   |            |
| AR 32                 | 32                     | 33.4                            | 2.3      | 1.5      | 33                                   |            |
| AR 33                 | 33                     | 34.4                            | 2.3      | 1.5      | 34                                   |            |
| AR 34                 | 34                     | 35.4                            | 2.3      | 1.5      | 35                                   |            |
| AR 35                 | 35                     | 36.4                            | 2.3      | 1.5      | 36                                   |            |
| AR 37                 | 37                     | 38.8                            | 2.3      | 1.5      | 38.2                                 |            |
| AR 38                 | 38                     | 39.8                            | 2.3      | 1.5      | 39.2                                 |            |
| AR 39                 | 39                     | 40.8                            | 2.3      | 1.5      | 40.2                                 |            |

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Bore dia.<br><i>D</i>  | <i>D</i> <sub>3</sub><br>(Min.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| AR 40                 | 40                     | 41.8                            | 2.3      | 1.5      | 41.2                                 | +0.16<br>0 |
| AR 42                 | 42                     | 43.8                            | 2.3      | 1.5      | 43.2                                 |            |
| AR 43                 | 43                     | 44.8                            | 2.3      | 1.5      | 44.2                                 |            |
| AR 44                 | 44                     | 45.8                            | 2.3      | 1.5      | 45.2                                 |            |
| AR 45                 | 45                     | 46.8                            | 2.3      | 1.5      | 46.2                                 |            |
| AR 47                 | 47                     | 48.8                            | 2.3      | 1.5      | 48.2                                 |            |
| AR 48                 | 48                     | 49.8                            | 2.3      | 1.5      | 49.2                                 |            |
| AR 50                 | 50                     | 51.8                            | 2.3      | 1.5      | 51.2                                 |            |
| AR 52                 | 52                     | 54.3                            | 2.3      | 1.5      | 53.5                                 |            |
| AR 53                 | 53                     | 55.3                            | 2.3      | 1.5      | 54.5                                 |            |
| AR 55                 | 55                     | 57.3                            | 2.3      | 1.5      | 56.5                                 | +0.19<br>0 |
| AR 57                 | 57                     | 59.3                            | 2.3      | 1.5      | 58.5                                 |            |
| AR 58                 | 58                     | 60.3                            | 2.3      | 1.5      | 59.5                                 |            |
| AR 60                 | 60                     | 62.3                            | 2.3      | 1.5      | 61.5                                 |            |
| AR 62                 | 62                     | 64.3                            | 2.3      | 1.5      | 63.5                                 |            |
| AR 65                 | 65                     | 67.3                            | 2.3      | 1.5      | 66.5                                 |            |
| AR 68                 | 68                     | 70.3                            | 2.3      | 1.5      | 69.5                                 |            |
| AR 70                 | 70                     | 72.3                            | 2.3      | 1.5      | 71.5                                 |            |
| AR 72                 | 72                     | 74.6                            | 2.8      | 2        | 73.8                                 |            |
| AR 73                 | 73                     | 75.6                            | 2.8      | 2        | 74.8                                 |            |
| AR 75                 | 75                     | 77.6                            | 2.8      | 2        | 76.8                                 | +0.22<br>0 |
| AR 76                 | 76                     | 78.6                            | 2.8      | 2        | 77.8                                 |            |
| AR 78                 | 78                     | 80.6                            | 2.8      | 2        | 79.8                                 |            |
| AR 80                 | 80                     | 82.6                            | 2.8      | 2        | 81.8                                 |            |
| AR 81                 | 81                     | 83.6                            | 2.8      | 2        | 82.8                                 |            |
| AR 82                 | 82                     | 84.6                            | 2.8      | 2        | 83.8                                 |            |
| AR 83                 | 83                     | 85.6                            | 2.8      | 2        | 84.8                                 |            |
| AR 85                 | 85                     | 87.6                            | 2.8      | 2        | 86.8                                 |            |
| AR 86                 | 86                     | 88.6                            | 2.8      | 2        | 87.8                                 |            |
| AR 88                 | 88                     | 91                              | 3.4      | 2.5      | 90                                   |            |
| AR 90                 | 90                     | 93                              | 3.4      | 2.5      | 92                                   | +0.25<br>0 |
| AR 92                 | 92                     | 95                              | 3.4      | 2.5      | 94                                   |            |

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Bore dia.<br><i>D</i>  | <i>D</i> <sub>3</sub><br>(Min.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| AR 93                 | 93                     | 96                              | 3.4      | 2.5      | 95                                   | +0.22<br>0 |
| AR 95                 | 95                     | 98                              | 3.4      | 2.5      | 97                                   |            |
| AR 97                 | 97                     | 100                             | 3.4      | 2.5      | 99                                   |            |
| AR 98                 | 98                     | 101                             | 3.4      | 2.5      | 100                                  |            |
| AR 100                | 100                    | 103                             | 3.4      | 2.5      | 102                                  |            |
| AR 102                | 102                    | 105.3                           | 3.4      | 2.5      | 104.3                                |            |
| AR 103                | 103                    | 106.3                           | 3.4      | 2.5      | 105.3                                |            |
| AR 105                | 105                    | 108.3                           | 3.4      | 2.5      | 107.3                                |            |
| AR 107                | 107                    | 110.3                           | 3.4      | 2.5      | 109.3                                |            |
| AR 108                | 108                    | 111.3                           | 3.4      | 2.5      | 110.3                                |            |
| AR 110                | 110                    | 113.3                           | 3.4      | 2.5      | 112.3                                | +0.25<br>0 |
| AR 112                | 112                    | 115.3                           | 3.4      | 2.5      | 114.3                                |            |
| AR 113                | 113                    | 116.3                           | 3.4      | 2.5      | 115.3                                |            |
| AR 115                | 115                    | 118.3                           | 3.4      | 2.5      | 117.3                                |            |
| AR 117                | 117                    | 120.3                           | 3.4      | 2.5      | 119.3                                |            |
| AR 118                | 118                    | 121.3                           | 3.4      | 2.5      | 120.3                                |            |
| AR 120                | 120                    | 123.3                           | 3.4      | 2.5      | 122.3                                |            |
| AR 123                | 123                    | 126.3                           | 3.4      | 2.5      | 125.3                                |            |
| AR 125                | 125                    | 128.3                           | 3.4      | 2.5      | 127.3                                |            |
| AR 127                | 127                    | 130.3                           | 3.4      | 2.5      | 129.3                                |            |
| AR 130                | 130                    | 133.3                           | 3.4      | 2.5      | 132.3                                | +0.36<br>0 |
| AR 133                | 133                    | 136.3                           | 3.4      | 2.5      | 135.3                                |            |
| AR 135                | 135                    | 138.3                           | 3.4      | 2.5      | 137.3                                |            |
| AR 137                | 137                    | 140.3                           | 3.4      | 2.5      | 139.3                                |            |
| AR 140                | 140                    | 143.6                           | 4        | 2.5      | 142.6                                |            |
| AR 143                | 143                    | 146.6                           | 4        | 2.5      | 145.6                                |            |
| AR 145                | 145                    | 148.6                           | 4        | 2.5      | 147.6                                |            |
| AR 150                | 150                    | 153.6                           | 4        | 2.5      | 152.6                                |            |
| AR 153                | 153                    | 156.6                           | 4        | 2.5      | 155.6                                |            |
| AR 160                | 160                    | 163.6                           | 4        | 2.5      | 162.6                                |            |
| AR 163                | 163                    | 166.6                           | 4        | 2.5      | 165.6                                | +0.4<br>0  |
| AR 165                | 165                    | 168.6                           | 4        | 2.5      | 167.6                                |            |

| Identification number | Boundary dimensions mm |                                 |          |          |                                      |            |
|-----------------------|------------------------|---------------------------------|----------|----------|--------------------------------------|------------|
|                       | Bore dia.<br><i>D</i>  | <i>D</i> <sub>3</sub><br>(Min.) | <i>e</i> | <i>f</i> | Groove dia.<br><i>D</i> <sub>1</sub> | Tolerance  |
| AR 170                | 170                    | 173.6                           | 4        | 2.5      | 172.6                                | +0.25<br>0 |
| AR 173                | 173                    | 176.6                           | 4        | 2.5      | 175.6                                |            |
| AR 175                | 175                    | 178.6                           | 4        | 2.5      | 177.6                                |            |
| AR 180                | 180                    | 183.6                           | 4        | 2.5      | 182.6                                |            |
| AR 183                | 183                    | 186.6                           | 4        | 2.5      | 185.6                                |            |
| AR 190                | 190                    | 194.5                           | 5        | 3        | 193                                  | +0.29<br>0 |
| AR 195                | 195                    | 199.5                           | 5        | 3        | 198                                  |            |
| AR 200                | 200                    | 204.5                           | 5        | 3        | 203                                  |            |
| AR 205                | 205                    | 209.5                           | 5        | 3        | 208                                  |            |
| AR 210                | 210                    | 214.5                           | 5        | 3        | 213                                  |            |
| AR 215                | 215                    | 219.5                           | 5        | 3        | 218                                  |            |
| AR 220                | 220                    | 224.5                           | 5        | 3        | 223                                  |            |
| AR 225                | 225                    | 229.5                           | 5        | 3        | 228                                  |            |
| AR 230                | 230                    | 234.5                           | 5        | 3        | 233                                  |            |
| AR 235                | 235                    | 239.5                           | 5        | 3        | 238                                  |            |
| AR 240                | 240                    | 244.5                           | 5        | 3        | 243                                  | +0.32<br>0 |
| AR 245                | 245                    | 249.5                           | 5        | 3        | 248                                  |            |
| AR 250                | 250                    | 254.5                           | 5        | 3        | 253                                  |            |
| AR 260                | 260                    | 267                             | 7.5      | 4        | 265                                  |            |
| AR 270                | 270                    | 277                             | 7.5      | 4        | 275                                  |            |
| AR 280                | 280                    | 287                             | 7.5      | 4        | 285                                  | +0.36<br>0 |
| AR 300                | 300                    | 307                             | 7.5      | 4        | 305                                  |            |
| AR 320                | 320                    | 327                             | 7.5      | 4        | 325                                  |            |
| AR 325                | 325                    | 332                             | 7.5      | 4        | 330                                  |            |
| AR 355                | 355                    | 362                             | 7.5      | 4        | 360                                  |            |
| AR 375                | 375                    | 382                             | 7.5      | 4        | 380                                  | +0.4<br>0  |
| AR 395                | 395                    | 402                             | 7.5      | 4        | 400                                  |            |
| AR 415                | 415                    | 422                             | 7.5      | 4        | 420                                  |            |
| AR 420                | 420                    | 427                             | 7.5      | 4        | 425                                  |            |
| AR 440                | 440                    | 447                             | 7.5      | 4        | 445                                  |            |



# Needle Rollers

## Features

IKO Needle Rollers are made of high carbon chromium bearing steel. They are rigid and highly accurate and are finished to a hardness of 58HRC or more (See Table 1.) and a surface roughness of 0.1  $\mu\text{mR}_a$  or less.

These needle rollers are widely used as rolling elements for bearings, and also as pins and shafts. Please contact IKO, if Needle Rollers made of stainless steel are required.

Table 1 Hardness

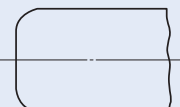
| Nominal diameter $D_w$ mm |       | Hardness  |             |
|---------------------------|-------|-----------|-------------|
| Over                      | Incl. | HRC       | HV          |
| —                         | 3     | (60 ~ 67) | 697 ~ 900   |
| 3                         | —     | 58 ~ 66   | (653 ~ 865) |

Remarks1. Hardness is flat surface hardness.  
2. The values in parentheses are converted values for reference.

## End Shapes

Needle Rollers come in spherical and flat end shapes, as shown in Table 2.  
Please contact IKO, if other shapes are required.

Table 2 Shapes of ends

| Type   | Spherical end                                                                       | Flat end                                                                            |
|--------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Shapes |  |  |
| Symbol | A                                                                                   | F                                                                                   |

## Accuracy

The dimensional accuracy of Needle Rollers conforms to JIS B 1506 (Rolling bearings-Rollers), and is shown in Table 3.

The selective classification for the mean diameter tolerance is shown in Table 4. The selective classification rollers according to Table 4 can be provided as requested.

Table 3 Dimensional accuracy of needle rollers unit:  $\mu\text{m}$

| Class | Diameter variation in a single radial plane <sup>(1)</sup><br>$V_{Dwp}$ (Max.) | Circularity <sup>(1)</sup><br>$\Delta_R$ (Max.) | Gauge lot diameter variation <sup>(1)</sup><br>$V_{DwL}$ (Max.) | Deviation of a single length <sup>(2)</sup><br>$\Delta_{Lws}$ |
|-------|--------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------|
| 2     | 1                                                                              | 1                                               | 2                                                               | h13                                                           |
| 3     | 1.5                                                                            | 1.5                                             | 3                                                               | h13                                                           |
| 5     | 2                                                                              | 2.5                                             | 5                                                               | h13                                                           |

Notes<sup>(1)</sup> Applicable to the measurement at the center of roller length  
<sup>(2)</sup> Tolerance is based on the classification according to the nominal length  $L_w$ .

Remark Any measured diameter along the total length of roller must not be larger than the actual maximum diameter at the center of roller length by the amount exceeding the values given below.  
0.5  $\mu\text{m}$  for Class 2  
0.8  $\mu\text{m}$  for Class 3  
1  $\mu\text{m}$  for Class 5

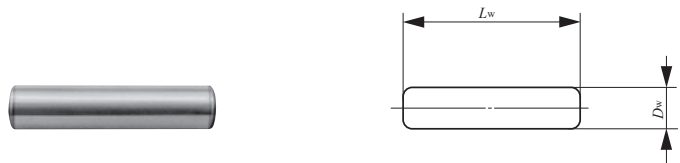
Table 4 Classification of needle rollers unit:  $\mu\text{m}$

| Classification symbol | Tolerance for mean dia. |
|-----------------------|-------------------------|
| C 3                   | 0 ~ - 3                 |
| B 2                   | 0 ~ - 2                 |
| B 4                   | - 2 ~ - 4               |
| B 6                   | - 4 ~ - 6               |
| B 8                   | - 6 ~ - 8               |
| B10                   | - 8 ~ - 10              |

## Use as Full-complement Bearings

For normal rotation, Needle Roller Bearings with cage are most suitable, but for low rotational speeds and for oscillating movement, full-complement bearings are also used.

If Needle Rollers are combined with a shaft and a housing which have been hardened and ground to form a suitable raceway surface, the combined assembly can be used as a full-complement bearing which has a large load capacity and a low sectional height. (See page A44, Design of shaft and housing.) Normally in this case, the radial clearance is made a little larger than that of a bearing with cage and the circumferential clearance is made to be approximately 1/10 of the diameter of needle rollers. When the bearing is used under severe conditions, please contact IKO for further information.



Roller dia. 1 — 6mm

| Nominal dimensions mm |       |               | Nominal dimensions mm |       |               | Nominal dimensions mm |       |               |
|-----------------------|-------|---------------|-----------------------|-------|---------------|-----------------------|-------|---------------|
| $D_w$                 | $L_w$ | Mass (Ref.) g | $D_w$                 | $L_w$ | Mass (Ref.) g | $D_w$                 | $L_w$ | Mass (Ref.) g |
| 1                     | 5.8   | 0.03          | 3.5                   | 11.8  | 0.86          | 5                     | 15.8  | 2.3           |
|                       | 6.8   | 0.04          |                       | 13.8  | 1             |                       | 17.8  | 2.6           |
|                       | 7.8   | 0.05          |                       | 15.8  | 1.15          |                       | 19.8  | 2.9           |
|                       | 9.8   | 0.06          |                       | 17.8  | 1.29          |                       | 21.8  | 3.2           |
| 1.5                   | 5.8   | 0.08          |                       | 19.8  | 1.44          |                       | 23.8  | 3.5           |
|                       | 6.8   | 0.09          |                       | 21.8  | 1.58          |                       | 25.8  | 3.8           |
|                       | 7.8   | 0.1           |                       | 23.8  | 1.73          |                       | 27.8  | 4.1           |
|                       | 9.8   | 0.13          |                       | 25.8  | 1.88          |                       | 29.8  | 4.4           |
|                       | 11.8  | 0.16          |                       | 27.8  | 2.1           |                       | 31.8  | 4.7           |
|                       | 13.8  | 0.18          |                       | 29.8  | 2.2           |                       | 34.8  | 5.2           |
| 2                     | 6.8   | 0.16          |                       | 31.8  | 2.3           |                       | 37.8  | 5.6           |
|                       | 7.8   | 0.19          |                       | 34.8  | 2.5           |                       | 39.8  | 5.9           |
|                       | 9.8   | 0.23          | 4                     | 11.8  | 1.12          |                       | 49.8  | 7.4           |
|                       | 11.8  | 0.28          |                       | 13.8  | 1.31          | 6                     | 17.8  | 3.9           |
|                       | 13.8  | 0.33          |                       | 15.8  | 1.5           |                       | 19.8  | 4.3           |
|                       | 15.8  | 0.38          |                       | 17.8  | 1.69          |                       | 21.8  | 4.8           |
|                       | 17.8  | 0.42          |                       | 19.8  | 1.88          |                       | 23.8  | 5.2           |
|                       | 19.8  | 0.47          |                       | 21.8  | 2.1           |                       | 25.8  | 5.5           |
| 2.5                   | 7.8   | 0.29          |                       | 23.8  | 2.3           |                       | 27.8  | 6             |
|                       | 9.8   | 0.36          |                       | 25.8  | 2.5           |                       | 29.8  | 6.4           |
|                       | 11.8  | 0.44          |                       | 27.8  | 2.6           |                       | 34.8  | 7.5           |
|                       | 13.8  | 0.51          |                       | 29.8  | 2.8           |                       | 39.8  | 8.6           |
|                       | 15.8  | 0.59          |                       | 31.8  | 3             |                       | 49.8  | 10.8          |
|                       | 17.8  | 0.66          |                       | 34.8  | 3.3           |                       | 59.8  | 13            |
|                       | 19.8  | 0.73          |                       | 37.8  | 3.6           |                       |       |               |
|                       | 21.8  | 0.81          |                       | 39.8  | 3.8           |                       |       |               |
|                       | 23.8  | 0.88          | 4.5                   | 17.8  | 2.1           |                       |       |               |
| 3                     | 9.8   | 0.52          |                       | 19.8  | 2.4           |                       |       |               |
|                       | 11.8  | 0.63          |                       | 21.8  | 2.6           |                       |       |               |
|                       | 13.8  | 0.74          |                       | 23.8  | 2.9           |                       |       |               |
|                       | 15.8  | 0.84          |                       | 25.8  | 3.1           |                       |       |               |
|                       | 17.8  | 0.95          |                       | 29.8  | 3.6           |                       |       |               |
|                       | 19.8  | 1.06          |                       | 31.8  | 3.8           |                       |       |               |
|                       | 21.8  | 1.16          |                       | 34.8  | 4.2           |                       |       |               |
|                       | 23.8  | 1.27          |                       | 37.8  | 4.5           |                       |       |               |
|                       | 25.8  | 1.38          |                       | 39.8  | 4.8           |                       |       |               |
|                       | 27.8  | 1.48          |                       | 44.8  | 5.4           |                       |       |               |
|                       | 29.8  | 1.59          |                       |       |               |                       |       |               |

Remark For the names of the needle rollers, nominal dimensions are used.  
Needle Rollers other than those shown in the dimension table can also be manufactured. Please contact IKO for further information.

MISCELLANEOUS TABLES

# MISCELLANEOUS TABLES

## ● Conversion Table of Units

Comparison table between SI units (system of international units), CGS units and gravitational system of units

| Item<br>System of units | Length | Mass                  | Time | Acceleration     | Force | Stress              | Pressure            |
|-------------------------|--------|-----------------------|------|------------------|-------|---------------------|---------------------|
| SI units                | m      | kg                    | s    | m/s <sup>2</sup> | N     | Pa                  | Pa                  |
| CGS units               | cm     | g                     | s    | Gal              | dyn   | dyn/cm <sup>2</sup> | dyn/cm <sup>2</sup> |
| Grav. units             | m      | kgf·s <sup>2</sup> /m | s    | m/s <sup>2</sup> | kgf   | kgf/m <sup>2</sup>  | kgf/m <sup>2</sup>  |

Conversion rates into SI units

| Item                                          | Unit name                            | Symbol              | Conversion rate into SI             | SI unit name            | Symbol           |
|-----------------------------------------------|--------------------------------------|---------------------|-------------------------------------|-------------------------|------------------|
| Angle                                         | Degree                               | °                   | $\pi / 180$                         | Radian                  | rad              |
|                                               | Minute                               | '                   | $\pi / 10\ 800$                     |                         |                  |
|                                               | Second                               | "                   | $\pi / 648\ 000$                    |                         |                  |
|                                               |                                      |                     |                                     |                         |                  |
| Length                                        | Meter                                | m                   | 1                                   | Meter                   | m                |
|                                               | Micrometer                           | $\mu$               | 10 <sup>-6</sup>                    |                         |                  |
|                                               | Angstrom                             | Å                   | 10 <sup>-10</sup>                   |                         |                  |
|                                               | X-ray unit                           |                     | $\approx 1.002\ 08 \times 10^{-13}$ |                         |                  |
|                                               | Nautical mile                        | n mile              | 1852                                |                         |                  |
| Area                                          | Square meter                         | m <sup>2</sup>      | 1                                   | Square meter            | m <sup>2</sup>   |
|                                               | Are                                  | a                   | 10 <sup>2</sup>                     |                         |                  |
|                                               | Hectare                              | ha                  | 10 <sup>4</sup>                     |                         |                  |
|                                               |                                      |                     |                                     |                         |                  |
| Volume                                        | Cubic meter                          | m <sup>3</sup>      | 1                                   | Cubic meter             | m <sup>3</sup>   |
|                                               | Liter                                | l, L                | 10 <sup>-3</sup>                    |                         |                  |
| Mass                                          | Kilogram                             | kg                  | 1                                   | Kilogram                | kg               |
|                                               | Ton                                  | t                   | 10 <sup>3</sup>                     |                         |                  |
|                                               | Atomic mass unit                     | u                   | $\approx 1.660\ 57 \times 10^{-27}$ |                         |                  |
| Time                                          | Second                               | s                   | 1                                   | Second                  | s                |
|                                               | Minute                               | min                 | 60                                  |                         |                  |
|                                               | Hour                                 | h                   | 3 600                               |                         |                  |
|                                               | Day                                  | d                   | 86 400                              |                         |                  |
| Velocity                                      | Meter per second                     | m/s                 | 1                                   | Meter per second        | m/s              |
|                                               | Knot                                 | kn                  | 1 852/3 600                         |                         |                  |
| Frequency and number of oscillations per time | Cycle                                | s <sup>-1</sup>     | 1                                   | Hertz                   | Hz               |
| Rotational speed                              | Rotation per minute                  | min <sup>-1</sup>   | 1/60                                | Per second              | s <sup>-1</sup>  |
| Angular velocity                              | Radian per second                    | rad/s               | 1                                   | Radian per second       | rad/s            |
| Acceleration                                  | Meter per square second              | m/s <sup>2</sup>    | 1                                   | Meter per square second | m/s <sup>2</sup> |
|                                               | G                                    | G                   | 9.806 65                            |                         |                  |
| Force                                         | Kilogram force                       | kgf                 | 9.806 65                            | Newton                  | N                |
|                                               | Ton force                            | tf                  | 9 806.65                            |                         |                  |
|                                               | Dyne                                 | dyn                 | 10 <sup>-5</sup>                    |                         |                  |
| Moment of force                               | Kilogram force-meter                 | kgf·m               | 9.806 65                            | Newton-meter            | N·m              |
|                                               |                                      |                     |                                     |                         |                  |
| Stress and pressure                           | Kilogram force per square meter      | kgf/m <sup>2</sup>  | 9.806 65                            | Pascal                  | Pa               |
|                                               | Kilogram force per square centimeter | kgf/cm <sup>2</sup> | $9.806\ 65 \times 10^4$             |                         |                  |
|                                               | Kilogram force per square millimeter | kgf/mm <sup>2</sup> | $9.806\ 65 \times 10^6$             |                         |                  |

| Energy | Power   | Temperature | Viscosity            | Kinematic viscosity | Magnetic flux | Magnetic flux density | Magnetic field intensity |
|--------|---------|-------------|----------------------|---------------------|---------------|-----------------------|--------------------------|
| J      | W       | K           | Pa·s                 | m <sup>2</sup> /s   | Wb            | T                     | A/m                      |
| erg    | erg/s   | °C          | P                    | St                  | Mx            | Gs                    | Oe                       |
| kgf·m  | kgf·m/s | °C          | kgf·s/m <sup>2</sup> | m <sup>2</sup> /s   | —             | —                     | —                        |

| Item                          | Unit name                              | Symbol               | Conversion rate into SI             | SI unit name            | Symbol            |
|-------------------------------|----------------------------------------|----------------------|-------------------------------------|-------------------------|-------------------|
| Pressure                      | Hydro-column meter                     | mH <sub>2</sub> O    | 9 806.65                            | Pascal                  | Pa                |
|                               | Mercurial column millimeter            | mmHg                 | 101 325/760                         |                         |                   |
|                               | Torr                                   | Torr                 | 101 325/760                         |                         |                   |
|                               | Atmosphere                             | atm                  | 101 325                             |                         |                   |
|                               | Bar                                    | bar                  | 10 <sup>5</sup>                     |                         |                   |
| Energy                        | Erg                                    | erg                  | 10 <sup>-7</sup>                    | Joule                   | J                 |
|                               | IT calorie                             | cal <sub>IT</sub>    | 4.186 8                             |                         |                   |
|                               | Kilogram force - meter                 | kgf·m                | 9.806 65                            |                         |                   |
|                               | Kilowatt hour                          | kW·h                 | $3.600 \times 10^6$                 |                         |                   |
|                               | Horse power hour (French)              | PS·h                 | $\approx 2.647\ 79 \times 10^6$     |                         |                   |
|                               | Electron volt                          | eV                   | $\approx 1.602\ 19 \times 10^{-19}$ |                         |                   |
| Power                         | Watt                                   | W                    | 1                                   | Watt                    | W                 |
|                               | Horse power (French)                   | PS                   | $\approx 735.5$                     |                         |                   |
|                               | Kilogram force -meter per second       | kgf·m/s              | 9.806 65                            |                         |                   |
| Viscosity                     | Poise                                  | P                    | 10 <sup>-1</sup>                    | Pascal-second           | Pa·s              |
|                               | Centipoise                             | cP                   | 10 <sup>-3</sup>                    |                         |                   |
|                               | Kilogram force-second per square meter | kgf·s/m <sup>2</sup> | 9.806 65                            |                         |                   |
| Kinematic viscosity           | Stokes                                 | St                   | 10 <sup>-4</sup>                    | Square meter per second | m <sup>2</sup> /s |
|                               | Centistokes                            | cSt                  | 10 <sup>-6</sup>                    |                         |                   |
| Temperature                   | Degree                                 | °C                   | +273.15                             | Kelvin                  | K                 |
| Radioactivity                 | Curie                                  | Ci                   | $3.7 \times 10^{10}$                | Becquerel               | Bq                |
|                               | Exposure dose                          | R                    | $2.58 \times 10^{-4}$               |                         |                   |
|                               | Absorbed dose                          | rad                  | 10 <sup>-2</sup>                    |                         |                   |
|                               | Dose equivalent                        | rem                  | 10 <sup>-2</sup>                    |                         |                   |
| Magnetic flux                 | Maxwell                                | Mx                   | 10 <sup>-8</sup>                    | Weber                   | Wb                |
| Magnetic flux density         | Gamma                                  | γ                    | 10 <sup>-9</sup>                    | Tesla                   | T                 |
|                               | Gauss                                  | Gs                   | 10 <sup>-4</sup>                    |                         |                   |
| Magnetic field intensity      | Oersted                                | Oe                   | $10^{3/4} \pi$                      | Ampere per meter        | A/m               |
| Quantity of electricity       | Coulomb                                | C                    | 1                                   | Coulomb                 | C                 |
| Electric potential difference | Volt                                   | V                    | 1                                   | Volt                    | V                 |
| Electrostatic capacity        | Farad                                  | F                    | 1                                   | Farad                   | F                 |
| (Electric) resistance         | Ohm                                    | Ω                    | 1                                   | Ohm                     | Ω                 |
| (Electric) conductance        | Siemens                                | S                    | 1                                   | Siemens                 | S                 |
| Inductance                    | Henry                                  | H                    | 1                                   | Henry                   | H                 |
| Current                       | Ampere                                 | A                    | 1                                   | Ampere                  | A                 |



1 inch = 25.4 mm

| inch     |          | 0"     | 1"     | 2"     | 3"     | 4"      | 5"      | 6"      | 7"      | 8"      |
|----------|----------|--------|--------|--------|--------|---------|---------|---------|---------|---------|
| Fraction | Decimal  |        |        |        |        |         |         |         |         |         |
|          | 0        |        | 25.400 | 50.800 | 76.200 | 101.600 | 127.000 | 152.400 | 177.800 | 203.200 |
| 1 / 64"  | 0.015625 | 0.397  | 25.797 | 51.197 | 76.597 | 101.997 | 127.397 | 152.797 | 178.197 | 203.597 |
| 1 / 32"  | 0.031250 | 0.794  | 26.194 | 51.594 | 76.994 | 102.394 | 127.794 | 153.194 | 178.594 | 203.994 |
| 3 / 64"  | 0.046875 | 1.191  | 26.591 | 51.991 | 77.391 | 102.791 | 128.191 | 153.591 | 178.991 | 204.391 |
| 1 / 16"  | 0.062500 | 1.588  | 26.988 | 52.388 | 77.788 | 103.188 | 128.588 | 153.988 | 179.388 | 204.788 |
| 5 / 64"  | 0.078125 | 1.984  | 27.384 | 52.784 | 78.184 | 103.584 | 128.984 | 154.384 | 179.784 | 205.184 |
| 3 / 32"  | 0.093750 | 2.381  | 27.781 | 53.181 | 78.581 | 103.981 | 129.381 | 154.781 | 180.181 | 205.581 |
| 7 / 64"  | 0.109375 | 2.778  | 28.178 | 53.578 | 78.978 | 104.378 | 129.778 | 155.178 | 180.578 | 205.978 |
| 1 / 8"   | 0.125000 | 3.175  | 28.575 | 53.975 | 79.375 | 104.775 | 130.175 | 155.575 | 180.975 | 206.375 |
| 9 / 64"  | 0.140625 | 3.572  | 28.972 | 54.372 | 79.772 | 105.172 | 130.572 | 155.972 | 181.372 | 206.772 |
| 5 / 32"  | 0.156250 | 3.969  | 29.369 | 54.769 | 80.169 | 105.569 | 130.969 | 156.369 | 181.769 | 207.169 |
| 11 / 64" | 0.171875 | 4.366  | 29.766 | 55.166 | 80.566 | 105.966 | 131.366 | 156.766 | 182.166 | 207.566 |
| 3 / 16"  | 0.187500 | 4.762  | 30.162 | 55.562 | 80.962 | 106.362 | 131.762 | 157.162 | 182.562 | 207.962 |
| 13 / 64" | 0.203125 | 5.159  | 30.559 | 55.959 | 81.359 | 106.759 | 132.159 | 157.559 | 182.959 | 208.359 |
| 7 / 32"  | 0.218750 | 5.556  | 30.956 | 56.356 | 81.756 | 107.156 | 132.556 | 157.956 | 183.356 | 208.756 |
| 15 / 64" | 0.234375 | 5.953  | 31.353 | 56.753 | 82.153 | 107.553 | 132.953 | 158.353 | 183.753 | 209.153 |
| 1 / 4"   | 0.250000 | 6.350  | 31.750 | 57.150 | 82.550 | 107.950 | 133.350 | 158.750 | 184.150 | 209.550 |
| 17 / 64" | 0.265625 | 6.747  | 32.147 | 57.547 | 82.947 | 108.347 | 133.747 | 159.147 | 184.547 | 209.947 |
| 9 / 32"  | 0.281250 | 7.144  | 32.544 | 57.944 | 83.344 | 108.744 | 134.144 | 159.544 | 184.944 | 210.344 |
| 19 / 64" | 0.296875 | 7.541  | 32.941 | 58.341 | 83.741 | 109.141 | 134.541 | 159.941 | 185.341 | 210.741 |
| 5 / 16"  | 0.312500 | 7.938  | 33.338 | 58.738 | 84.138 | 109.538 | 134.938 | 160.338 | 185.738 | 211.138 |
| 21 / 64" | 0.328125 | 8.334  | 33.734 | 59.134 | 84.534 | 109.934 | 135.334 | 160.734 | 186.134 | 211.534 |
| 11 / 32" | 0.343750 | 8.731  | 34.131 | 59.531 | 84.931 | 110.331 | 135.731 | 161.131 | 186.531 | 211.931 |
| 23 / 64" | 0.359375 | 9.128  | 34.528 | 59.928 | 85.328 | 110.728 | 136.128 | 161.528 | 186.928 | 212.328 |
| 3 / 8"   | 0.375000 | 9.525  | 34.925 | 60.325 | 85.725 | 111.125 | 136.525 | 161.925 | 187.325 | 212.725 |
| 25 / 64" | 0.390625 | 9.922  | 35.322 | 60.722 | 86.122 | 111.522 | 136.922 | 162.322 | 187.722 | 213.122 |
| 13 / 32" | 0.406250 | 10.319 | 35.719 | 61.119 | 86.519 | 111.919 | 137.319 | 162.719 | 188.119 | 213.519 |
| 27 / 64" | 0.421875 | 10.716 | 36.116 | 61.516 | 86.916 | 112.316 | 137.716 | 163.116 | 188.516 | 213.916 |
| 7 / 16"  | 0.437500 | 11.112 | 36.512 | 61.912 | 87.312 | 112.712 | 138.112 | 163.512 | 188.912 | 214.312 |
| 29 / 64" | 0.453125 | 11.509 | 36.909 | 62.309 | 87.709 | 113.109 | 138.509 | 163.909 | 189.309 | 214.709 |
| 15 / 32" | 0.468750 | 11.906 | 37.306 | 62.706 | 88.106 | 113.506 | 138.906 | 164.306 | 189.706 | 215.106 |
| 31 / 64" | 0.484375 | 12.303 | 37.703 | 63.103 | 88.503 | 113.903 | 139.303 | 164.703 | 190.103 | 215.503 |
| 1 / 2"   | 0.500000 | 12.700 | 38.100 | 63.500 | 88.900 | 114.300 | 139.700 | 165.100 | 190.500 | 215.900 |

1 inch = 25.4 mm

| inch     |          | 0"     | 1"     | 2"     | 3"      | 4"      | 5"      | 6"      | 7"      | 8"      |
|----------|----------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| Fraction | Decimal  |        |        |        |         |         |         |         |         |         |
| 33 / 64" | 0.515625 | 13.097 | 38.497 | 63.897 | 89.297  | 114.697 | 140.097 | 165.497 | 190.897 | 216.297 |
| 17 / 32" | 0.531250 | 13.494 | 38.894 | 64.294 | 89.694  | 115.094 | 140.494 | 165.894 | 191.294 | 216.694 |
| 35 / 64" | 0.546875 | 13.891 | 39.291 | 64.691 | 90.091  | 115.491 | 140.891 | 166.291 | 191.691 | 217.091 |
| 9 / 16"  | 0.562500 | 14.288 | 39.688 | 65.088 | 90.488  | 115.888 | 141.288 | 166.688 | 192.088 | 217.488 |
| 37 / 64" | 0.578125 | 14.684 | 40.084 | 65.484 | 90.884  | 116.284 | 141.684 | 167.084 | 192.484 | 217.884 |
| 19 / 32" | 0.593750 | 15.081 | 40.481 | 65.881 | 91.281  | 116.681 | 142.081 | 167.481 | 192.881 | 218.281 |
| 39 / 64" | 0.609375 | 15.478 | 40.878 | 66.278 | 91.678  | 117.078 | 142.478 | 167.878 | 193.278 | 218.678 |
| 5 / 8"   | 0.625000 | 15.875 | 41.275 | 66.675 | 92.075  | 117.475 | 142.875 | 168.275 | 193.675 | 219.075 |
| 41 / 64" | 0.640625 | 16.272 | 41.672 | 67.072 | 92.472  | 117.872 | 143.272 | 168.672 | 194.072 | 219.472 |
| 21 / 32" | 0.656250 | 16.669 | 42.069 | 67.469 | 92.869  | 118.269 | 143.669 | 169.069 | 194.469 | 219.869 |
| 43 / 64" | 0.671875 | 17.066 | 42.466 | 67.866 | 93.266  | 118.666 | 144.066 | 169.466 | 194.866 | 220.266 |
| 11 / 16" | 0.687500 | 17.462 | 42.862 | 68.262 | 93.662  | 119.062 | 144.462 | 169.862 | 195.262 | 220.662 |
| 45 / 64" | 0.703125 | 17.859 | 43.259 | 68.659 | 94.059  | 119.459 | 144.859 | 170.259 | 195.659 | 221.059 |
| 23 / 32" | 0.718750 | 18.256 | 43.656 | 69.056 | 94.456  | 119.856 | 145.256 | 170.656 | 196.056 | 221.456 |
| 47 / 64" | 0.734375 | 18.653 | 44.053 | 69.453 | 94.853  | 120.253 | 145.653 | 171.053 | 196.453 | 221.853 |
| 3 / 4"   | 0.750000 | 19.050 | 44.450 | 69.850 | 95.250  | 120.650 | 146.050 | 171.450 | 196.850 | 222.250 |
| 49 / 64" | 0.765625 | 19.447 | 44.847 | 70.247 | 95.647  | 121.047 | 146.447 | 171.847 | 197.247 | 222.647 |
| 25 / 32" | 0.781250 | 19.844 | 45.244 | 70.644 | 96.044  | 121.444 | 146.844 | 172.244 | 197.644 | 223.044 |
| 51 / 64" | 0.796875 | 20.241 | 45.641 | 71.041 | 96.441  | 121.841 | 147.241 | 172.641 | 198.041 | 223.441 |
| 13 / 16" | 0.812500 | 20.638 | 46.038 | 71.438 | 96.838  | 122.238 | 147.638 | 173.038 | 198.438 | 223.838 |
| 53 / 64" | 0.828125 | 21.034 | 46.434 | 71.834 | 97.234  | 122.634 | 148.034 | 173.434 | 198.834 | 224.234 |
| 27 / 32" | 0.843750 | 21.431 | 46.831 | 72.231 | 97.631  | 123.031 | 148.431 | 173.831 | 199.231 | 224.631 |
| 55 / 64" | 0.859375 | 21.828 | 47.228 | 72.628 | 98.028  | 123.428 | 148.828 | 174.228 | 199.628 | 225.028 |
| 7 / 8"   | 0.875000 | 22.225 | 47.625 | 73.025 | 98.425  | 123.825 | 149.225 | 174.625 | 200.025 | 225.425 |
| 57 / 64" | 0.890625 | 22.622 | 48.022 | 73.422 | 98.822  | 124.222 | 149.622 | 175.022 | 200.422 | 225.822 |
| 29 / 32" | 0.906250 | 23.019 | 48.419 | 73.819 | 99.219  | 124.619 | 150.019 | 175.419 | 200.819 | 226.219 |
| 59 / 64" | 0.921875 | 23.416 | 48.816 | 74.216 | 99.616  | 125.016 | 150.416 | 175.816 | 201.216 | 226.616 |
| 15 / 16" | 0.937500 | 23.812 | 49.212 | 74.612 | 100.012 | 125.412 | 150.812 | 176.212 | 201.612 | 227.012 |
| 61 / 64" | 0.953125 | 24.209 | 49.609 | 75.009 | 100.409 | 125.809 | 151.209 | 176.609 | 202.009 | 227.409 |
| 31 / 32" | 0.968750 | 24.606 | 50.006 | 75.406 | 100.806 | 126.206 | 151.606 | 177.006 | 202.406 | 227.806 |
| 63 / 64" | 0.984375 | 25.003 | 50.403 | 75.803 | 101.203 | 126.603 | 152.003 | 177.403 | 202.803 | 228.203 |



● Hardness Conversion Table (Reference)

| Rockwell C<br>scale hardness<br>Load 1471N | Vickers' hardness | Brinell hardness |                          | Rockwell hardness                               |                                      | Shore hardness |
|--------------------------------------------|-------------------|------------------|--------------------------|-------------------------------------------------|--------------------------------------|----------------|
|                                            |                   | Standard ball    | Tungsten<br>carbide ball | A scale<br>Load 588.4N<br>Diamond circular cone | B scale<br>Load 980.7N<br>1/16" ball |                |
| HRC                                        | HV                |                  |                          |                                                 |                                      | HS             |
| 68                                         | 940               | —                | —                        | 85.6                                            | —                                    | 97             |
| 67                                         | 900               | —                | —                        | 85.0                                            | —                                    | 95             |
| 66                                         | 865               | —                | —                        | 84.5                                            | —                                    | 92             |
| 65                                         | 832               | —                | (739)                    | 83.9                                            | —                                    | 91             |
| 64                                         | 800               | —                | (722)                    | 83.4                                            | —                                    | 88             |
| 63                                         | 772               | —                | (705)                    | 82.8                                            | —                                    | 87             |
| 62                                         | 746               | —                | (688)                    | 82.3                                            | —                                    | 85             |
| 61                                         | 720               | —                | (670)                    | 81.8                                            | —                                    | 83             |
| 60                                         | 697               | —                | (654)                    | 81.2                                            | —                                    | 81             |
| 59                                         | 674               | —                | (634)                    | 80.7                                            | —                                    | 80             |
| 58                                         | 653               | —                | 615                      | 80.1                                            | —                                    | 78             |
| 57                                         | 633               | —                | 595                      | 79.6                                            | —                                    | 76             |
| 56                                         | 613               | —                | 577                      | 79.0                                            | —                                    | 75             |
| 55                                         | 595               | —                | 560                      | 78.5                                            | —                                    | 74             |
| 54                                         | 577               | —                | 543                      | 78.0                                            | —                                    | 72             |
| 53                                         | 560               | —                | 525                      | 77.4                                            | —                                    | 71             |
| 52                                         | 544               | (500)            | 512                      | 76.8                                            | —                                    | 69             |
| 51                                         | 528               | (487)            | 496                      | 76.3                                            | —                                    | 68             |
| 50                                         | 513               | (475)            | 481                      | 75.9                                            | —                                    | 67             |
| 49                                         | 498               | (464)            | 469                      | 75.2                                            | —                                    | 66             |
| 48                                         | 484               | 451              | 455                      | 74.7                                            | —                                    | 64             |
| 47                                         | 471               | 442              | 443                      | 74.1                                            | —                                    | 63             |
| 46                                         | 458               | 432              | 432                      | 73.6                                            | —                                    | 62             |
| 45                                         | 446               | 421              | 421                      | 73.1                                            | —                                    | 60             |
| 44                                         | 434               | 409              | 409                      | 72.5                                            | —                                    | 58             |
| 43                                         | 423               | 400              | 400                      | 72.0                                            | —                                    | 57             |
| 42                                         | 412               | 390              | 390                      | 71.5                                            | —                                    | 56             |
| 41                                         | 402               | 381              | 381                      | 70.9                                            | —                                    | 55             |
| 40                                         | 392               | 371              | 371                      | 70.4                                            | —                                    | 54             |
| 39                                         | 382               | 362              | 362                      | 69.9                                            | —                                    | 52             |

| Rockwell C<br>scale hardness<br>Load 1471N | Vickers' hardness | Brinell hardness |                          | Rockwell hardness                               |                                      | Shore hardness |
|--------------------------------------------|-------------------|------------------|--------------------------|-------------------------------------------------|--------------------------------------|----------------|
|                                            |                   | Standard ball    | Tungsten<br>carbide ball | A scale<br>Load 588.4N<br>Diamond circular cone | B scale<br>Load 980.7N<br>1/16" ball |                |
| HRC                                        | HV                |                  |                          |                                                 |                                      | HS             |
| 38                                         | 372               | 353              | 353                      | 69.4                                            | —                                    | 51             |
| 37                                         | 363               | 344              | 344                      | 68.9                                            | —                                    | 50             |
| 36                                         | 354               | 336              | 336                      | 68.4                                            | (109.0)                              | 49             |
| 35                                         | 345               | 327              | 327                      | 67.9                                            | (108.5)                              | 48             |
| 34                                         | 336               | 319              | 319                      | 67.4                                            | (108.0)                              | 47             |
| 33                                         | 327               | 311              | 311                      | 66.8                                            | (107.5)                              | 46             |
| 32                                         | 318               | 301              | 301                      | 66.3                                            | (107.0)                              | 44             |
| 31                                         | 310               | 294              | 294                      | 65.8                                            | (106.0)                              | 43             |
| 30                                         | 302               | 286              | 286                      | 65.3                                            | (105.5)                              | 42             |
| 29                                         | 294               | 279              | 279                      | 64.7                                            | (104.5)                              | 41             |
| 28                                         | 286               | 271              | 271                      | 64.3                                            | (104.0)                              | 41             |
| 27                                         | 279               | 264              | 264                      | 63.8                                            | (103.0)                              | 40             |
| 26                                         | 272               | 258              | 258                      | 63.3                                            | (102.5)                              | 38             |
| 25                                         | 266               | 253              | 253                      | 62.8                                            | (101.5)                              | 38             |
| 24                                         | 260               | 247              | 247                      | 62.4                                            | (101.0)                              | 37             |
| 23                                         | 254               | 243              | 243                      | 62.0                                            | 100.0                                | 36             |
| 22                                         | 248               | 237              | 237                      | 61.5                                            | 99.0                                 | 35             |
| 21                                         | 243               | 231              | 231                      | 61.0                                            | 98.5                                 | 35             |
| 20                                         | 238               | 226              | 226                      | 60.5                                            | 97.8                                 | 34             |
| (18)                                       | 230               | 219              | 219                      | —                                               | 96.7                                 | 33             |
| (16)                                       | 222               | 212              | 212                      | —                                               | 95.5                                 | 32             |
| (14)                                       | 213               | 203              | 203                      | —                                               | 93.9                                 | 31             |
| (12)                                       | 204               | 194              | 194                      | —                                               | 92.3                                 | 29             |
| (10)                                       | 196               | 187              | 187                      | —                                               | 90.7                                 | 28             |
| (8)                                        | 188               | 179              | 179                      | —                                               | 89.5                                 | 27             |
| (6)                                        | 180               | 171              | 171                      | —                                               | 87.1                                 | 26             |
| (4)                                        | 173               | 165              | 165                      | —                                               | 85.5                                 | 25             |
| (2)                                        | 166               | 158              | 158                      | —                                               | 83.5                                 | 24             |
| (0)                                        | 160               | 152              | 152                      | —                                               | 81.7                                 | 24             |



Tolerance of Shaft Diameter

| Nominal Diameter<br>mm |       | b12  |       | c12  |       | d6   |      | e6   |      | e12  |      | f5   |     | f6   |      | g5   |     |
|------------------------|-------|------|-------|------|-------|------|------|------|------|------|------|------|-----|------|------|------|-----|
| Over                   | Incl. | High | Low   | High | Low   | High | Low  | High | Low  | High | Low  | High | Low | High | Low  | High | Low |
| —                      | 3     | −140 | − 240 | − 60 | − 160 | − 20 | − 26 | − 14 | − 20 | − 14 | −114 | − 6  | −10 | − 6  | − 12 | − 2  | − 6 |
| 3                      | 6     | −140 | − 260 | − 70 | − 190 | − 30 | − 38 | − 20 | − 28 | − 20 | −140 | −10  | −15 | −10  | − 18 | − 4  | − 9 |
| 6                      | 10    | −150 | − 300 | − 80 | − 230 | − 40 | − 49 | − 25 | − 34 | − 25 | −175 | −13  | −19 | −13  | − 22 | − 5  | −11 |
| 10                     | 18    | −150 | − 330 | − 95 | − 275 | − 50 | − 61 | − 32 | − 43 | − 32 | −212 | −16  | −24 | −16  | − 27 | − 6  | −14 |
| 18                     | 30    | −160 | − 370 | −110 | − 320 | − 65 | − 78 | − 40 | − 53 | − 40 | −250 | −20  | −29 | −20  | − 33 | − 7  | −16 |
| 30                     | 40    | −170 | − 420 | −120 | − 370 | − 80 | − 96 | − 50 | − 66 | − 50 | −300 | −25  | −36 | −25  | − 41 | − 9  | −20 |
| 40                     | 50    | −180 | − 430 | −130 | − 380 |      |      |      |      |      |      |      |     |      |      |      |     |
| 50                     | 65    | −190 | − 490 | −140 | − 440 | −100 | −119 | − 60 | − 79 | − 60 | −360 | −30  | −43 | −30  | − 49 | −10  | −23 |
| 65                     | 80    | −200 | − 500 | −150 | − 450 |      |      |      |      |      |      |      |     |      |      |      |     |
| 80                     | 100   | −220 | − 570 | −170 | − 520 | −120 | −142 | − 72 | − 94 | − 72 | −422 | −36  | −51 | −36  | − 58 | −12  | −27 |
| 100                    | 120   | −240 | − 590 | −180 | − 530 |      |      |      |      |      |      |      |     |      |      |      |     |
| 120                    | 140   | −260 | − 660 | −200 | − 600 |      |      |      |      |      |      |      |     |      |      |      |     |
| 140                    | 160   | −280 | − 680 | −210 | − 610 | −145 | −170 | − 85 | −110 | − 85 | −485 | −43  | −61 | −43  | − 68 | −14  | −32 |
| 160                    | 180   | −310 | − 710 | −230 | − 630 |      |      |      |      |      |      |      |     |      |      |      |     |
| 180                    | 200   | −340 | − 800 | −240 | − 700 |      |      |      |      |      |      |      |     |      |      |      |     |
| 200                    | 225   | −380 | − 840 | −260 | − 720 | −170 | −199 | −100 | −129 | −100 | −560 | −50  | −70 | −50  | − 79 | −15  | −35 |
| 225                    | 250   | −420 | − 880 | −280 | − 740 |      |      |      |      |      |      |      |     |      |      |      |     |
| 250                    | 280   | −480 | −1000 | −300 | − 820 | −190 | −222 | −110 | −142 | −110 | −630 | −56  | −79 | −56  | − 88 | −17  | −40 |
| 280                    | 315   | −540 | −1060 | −330 | − 850 |      |      |      |      |      |      |      |     |      |      |      |     |
| 315                    | 355   | −600 | −1170 | −360 | − 930 | −210 | −246 | −125 | −161 | −125 | −695 | −62  | −87 | −62  | − 98 | −18  | −43 |
| 355                    | 400   | −680 | −1250 | −400 | − 970 |      |      |      |      |      |      |      |     |      |      |      |     |
| 400                    | 450   | −760 | −1390 | −440 | −1070 | −230 | −270 | −135 | −175 | −135 | −765 | −68  | −95 | −68  | −108 | −20  | −47 |
| 450                    | 500   | −840 | −1470 | −480 | −1110 |      |      |      |      |      |      |      |     |      |      |      |     |

| Nominal Diameter<br>mm |       | h12  |      | h13  |      | js5   |       | j5   |     | js6   |       | j6   |     | j7   |     | k5   |     |
|------------------------|-------|------|------|------|------|-------|-------|------|-----|-------|-------|------|-----|------|-----|------|-----|
| Over                   | Incl. | High | Low  | High | Low  | High  | Low   | High | Low | High  | Low   | High | Low | High | Low | High | Low |
| —                      | 3     | 0    | −100 | 0    | −140 | + 2   | − 2   | +2   | − 2 | + 3   | − 3   | + 4  | − 2 | + 6  | − 4 | + 4  | 0   |
| 3                      | 6     | 0    | −120 | 0    | −180 | + 2.5 | − 2.5 | +3   | − 2 | + 4   | − 4   | + 6  | − 2 | + 8  | − 4 | + 6  | +1  |
| 6                      | 10    | 0    | −150 | 0    | −220 | + 3   | − 3   | +4   | − 2 | + 4.5 | − 4.5 | + 7  | − 2 | +10  | − 5 | + 7  | +1  |
| 10                     | 18    | 0    | −180 | 0    | −270 | + 4   | − 4   | +5   | − 3 | + 5.5 | − 5.5 | + 8  | − 3 | +12  | − 6 | + 9  | +1  |
| 18                     | 30    | 0    | −210 | 0    | −330 | + 4.5 | − 4.5 | +5   | − 4 | + 6.5 | − 6.5 | + 9  | − 4 | +13  | − 8 | +11  | +2  |
| 30                     | 40    | 0    | −250 | 0    | −390 | + 5.5 | − 5.5 | +6   | − 5 | + 8   | − 8   | +11  | − 5 | +15  | −10 | +13  | +2  |
| 40                     | 50    |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 50                     | 65    | 0    | −300 | 0    | −460 | + 6.5 | − 6.5 | +6   | − 7 | + 9.5 | − 9.5 | +12  | − 7 | +18  | −12 | +15  | +2  |
| 65                     | 80    |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 80                     | 100   | 0    | −350 | 0    | −540 | + 7.5 | − 7.5 | +6   | − 9 | +11   | −11   | +13  | − 9 | +20  | −15 | +18  | +3  |
| 100                    | 120   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 120                    | 140   | 0    | −400 | 0    | −630 | + 9   | − 9   | +7   | −11 | +12.5 | −12.5 | +14  | −11 | +22  | −18 | +21  | +3  |
| 140                    | 160   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 160                    | 180   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 180                    | 200   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 200                    | 225   | 0    | −460 | 0    | −720 | +10   | −10   | +7   | −13 | +14.5 | −14.5 | +16  | −13 | +25  | −21 | +24  | +4  |
| 225                    | 250   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 250                    | 280   | 0    | −520 | 0    | −810 | +11.5 | −11.5 | +7   | −16 | +16   | −16   | +16  | −16 | +26  | −26 | +27  | +4  |
| 280                    | 315   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 315                    | 355   | 0    | −570 | 0    | −890 | +12.5 | −12.5 | +7   | −18 | +18   | −18   | +18  | −18 | +29  | −28 | +29  | +4  |
| 355                    | 400   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |
| 400                    | 450   | 0    | −630 | 0    | −970 | +13.5 | −13.5 | +7   | −20 | +20   | −20   | +20  | −20 | +31  | −32 | +32  | +5  |
| 450                    | 500   |      |      |      |      |       |       |      |     |       |       |      |     |      |     |      |     |

unit : μm

| g6   |     | h5   |     | h6   |     | h7   |     | h8   |     | h9   |      | h10  |      | h11  |      | Nominal Diameter<br>mm |       |
|------|-----|------|-----|------|-----|------|-----|------|-----|------|------|------|------|------|------|------------------------|-------|
| High | Low | High | Low | High | Low | High | Low | High | Low | High | Low  | High | Low  | High | Low  | Over                   | Incl. |
| − 2  | − 8 | 0    | − 4 | 0    | − 6 | 0    | −10 | 0    | −14 | 0    | − 25 | 0    | − 40 | 0    | − 60 | —                      | 3     |
| − 4  | −12 | 0    | − 5 | 0    | − 8 | 0    | −12 | 0    | −18 | 0    | − 30 | 0    | − 48 | 0    | − 75 | 3                      | 6     |
| − 5  | −14 | 0    | − 6 | 0    | − 9 | 0    | −15 | 0    | −22 | 0    | − 36 | 0    | − 58 | 0    | − 90 | 6                      | 10    |
| − 6  | −17 | 0    | − 8 | 0    | −11 | 0    | −18 | 0    | −27 | 0    | − 43 | 0    | − 70 | 0    | −110 | 10                     | 18    |
| − 7  | −20 | 0    | − 9 | 0    | −13 | 0    | −21 | 0    | −33 | 0    | − 52 | 0    | − 84 | 0    | −130 | 18                     | 30    |
| − 9  | −25 | 0    | −11 | 0    | −16 | 0    | −25 | 0    | −39 | 0    | − 62 | 0    | −100 | 0    | −160 | 30                     | 40    |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 40                     | 50    |
| −10  | −29 | 0    | −13 | 0    | −19 | 0    | −30 | 0    | −46 | 0    | − 74 | 0    | −120 | 0    | −190 | 50                     | 65    |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 65                     | 80    |
| −12  | −34 | 0    | −15 | 0    | −22 | 0    | −35 | 0    | −54 | 0    | − 87 | 0    | −140 | 0    | −220 | 80                     | 100   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 100                    | 120   |
| −14  | −39 | 0    | −18 | 0    | −25 | 0    | −40 | 0    | −63 | 0    | −100 | 0    | −160 | 0    | −250 | 120                    | 140   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 140                    | 160   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 160                    | 180   |
| −15  | −44 | 0    | −20 | 0    | −29 | 0    | −46 | 0    | −72 | 0    | −115 | 0    | −185 | 0    | −290 | 180                    | 200   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 200                    | 225   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 225                    | 250   |
| −17  | −49 | 0    | −23 | 0    | −32 | 0    | −52 | 0    | −81 | 0    | −130 | 0    | −210 | 0    | −320 | 250                    | 280   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 280                    | 315   |
| −18  | −54 | 0    | −25 | 0    | −36 | 0    | −57 | 0    | −89 | 0    | −140 | 0    | −230 | 0    | −360 | 315                    | 355   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 355                    | 400   |
| −20  | −60 | 0    | −27 | 0    | −40 | 0    | −63 | 0    | −97 | 0    | −155 | 0    | −250 | 0    | −400 | 400                    | 450   |
|      |     |      |     |      |     |      |     |      |     |      |      |      |      |      |      | 450                    | 500   |

unit : μm

| k6   |     | m5   |     | m6   |     | n5   |     | n6   |     | p6   |     | Nominal Diameter<br>mm |       |
|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------------------------|-------|
| High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | Over                   | Incl. |
| + 6  | 0   | + 6  | + 2 | + 8  | + 2 | + 8  | + 4 | +10  | + 4 | +12  | + 6 | —                      | 3     |
| + 9  | +1  | + 9  | + 4 | +12  | + 4 | +13  | + 8 | +16  | + 8 | + 20 | +12 | 3                      | 6     |
| +10  | +1  | +12  | + 6 | +15  | + 6 | +16  | +10 | +19  | +10 | + 24 | +15 | 6                      | 10    |
| +12  | +1  | +15  | + 7 | +18  | + 7 | +20  | +12 | +23  | +12 | + 29 | +18 | 10                     | 18    |
| +15  | +2  | +17  | + 8 | +21  | + 8 | +24  | +15 | +28  | +15 | + 35 | +22 | 18                     | 30    |
| +18  | +2  | +20  | + 9 | +25  | + 9 | +28  | +17 | +33  | +17 | + 42 | +26 | 30                     | 40    |
|      |     |      |     |      |     |      |     |      |     |      |     | 40                     | 50    |
| +21  | +2  | +24  | +11 | +30  | +11 | +33  | +20 | +39  | +20 | + 51 | +32 | 50                     | 65    |
|      |     |      |     |      |     |      |     |      |     |      |     | 65                     | 80    |
| +25  | +3  | +28  | +13 | +35  | +13 | +38  | +23 | +45  | +23 | + 59 | +37 | 80                     | 100   |
|      |     |      |     |      |     |      |     |      |     |      |     | 100                    | 120   |
| +28  | +3  | +33  | +15 | +40  | +15 | +45  | +27 | +52  | +27 | + 68 | +43 | 120                    | 140   |
|      |     |      |     |      |     |      |     |      |     |      |     | 140                    | 160   |
|      |     |      |     |      |     |      |     |      |     |      |     | 160                    | 180   |
| +33  | +4  | +37  | +17 | +46  | +17 | +51  | +31 | +60  | +31 | + 79 | +50 | 180                    | 200   |
|      |     |      |     |      |     |      |     |      |     |      |     | 200                    | 225   |
|      |     |      |     |      |     |      |     |      |     |      |     | 225                    | 250   |
| +36  | +4  | +43  | +20 | +52  | +20 | +57  | +34 | +66  | +34 | + 88 | +56 | 250                    | 280   |
|      |     |      |     |      |     |      |     |      |     |      |     | 280                    | 315   |
| +40  | +4  | +46  | +21 | +57  | +21 | +62  | +37 | +73  | +37 | + 98 | +62 | 315                    | 355   |
|      |     |      |     |      |     |      |     |      |     |      |     | 355                    | 400   |
| +45  | +5  | +50  | +23 | +63  | +23 | +67  | +40 | +80  | +40 | +108 | +68 | 400                    | 450   |
|      |     |      |     |      |     |      |     |      |     |      |     | 450                    | 500   |

● Tolerance of Housing Bore Diameter

| Nominal Diameter<br>mm |       | B12   |      | E7   |      | E11  |      | E12  |      | F6   |     | F7   |     | G6   |     | G7   |     |
|------------------------|-------|-------|------|------|------|------|------|------|------|------|-----|------|-----|------|-----|------|-----|
| Over                   | Incl. | High  | Low  | High | Low  | High | Low  | High | Low  | High | Low | High | Low | High | Low | High | Low |
| —                      | 3     | + 240 | +140 | + 24 | + 14 | + 74 | + 14 | +114 | + 14 | + 12 | + 6 | + 16 | + 6 | + 8  | + 2 | +12  | + 2 |
| 3                      | 6     | + 260 | +140 | + 32 | + 20 | + 95 | + 20 | +140 | + 20 | + 18 | +10 | + 22 | +10 | +12  | + 4 | +16  | + 4 |
| 6                      | 10    | + 300 | +150 | + 40 | + 25 | +115 | + 25 | +175 | + 25 | + 22 | +13 | + 28 | +13 | +14  | + 5 | +20  | + 5 |
| 10                     | 18    | + 330 | +150 | + 50 | + 32 | +142 | + 32 | +212 | + 32 | + 27 | +16 | + 34 | +16 | +17  | + 6 | +24  | + 6 |
| 18                     | 30    | + 370 | +160 | + 61 | + 40 | +170 | + 40 | +250 | + 40 | + 33 | +20 | + 41 | +20 | +20  | + 7 | +28  | + 7 |
| 30                     | 40    | + 420 | +170 | + 75 | + 50 | +210 | + 50 | +300 | + 50 | + 41 | +25 | + 50 | +25 | +25  | + 9 | +34  | + 9 |
| 40                     | 50    | + 430 | +180 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 50                     | 65    | + 490 | +190 | + 90 | + 60 | +250 | + 60 | +360 | + 60 | + 49 | +30 | + 60 | +30 | +29  | +10 | +40  | +10 |
| 65                     | 80    | + 500 | +200 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 80                     | 100   | + 570 | +220 | +107 | + 72 | +292 | + 72 | +422 | + 72 | + 58 | +36 | + 71 | +36 | +34  | +12 | +47  | +12 |
| 100                    | 120   | + 590 | +240 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 120                    | 140   | + 660 | +260 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 140                    | 160   | + 680 | +280 | +125 | + 85 | +335 | + 85 | +485 | + 85 | + 68 | +43 | + 83 | +43 | +39  | +14 | +54  | +14 |
| 160                    | 180   | + 710 | +310 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 180                    | 200   | + 800 | +340 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 200                    | 225   | + 840 | +380 | +146 | +100 | +390 | +100 | +560 | +100 | + 79 | +50 | + 96 | +50 | +44  | +15 | +61  | +15 |
| 225                    | 250   | + 880 | +420 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 250                    | 280   | +1000 | +480 | +162 | +110 | +430 | +110 | +630 | +110 | + 88 | +56 | +108 | +56 | +49  | +17 | +69  | +17 |
| 280                    | 315   | +1060 | +540 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 315                    | 355   | +1170 | +600 | +182 | +125 | +485 | +125 | +695 | +125 | + 98 | +62 | +119 | +62 | +54  | +18 | +75  | +18 |
| 355                    | 400   | +1250 | +680 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |
| 400                    | 450   | +1390 | +760 | +198 | +135 | +535 | +135 | +765 | +135 | +108 | +68 | +131 | +68 | +60  | +20 | +83  | +20 |
| 450                    | 500   | +1470 | +840 |      |      |      |      |      |      |      |     |      |     |      |     |      |     |

| Nominal Diameter<br>mm |       | JS7  |     | J7   |     | K5   |     | K6   |     | K7   |     | M6   |     | M7   |     | N6   |     |
|------------------------|-------|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|
| Over                   | Incl. | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low |
| —                      | 3     | + 5  | − 5 | + 4  | − 6 | 0    | − 4 | 0    | − 6 | 0    | −10 | − 2  | − 8 | −2   | −12 | − 4  | −10 |
| 3                      | 6     | + 6  | − 6 | + 6  | − 6 | 0    | − 5 | +2   | − 6 | + 3  | − 9 | − 1  | − 9 | 0    | −12 | − 5  | −13 |
| 6                      | 10    | + 7  | − 7 | + 8  | − 7 | +1   | − 5 | +2   | − 7 | + 5  | −10 | − 3  | −12 | 0    | −15 | − 7  | −16 |
| 10                     | 18    | + 9  | − 9 | +10  | − 8 | +2   | − 6 | +2   | − 9 | + 6  | −12 | − 4  | −15 | 0    | −18 | − 9  | −20 |
| 18                     | 30    | +10  | −10 | +12  | − 9 | +1   | − 8 | +2   | −11 | + 6  | −15 | − 4  | −17 | 0    | −21 | −11  | −24 |
| 30                     | 40    | +12  | −12 | +14  | −11 | +2   | − 9 | +3   | −13 | + 7  | −18 | − 4  | −20 | 0    | −25 | −12  | −28 |
| 40                     | 50    |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 50                     | 65    | +15  | −15 | +18  | −12 | +3   | −10 | +4   | −15 | + 9  | −21 | − 5  | −24 | 0    | −30 | −14  | −33 |
| 65                     | 80    |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 80                     | 100   | +17  | −17 | +22  | −13 | +2   | −13 | +4   | −18 | +10  | −25 | − 6  | −28 | 0    | −35 | −16  | −38 |
| 100                    | 120   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 120                    | 140   | +20  | −20 | +26  | −14 | +3   | −15 | +4   | −21 | +12  | −28 | − 8  | −33 | 0    | −40 | −20  | −45 |
| 140                    | 160   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 160                    | 180   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 180                    | 200   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 200                    | 225   | +23  | −23 | +30  | −16 | +2   | −18 | +5   | −24 | +13  | −33 | − 8  | −37 | 0    | −46 | −22  | −51 |
| 225                    | 250   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 250                    | 280   | +26  | −26 | +36  | −16 | +3   | −20 | +5   | −27 | +16  | −36 | − 9  | −41 | 0    | −52 | −25  | −57 |
| 280                    | 315   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 315                    | 355   | +28  | −28 | +39  | −18 | +3   | −22 | +7   | −29 | +17  | −40 | −10  | −46 | 0    | −57 | −26  | −62 |
| 355                    | 400   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |
| 400                    | 450   | +31  | −31 | +43  | −20 | +2   | −25 | +8   | −32 | +18  | −45 | −10  | −50 | 0    | −63 | −27  | −67 |
| 450                    | 500   |      |     |      |     |      |     |      |     |      |     |      |     |      |     |      |     |

unit : μm

| H6   |     | H7   |     | H8   |     | H9   |     | H10  |     | H11  |     | JS6   |       | J6   |     | Nominal Diameter<br>mm |       |
|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|-------|-------|------|-----|------------------------|-------|
| High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High  | Low   | High | Low | Over                   | Incl. |
| + 6  | 0   | +10  | 0   | +14  | 0   | + 25 | 0   | + 40 | 0   | + 60 | 0   | + 3   | − 3   | + 2  | −4  | —                      | 3     |
| + 8  | 0   | +12  | 0   | +18  | 0   | + 30 | 0   | + 48 | 0   | + 75 | 0   | + 4   | − 4   | + 5  | −3  | 3                      | 6     |
| + 9  | 0   | +15  | 0   | +22  | 0   | + 36 | 0   | + 58 | 0   | + 90 | 0   | + 4.5 | − 4.5 | + 5  | −4  | 6                      | 10    |
| +11  | 0   | +18  | 0   | +27  | 0   | + 43 | 0   | + 70 | 0   | +110 | 0   | + 5.5 | − 5.5 | + 6  | −5  | 10                     | 18    |
| +13  | 0   | +21  | 0   | +33  | 0   | + 52 | 0   | + 84 | 0   | +130 | 0   | + 6.5 | − 6.5 | + 8  | −5  | 18                     | 30    |
| +16  | 0   | +25  | 0   | +39  | 0   | + 62 | 0   | +100 | 0   | +160 | 0   | + 8   | − 8   | +10  | −6  | 30                     | 40    |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 40                     | 50    |
| +19  | 0   | +30  | 0   | +46  | 0   | + 74 | 0   | +120 | 0   | +190 | 0   | + 9.5 | − 9.5 | +13  | −6  | 50                     | 65    |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 65                     | 80    |
| +22  | 0   | +35  | 0   | +54  | 0   | + 87 | 0   | +140 | 0   | +220 | 0   | +11   | −11   | +16  | −6  | 80                     | 100   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 100                    | 120   |
| +25  | 0   | +40  | 0   | +63  | 0   | +100 | 0   | +160 | 0   | +250 | 0   | +12.5 | −12.5 | +18  | −7  | 120                    | 140   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 140                    | 160   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 160                    | 180   |
| +29  | 0   | +46  | 0   | +72  | 0   | +115 | 0   | +185 | 0   | +290 | 0   | +14.5 | −14.5 | +22  | −7  | 180                    | 200   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 200                    | 225   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 225                    | 250   |
| +32  | 0   | +52  | 0   | +81  | 0   | +130 | 0   | +210 | 0   | +320 | 0   | +16   | −16   | +25  | −7  | 250                    | 280   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 280                    | 315   |
| +36  | 0   | +57  | 0   | +89  | 0   | +140 | 0   | +230 | 0   | +360 | 0   | +18   | −18   | +29  | −7  | 315                    | 355   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 355                    | 400   |
| +40  | 0   | +63  | 0   | +97  | 0   | +155 | 0   | +250 | 0   | +400 | 0   | +20   | −20   | +33  | −7  | 400                    | 450   |
|      |     |      |     |      |     |      |     |      |     |      |     |       |       |      |     | 450                    | 500   |

unit : μm

| N7   |     | P6   |     | P7   |      | R7   |      | S7   |      | Nominal Diameter<br>mm |       |
|------|-----|------|-----|------|------|------|------|------|------|------------------------|-------|
| High | Low | High | Low | High | Low  | High | Low  | High | Low  | Over                   | Incl. |
| − 4  | −14 | − 6  | −12 | − 6  | − 16 | −10  | − 20 | − 14 | − 24 | —                      | 3     |
| − 4  | −16 | − 9  | −17 | − 8  | − 20 | −11  | − 23 | − 15 | − 27 | 3                      | 6     |
| − 4  | −19 | −12  | −21 | − 9  | − 24 | −13  | − 28 | − 17 | − 32 | 6                      | 10    |
| − 5  | −23 | −15  | −26 | −11  | − 29 | −16  | − 34 | − 21 | − 39 | 10                     | 18    |
| − 7  | −28 | −18  | −31 | −14  | − 35 | −20  | − 41 | − 27 | − 48 | 18                     | 30    |
| − 8  | −33 | −21  | −37 | −17  | − 42 | −25  | − 50 | − 34 | − 59 | 30                     | 40    |
|      |     |      |     |      |      |      |      |      |      | 40                     | 50    |
| − 9  | −39 | −26  | −45 | −21  | − 51 | −30  | − 60 | − 42 | − 72 | 50                     | 65    |
|      |     |      |     |      |      |      |      |      |      | 65                     | 80    |
| −10  | −45 | −30  | −52 | −24  | − 59 | −38  | − 73 | − 58 | − 93 | 80                     | 100   |
|      |     |      |     |      |      |      |      |      |      | 100                    | 120   |
| −12  | −52 | −36  | −61 | −28  | − 68 | −48  | − 88 | − 77 | −117 | 120                    | 140   |
|      |     |      |     |      |      |      |      |      |      | 140                    | 160   |
|      |     |      |     |      |      |      |      |      |      | 160                    | 180   |
| −14  | −60 | −41  | −70 | −33  | − 79 | −60  | −106 | −105 | −151 | 180                    | 200   |
|      |     |      |     |      |      |      |      |      |      | 200                    | 225   |
|      |     |      |     |      |      |      |      |      |      | 225                    | 250   |
| −14  | −66 | −47  | −79 | −36  | − 88 | −74  | −126 | −138 | −190 | 250                    | 280   |
|      |     |      |     |      |      |      |      |      |      | 280                    | 315   |
| −16  | −73 | −51  | −87 | −41  | − 98 | −87  | −144 | −169 | −226 | 315                    | 355   |
|      |     |      |     |      |      |      |      |      |      | 355                    | 400   |
| −17  | −80 | −55  | −95 | −45  | −108 | −103 | −166 | −209 | −272 | 400                    | 450   |
|      |     |      |     |      |      |      |      |      |      | 450                    | 500   |



● N-lbf Conversion Table

| 1N = 0.224809 lbf 1lbf = 4.44822 N |    |       |        |    |        |        |    |        |
|------------------------------------|----|-------|--------|----|--------|--------|----|--------|
| N                                  |    | lbf   | N      |    | lbf    | N      |    | lbf    |
| 4.448                              | 1  | 0.225 | 151.24 | 34 | 7.643  | 298.03 | 67 | 15.062 |
| 8.896                              | 2  | 0.450 | 155.69 | 35 | 7.868  | 302.48 | 68 | 15.287 |
| 13.345                             | 3  | 0.674 | 160.14 | 36 | 8.093  | 306.93 | 69 | 15.512 |
| 17.793                             | 4  | 0.899 | 164.58 | 37 | 8.318  | 311.38 | 70 | 15.737 |
| 22.241                             | 5  | 1.124 | 169.03 | 38 | 8.543  | 315.82 | 71 | 15.961 |
|                                    |    |       |        |    |        |        |    |        |
| 26.689                             | 6  | 1.349 | 173.48 | 39 | 8.768  | 320.27 | 72 | 16.186 |
| 31.138                             | 7  | 1.574 | 177.93 | 40 | 8.992  | 324.72 | 73 | 16.411 |
| 35.586                             | 8  | 1.798 | 182.38 | 41 | 9.217  | 329.17 | 74 | 16.636 |
| 40.034                             | 9  | 2.023 | 186.83 | 42 | 9.442  | 333.62 | 75 | 16.861 |
| 44.482                             | 10 | 2.248 | 191.27 | 43 | 9.667  | 338.06 | 76 | 17.085 |
|                                    |    |       |        |    |        |        |    |        |
| 48.930                             | 11 | 2.473 | 195.72 | 44 | 9.892  | 342.51 | 77 | 17.310 |
| 53.379                             | 12 | 2.698 | 200.17 | 45 | 10.116 | 346.96 | 78 | 17.535 |
| 57.827                             | 13 | 2.923 | 204.62 | 46 | 10.341 | 351.41 | 79 | 17.760 |
| 62.275                             | 14 | 3.147 | 209.07 | 47 | 10.566 | 355.86 | 80 | 17.985 |
| 66.723                             | 15 | 3.372 | 213.51 | 48 | 10.791 | 360.31 | 81 | 18.210 |
|                                    |    |       |        |    |        |        |    |        |
| 71.171                             | 16 | 3.597 | 217.96 | 49 | 11.016 | 364.75 | 82 | 18.434 |
| 75.620                             | 17 | 3.822 | 222.41 | 50 | 11.240 | 369.20 | 83 | 18.659 |
| 80.068                             | 18 | 4.047 | 226.86 | 51 | 11.465 | 373.65 | 84 | 18.884 |
| 84.516                             | 19 | 4.271 | 231.31 | 52 | 11.690 | 378.10 | 85 | 19.109 |
| 88.964                             | 20 | 4.496 | 235.76 | 53 | 11.915 | 382.55 | 86 | 19.334 |
|                                    |    |       |        |    |        |        |    |        |
| 93.413                             | 21 | 4.721 | 240.20 | 54 | 12.140 | 386.99 | 87 | 19.558 |
| 97.861                             | 22 | 4.946 | 244.65 | 55 | 12.364 | 391.44 | 88 | 19.783 |
| 102.31                             | 23 | 5.171 | 249.10 | 56 | 12.589 | 395.89 | 89 | 20.008 |
| 106.76                             | 24 | 5.395 | 253.55 | 57 | 12.814 | 400.34 | 90 | 20.233 |
| 111.21                             | 25 | 5.620 | 258.00 | 58 | 13.039 | 404.79 | 91 | 20.458 |
|                                    |    |       |        |    |        |        |    |        |
| 115.65                             | 26 | 5.845 | 262.44 | 59 | 13.264 | 409.24 | 92 | 20.682 |
| 120.10                             | 27 | 6.070 | 266.89 | 60 | 13.489 | 413.68 | 93 | 20.907 |
| 124.55                             | 28 | 6.295 | 271.34 | 61 | 13.713 | 418.13 | 94 | 21.132 |
| 129.00                             | 29 | 6.519 | 275.79 | 62 | 13.938 | 422.58 | 95 | 21.357 |
| 133.45                             | 30 | 6.744 | 280.24 | 63 | 14.163 | 427.03 | 96 | 21.582 |
|                                    |    |       |        |    |        |        |    |        |
| 137.89                             | 31 | 6.969 | 284.69 | 64 | 14.388 | 431.48 | 97 | 21.806 |
| 142.34                             | 32 | 7.194 | 289.13 | 65 | 14.613 | 435.93 | 98 | 22.031 |
| 146.79                             | 33 | 7.419 | 293.58 | 66 | 14.837 | 440.37 | 99 | 22.256 |

How to use : For example, to convert 20 N into lbf, find the number 20 in the center of the first column. By referring to the lbf column on the right, it will be found that 20 N equals 4.496 lbf.  
To convert 20 lbf into N, refer to the N column on the left and it will be found that 20 lbf equals 88.964 N.

● N-kgf Conversion Table

| 1N = 0.1019716 kgf 1kgf = 9.80665 N |    |        |        |    |        |        |    |         |
|-------------------------------------|----|--------|--------|----|--------|--------|----|---------|
| N                                   |    | kgf    | N      |    | kgf    | N      |    | kgf     |
| 9.8066                              | 1  | 0.1020 | 333.43 | 34 | 3.4670 | 657.05 | 67 | 6.8321  |
| 19.613                              | 2  | 0.2039 | 343.23 | 35 | 3.5690 | 666.85 | 68 | 6.9341  |
| 29.420                              | 3  | 0.3059 | 353.04 | 36 | 3.6710 | 676.66 | 69 | 7.0360  |
| 39.227                              | 4  | 0.4079 | 362.85 | 37 | 3.7729 | 686.47 | 70 | 7.1380  |
| 49.033                              | 5  | 0.5099 | 372.65 | 38 | 3.8749 | 696.27 | 71 | 7.2400  |
|                                     |    |        |        |    |        |        |    |         |
| 58.840                              | 6  | 0.6118 | 382.46 | 39 | 3.9769 | 706.08 | 72 | 7.3420  |
| 68.647                              | 7  | 0.7138 | 392.27 | 40 | 4.0789 | 715.89 | 73 | 7.4439  |
| 78.453                              | 8  | 0.8158 | 402.07 | 41 | 4.1808 | 725.69 | 74 | 7.5459  |
| 88.260                              | 9  | 0.9177 | 411.88 | 42 | 4.2828 | 735.50 | 75 | 7.6479  |
| 98.066                              | 10 | 1.0197 | 421.69 | 43 | 4.3848 | 745.31 | 76 | 7.7498  |
|                                     |    |        |        |    |        |        |    |         |
| 107.87                              | 11 | 1.1217 | 431.49 | 44 | 4.4868 | 755.11 | 77 | 7.8518  |
| 117.68                              | 12 | 1.2237 | 441.30 | 45 | 4.5887 | 764.92 | 78 | 7.9538  |
| 127.49                              | 13 | 1.3256 | 451.11 | 46 | 4.6907 | 774.73 | 79 | 8.0558  |
| 137.29                              | 14 | 1.4276 | 460.91 | 47 | 4.7927 | 784.53 | 80 | 8.1577  |
| 147.10                              | 15 | 1.5296 | 470.72 | 48 | 4.8946 | 794.34 | 81 | 8.2597  |
|                                     |    |        |        |    |        |        |    |         |
| 156.91                              | 16 | 1.6315 | 480.53 | 49 | 4.9966 | 804.15 | 82 | 8.3617  |
| 166.71                              | 17 | 1.7335 | 490.33 | 50 | 5.0986 | 813.95 | 83 | 8.4636  |
| 176.52                              | 18 | 1.8355 | 500.14 | 51 | 5.2006 | 823.76 | 84 | 8.5656  |
| 186.33                              | 19 | 1.9375 | 509.95 | 52 | 5.3025 | 833.57 | 85 | 8.6676  |
| 196.13                              | 20 | 2.0394 | 519.75 | 53 | 5.4045 | 843.37 | 86 | 8.7696  |
|                                     |    |        |        |    |        |        |    |         |
| 205.94                              | 21 | 2.1414 | 529.56 | 54 | 5.5065 | 853.18 | 87 | 8.8715  |
| 215.75                              | 22 | 2.2434 | 539.37 | 55 | 5.6084 | 862.99 | 88 | 8.9735  |
| 225.55                              | 23 | 2.3453 | 549.17 | 56 | 5.7104 | 872.79 | 89 | 9.0755  |
| 235.36                              | 24 | 2.4473 | 558.98 | 57 | 5.8124 | 882.60 | 90 | 9.1774  |
| 245.17                              | 25 | 2.5493 | 568.79 | 58 | 5.9144 | 892.41 | 91 | 9.2794  |
|                                     |    |        |        |    |        |        |    |         |
| 254.97                              | 26 | 2.6513 | 578.59 | 59 | 6.0163 | 902.21 | 92 | 9.3814  |
| 264.78                              | 27 | 2.7532 | 588.40 | 60 | 6.1183 | 912.02 | 93 | 9.4834  |
| 274.59                              | 28 | 2.8552 | 598.21 | 61 | 6.2203 | 921.83 | 94 | 9.5853  |
| 284.39                              | 29 | 2.9572 | 608.01 | 62 | 6.3222 | 931.63 | 95 | 9.6873  |
| 294.20                              | 30 | 3.0591 | 617.82 | 63 | 6.4242 | 941.44 | 96 | 9.7893  |
|                                     |    |        |        |    |        |        |    |         |
| 304.01                              | 31 | 3.1611 | 627.63 | 64 | 6.5262 | 951.25 | 97 | 9.8912  |
| 313.81                              | 32 | 3.2631 | 637.43 | 65 | 6.6282 | 961.05 | 98 | 9.9932  |
| 323.62                              | 33 | 3.3651 | 647.24 | 66 | 6.7301 | 970.86 | 99 | 10.0952 |

How to use : For example, to convert 20 N into kgf, find the number 20 in the center of the first column. By referring to the kgf column on the right, it will be found that 20 N equals 2.0394 kgf.  
To convert 20 kgf into N, refer to the N column on the left and it will be found that 20 kgf equals 196.13 N.



● Temperature Conversion Table

| °C    |      | °F     | °C   |    | °F    | °C   |    | °F    | °C    |      | °F    |
|-------|------|--------|------|----|-------|------|----|-------|-------|------|-------|
| -73.3 | -100 | -148.0 | -2.2 | 28 | 82.4  | 16.1 | 61 | 141.8 | 34.4  | 94   | 201.2 |
| -62.2 | - 80 | -112.0 | -1.7 | 29 | 84.2  | 16.7 | 62 | 143.6 | 35.0  | 95   | 203.0 |
| -51.1 | - 60 | - 76.0 | -1.1 | 30 | 86.0  | 17.2 | 63 | 145.4 | 35.6  | 96   | 204.8 |
| -40.0 | - 40 | - 40.0 | -0.6 | 31 | 87.8  | 17.8 | 64 | 147.2 | 36.1  | 97   | 206.6 |
| -28.9 | - 20 | - 4.0  | 0    | 32 | 89.6  | 18.3 | 65 | 149.0 | 36.7  | 98   | 208.4 |
| -17.8 | 0    | 32.0   | 0.6  | 33 | 91.4  | 18.9 | 66 | 150.8 | 37.2  | 99   | 210.2 |
| -17.2 | 1    | 33.8   | 1.1  | 34 | 93.2  | 19.4 | 67 | 152.6 | 37.8  | 100  | 212   |
| -16.7 | 2    | 35.6   | 1.7  | 35 | 95.0  | 20.0 | 68 | 154.4 | 43.3  | 110  | 230   |
| -16.1 | 3    | 37.4   | 2.2  | 36 | 96.8  | 20.6 | 69 | 156.2 | 48.9  | 120  | 248   |
| -15.6 | 4    | 39.2   | 2.8  | 37 | 98.6  | 21.1 | 70 | 158.0 | 54.4  | 130  | 266   |
| -15.0 | 5    | 41.0   | 3.3  | 38 | 100.4 | 21.7 | 71 | 159.8 | 60.0  | 140  | 284   |
| -14.4 | 6    | 42.8   | 3.9  | 39 | 102.2 | 22.2 | 72 | 161.6 | 65.6  | 150  | 302   |
| -13.9 | 7    | 44.6   | 4.4  | 40 | 104.0 | 22.8 | 73 | 163.4 | 71.1  | 160  | 320   |
| -13.3 | 8    | 46.4   | 5.0  | 41 | 105.8 | 23.3 | 74 | 165.2 | 76.7  | 170  | 338   |
| -12.8 | 9    | 48.2   | 5.6  | 42 | 107.6 | 23.9 | 75 | 167.0 | 82.2  | 180  | 356   |
| -12.2 | 10   | 50.0   | 6.1  | 43 | 109.4 | 24.4 | 76 | 168.8 | 87.8  | 190  | 374   |
| -11.7 | 11   | 51.8   | 6.7  | 44 | 111.2 | 25.0 | 77 | 170.6 | 93.3  | 200  | 392   |
| -11.1 | 12   | 53.6   | 7.2  | 45 | 113.0 | 25.6 | 78 | 172.4 | 121.1 | 250  | 482   |
| -10.6 | 13   | 55.4   | 7.8  | 46 | 114.8 | 26.1 | 79 | 174.2 | 149   | 300  | 572   |
| -10.0 | 14   | 57.2   | 8.3  | 47 | 116.6 | 26.7 | 80 | 176.0 | 177   | 350  | 662   |
| - 9.4 | 15   | 59.0   | 8.9  | 48 | 118.4 | 27.2 | 81 | 177.8 | 204   | 400  | 752   |
| - 8.9 | 16   | 60.8   | 9.4  | 49 | 120.2 | 27.8 | 82 | 179.6 | 232   | 450  | 842   |
| - 8.3 | 17   | 62.6   | 10.0 | 50 | 122.0 | 28.3 | 83 | 181.4 | 260   | 500  | 932   |
| - 7.8 | 18   | 64.4   | 10.6 | 51 | 123.8 | 28.9 | 84 | 183.2 | 288   | 550  | 1022  |
| - 7.2 | 19   | 66.2   | 11.1 | 52 | 125.6 | 29.4 | 85 | 185.0 | 316   | 600  | 1112  |
| - 6.7 | 20   | 68.0   | 11.7 | 53 | 127.4 | 30.0 | 86 | 186.8 | 343   | 650  | 1202  |
| - 6.1 | 21   | 69.8   | 12.2 | 54 | 129.2 | 30.6 | 87 | 188.6 | 371   | 700  | 1292  |
| - 5.6 | 22   | 71.6   | 12.8 | 55 | 131.0 | 31.1 | 88 | 190.4 | 399   | 750  | 1382  |
| - 5.0 | 23   | 73.4   | 13.3 | 56 | 132.8 | 31.7 | 89 | 192.2 | 427   | 800  | 1472  |
| - 4.4 | 24   | 75.2   | 13.9 | 57 | 134.6 | 32.2 | 90 | 194.0 | 454   | 850  | 1562  |
| - 3.9 | 25   | 77.0   | 14.4 | 58 | 136.4 | 32.8 | 91 | 195.8 | 482   | 900  | 1652  |
| - 3.3 | 26   | 78.8   | 15.0 | 59 | 138.2 | 33.3 | 92 | 197.6 | 510   | 950  | 1742  |
| - 2.8 | 27   | 80.6   | 15.6 | 60 | 140.0 | 33.9 | 93 | 199.4 | 538   | 1000 | 1832  |

| °C   |    | °F    | °C   |    | °F    | °C    |      | °F    | °C    |      | °F   |
|------|----|-------|------|----|-------|-------|------|-------|-------|------|------|
| -2.2 | 28 | 82.4  | 16.1 | 61 | 141.8 | 34.4  | 94   | 201.2 | 48.9  | 120  | 248  |
| -1.7 | 29 | 84.2  | 16.7 | 62 | 143.6 | 35.0  | 95   | 203.0 | 54.4  | 130  | 266  |
| -1.1 | 30 | 86.0  | 17.2 | 63 | 145.4 | 35.6  | 96   | 204.8 | 60.0  | 140  | 284  |
| -0.6 | 31 | 87.8  | 17.8 | 64 | 147.2 | 36.1  | 97   | 206.6 | 65.6  | 150  | 302  |
| 0    | 32 | 89.6  | 18.3 | 65 | 149.0 | 36.7  | 98   | 208.4 | 71.1  | 160  | 320  |
| 0.6  | 33 | 91.4  | 18.9 | 66 | 150.8 | 37.2  | 99   | 210.2 | 76.7  | 170  | 338  |
| 1.1  | 34 | 93.2  | 19.4 | 67 | 152.6 | 37.8  | 100  | 212   | 82.2  | 180  | 356  |
| 1.7  | 35 | 95.0  | 20.0 | 68 | 154.4 | 43.3  | 110  | 230   | 87.8  | 190  | 374  |
| 2.2  | 36 | 96.8  | 20.6 | 69 | 156.2 | 48.9  | 120  | 248   | 93.3  | 200  | 392  |
| 2.8  | 37 | 98.6  | 21.1 | 70 | 158.0 | 54.4  | 130  | 266   | 121.1 | 250  | 482  |
| 3.3  | 38 | 100.4 | 21.7 | 71 | 159.8 | 60.0  | 140  | 284   | 149   | 300  | 572  |
| 3.9  | 39 | 102.2 | 22.2 | 72 | 161.6 | 65.6  | 150  | 302   | 177   | 350  | 662  |
| 4.4  | 40 | 104.0 | 22.8 | 73 | 163.4 | 71.1  | 160  | 320   | 204   | 400  | 752  |
| 5.0  | 41 | 105.8 | 23.3 | 74 | 165.2 | 76.7  | 170  | 338   | 232   | 450  | 842  |
| 5.6  | 42 | 107.6 | 23.9 | 75 | 167.0 | 82.2  | 180  | 356   | 260   | 500  | 932  |
| 6.1  | 43 | 109.4 | 24.4 | 76 | 168.8 | 87.8  | 190  | 374   | 288   | 550  | 1022 |
| 6.7  | 44 | 111.2 | 25.0 | 77 | 170.6 | 93.3  | 200  | 392   | 316   | 600  | 1112 |
| 7.2  | 45 | 113.0 | 25.6 | 78 | 172.4 | 121.1 | 250  | 482   | 343   | 650  | 1202 |
| 7.8  | 46 | 114.8 | 26.1 | 79 | 174.2 | 149   | 300  | 572   | 371   | 700  | 1292 |
| 8.3  | 47 | 116.6 | 26.7 | 80 | 176.0 | 177   | 350  | 662   | 399   | 750  | 1382 |
| 8.9  | 48 | 118.4 | 27.2 | 81 | 177.8 | 204   | 400  | 752   | 427   | 800  | 1472 |
| 9.4  | 49 | 120.2 | 27.8 | 82 | 179.6 | 232   | 450  | 842   | 454   | 850  | 1562 |
| 10.0 | 50 | 122.0 | 28.3 | 83 | 181.4 | 260   | 500  | 932   | 482   | 900  | 1652 |
| 10.6 | 51 | 123.8 | 28.9 | 84 | 183.2 | 288   | 550  | 1022  | 510   | 950  | 1742 |
| 11.1 | 52 | 125.6 | 29.4 | 85 | 185.0 | 316   | 600  | 1112  | 538   | 1000 | 1832 |
| 11.7 | 53 | 127.4 | 30.0 | 86 | 186.8 | 343   | 650  | 1202  |       |      |      |
| 12.2 | 54 | 129.2 | 30.6 | 87 | 188.6 | 371   | 700  | 1292  |       |      |      |
| 12.8 | 55 | 131.0 | 31.1 | 88 | 190.4 | 399   | 750  | 1382  |       |      |      |
| 13.3 | 56 | 132.8 | 31.7 | 89 | 192.2 | 427   | 800  | 1472  |       |      |      |
| 13.9 | 57 | 134.6 | 32.2 | 90 | 194.0 | 454   | 850  | 1562  |       |      |      |
| 14.4 | 58 | 136.4 | 32.8 | 91 | 195.8 | 482   | 900  | 1652  |       |      |      |
| 15.0 | 59 | 138.2 | 33.3 | 92 | 197.6 | 510   | 950  | 1742  |       |      |      |
| 15.6 | 60 | 140.0 | 33.9 | 93 | 199.4 | 538   | 1000 | 1832  |       |      |      |

How to use : For example, to convert 20°C into °F, find the number 20 in the center of the first column. By referring the °F column on the right, it will be found that 20°C equals 68.0°F.  
To convert 20°F into °C, refer to the °C column on the left and it will be found that 20°F equals -6.7°C.

$C = \frac{5}{9}(F-32) \quad F = 32 + \frac{9}{5}C$

● Grease names and the characteristics (Reference)

| Sort                   | Name                      | Supplier                 | Thickener of metallic soap | Con-sistency | Dropping point (°C) | Service range(1) (°C)       | Remarks                                                                                                          |
|------------------------|---------------------------|--------------------------|----------------------------|--------------|---------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------|
| General purpose        | ALVANIA GREASE S1         | SHELL LUBRICANTS JAPAN   | Li                         | 323          | 182                 | -35~+120                    | General, Centralized greasing                                                                                    |
|                        | ALVANIA GREASE S2         | SHELL LUBRICANTS JAPAN   | Li                         | 283          | 185                 | -25~+120                    | General, Centralized greasing                                                                                    |
|                        | ALVANIA GREASE S3         | SHELL LUBRICANTS JAPAN   | Li                         | 242          | 185                 | -20~+135                    | General                                                                                                          |
|                        | DAPHNE GREASE MP NO.2     | IDEMITSU                 | Li                         | 276          | 195                 | -20~+120                    | General                                                                                                          |
|                        | COSMO GREASE DYNAMAX No.2 | COSMO                    | Li                         | 280          | 188                 | -20~+120                    | General                                                                                                          |
| Low temperature        | MULTINOC GREASE 2         | JXTG NIPPON OIL & ENERGY | Li                         | 278          | 212                 | -30~+125                    | General                                                                                                          |
|                        | ALVANIA GREASE RA-J       | SHELL LUBRICANTS JAPAN   | Li                         | 252          | 183                 | -40~+130                    | Low temperature                                                                                                  |
|                        | BEACON 325                | EMG LUBRICANTS           | Li                         | 280          | 193                 | -60~ <sup>(+160)</sup> +120 | Low temperature, Low torque                                                                                      |
|                        | ISOFLEX LDS 18 SPECIAL A  | KLÜBER                   | Li                         | 280          | ≥185                | -60~+130                    | Low temperature, High speed,Extreme pressure                                                                     |
|                        | ISOFLEX SUPER LDS 18      | KLÜBER                   | Li                         | 280          | ≥185                | -60~+130                    | Low temperature, High speed,Low noise                                                                            |
| Wide temperature range | LT GREASE No.2            | JXTG NIPPON OIL & ENERGY | Li                         | 275          | 181                 | -50~+150                    | Low temperature                                                                                                  |
|                        | TEMPREX N3                | EMG LUBRICANTS           | Li Complex                 | 235          | ≥300                | -20~ <sup>(+200)</sup> +160 | Wide temperature range, High temperature                                                                         |
|                        | AEROSHELL GREASE 7        | SHELL LUBRICANTS JAPAN   | Microgel                   | 288          | ≥260                | -73~+149                    | Wide temperature range, Low temperature                                                                          |
|                        | MULTEMP PS No.2           | KYODO YUSHI              | Li                         | 275          | 190                 | -50~+130                    | Wide temperature range, For low temperature & low noise                                                          |
|                        | MULTEMP SRL               | KYODO YUSHI              | Li                         | 242          | 192                 | -50~+150                    | Wide temperature range, For low temperature & low noise                                                          |
| Extreme pressure       | MULTINOC WIDE No.2        | JXTG NIPPON OIL & ENERGY | Li+special Na              | 247          | 203                 | -40~+135                    | Wide temperature range                                                                                           |
|                        | ALVANIA EP GREASE 2       | SHELL LUBRICANTS JAPAN   | Li                         | 276          | 187                 | -20~+110                    | Extreme pressure, Centralized greasing                                                                           |
|                        | MOLYKOTE BR2-PLUS         | TORAY/DOW CORNING        | Li                         | 265          | 185                 | -30~+150                    | With MoS2, Extreme pressure                                                                                      |
|                        | MOLUB-ALLOY #777-2        | CASTROL                  | Li                         | 280          | 182                 | 0~+135                      | With MoS2, Extreme pressure                                                                                      |
|                        | G 40M                     | SHIN-ETSU                | Li                         | 260          | ≥200                | -30~+200                    | Wide temperatur range, Superior at high temperature with stable anti-oxidation and water proof, Chemically inert |
| Others                 | G 40H                     | SHIN-ETSU                | Li                         | 220          | ≥200                | -30~+200                    | Wide temperatur range, Superior at high temperature with stable anti-oxidation and water proof, Chemically inert |
|                        | KRYTOX 240AD              | CHEMOURS                 | Fluorinated                | 275          | None                | -30~+288                    | Stabl at high temperature, Chemically inert, Anti-solvent                                                        |
|                        | BARRIERTA L55/2           | KLÜBER                   | Fluorinated                | No.2         | None                | -35~ <sup>(+250)</sup> +220 | General, Low evaporation at high temperature, Chemically inert                                                   |
|                        | BARRIERTA IMI/V           | KLÜBER                   | Fluorinated                | No.2         | None                | -50~+220                    | For high vacuum                                                                                                  |
|                        | DOLIUM GREASE R           | SHELL LUBRICANTS JAPAN   | Polyurea                   | 281          | 249                 | -30~+150                    | Heat resistant, Superior at high temperature with stable anti-oxidation                                          |
|                        | STAMINA GREASE RL2        | SHELL LUBRICANTS JAPAN   | Polyurea                   | 268          | 271                 | -20~+180                    | Heat resistant, Superior at high temperature with stable anti-oxidation                                          |
|                        |                           |                          |                            |              |                     |                             |                                                                                                                  |

Note(1) : Figures in parentheses show the maximum allowable temperature in very short time operation, and they are not applicable for continuous operation.  
Remark When using these products, see individual manufacturer's catalogs.

# IKO Linear Motion Rolling Guide Series,

# Configuration of General Catalog

IKO Linear Motion Rolling Guide Series General Catalog Consists of **BLUE** and (CAT-1587E)

**RED** , the two volumes. (CAT-1588E)



CAT-1587E

**【Models】**

- Rail Guide Type  
Endless Linear Motion Type



CAT-1588E

**【Models】**

- Rail Guide Type  
Limited Linear Motion Type
- Shaft Guide Type  
Endless Linear Motion Type  
Limited Linear Motion Type + Rolling Motion Type
- Flat Guide Type  
Endless Linear Motion Type  
Limited Linear Motion Type

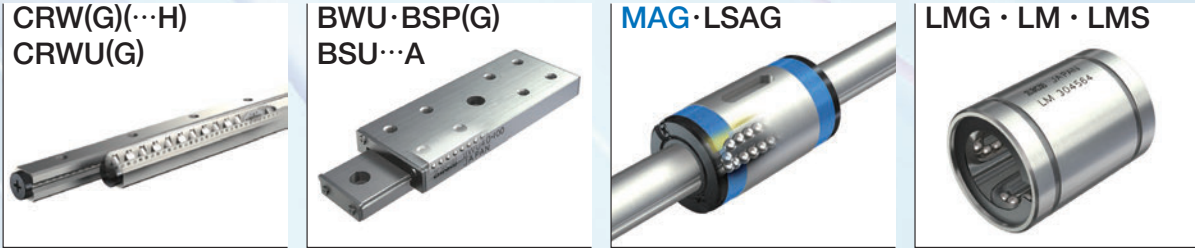
C-Lube Linear Way ML C-Lube Linear Way MLV C-Lube Linear Way MV C-Lube Linear Way ME C-Lube Linear Way MH  
Linear Way L Linear Way E Linear Way H



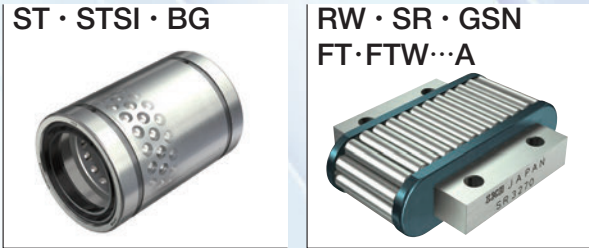
Linear Way F C-Lube Linear Way MUL C-Lube Linear Roller Way Super MX  
Linear Way U Linear Roller Way Super X Linear Roller Way X Linear Way Module



Rail Guide Type Crossed Roller Way Rail Guide Type Linear Slide Unit Shaft Guide Type Linear Ball Spline Shaft Guide Type Linear Bushing



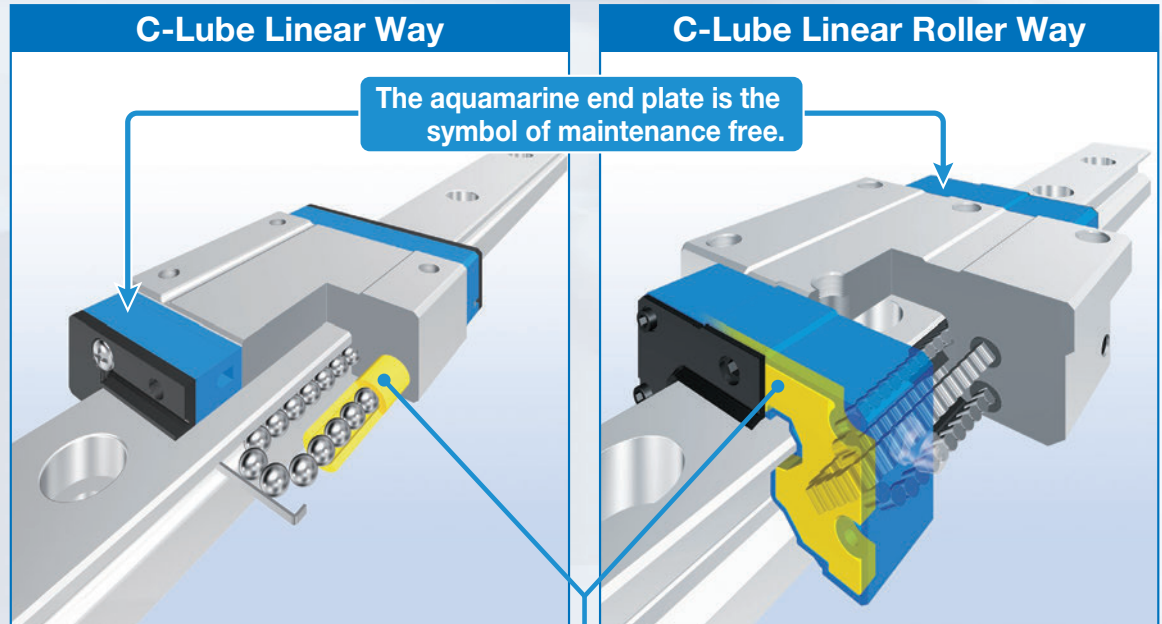
Shaft Guide Type Stroke Rotary Bushing Flat Guide Type Roller Way & Flat Roller Cage



**Oil Minimum**  
IKO Gentle to The Earth

Features of C-Lube Linear Way and C-Lube Linear Roller Way

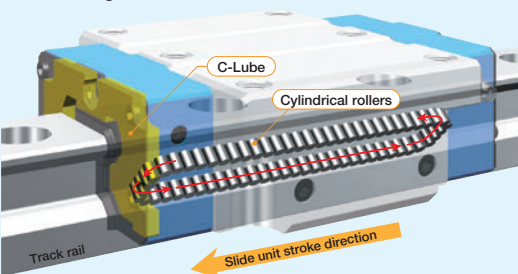
Original and world's first  
structure with [C-Lube]



C-Lube integrated

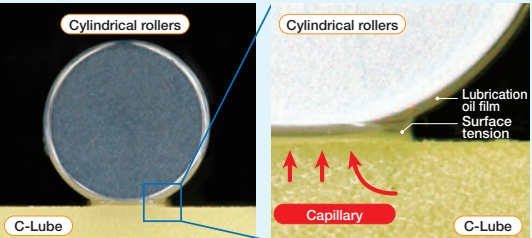
Lubrication oil is carried through circulation of rolling elements

The lubrication oil is supplied directly to the rolling elements, not to the track rail.  
When rolling elements make contact with the capillary lubricating element integrated with the circulation path of slide unit rolling elements, the lubrication oil is supplied to surfaces of rolling elements and carried to the loading area through circulation of rolling elements.  
This results in adequate lubrication oil being properly maintained in the loading area and lubrication performance will last for a long time.



Lubrication oil is directly supplied to surfaces of the rolling elements

The surface of capillary lubricating element is always covered with the lubrication oil.  
Lubrication oil is continuously supplied to the surface of rolling elements by surface tension in the contact of capillary lubricating element surface and rolling elements.  
On the surface of capillary lubricating element with which the rolling elements make contact, new lubrication oil is always supplied from the other sections.



Long term maintenance free is realized with  
oil impregnated with C-Lube only !!

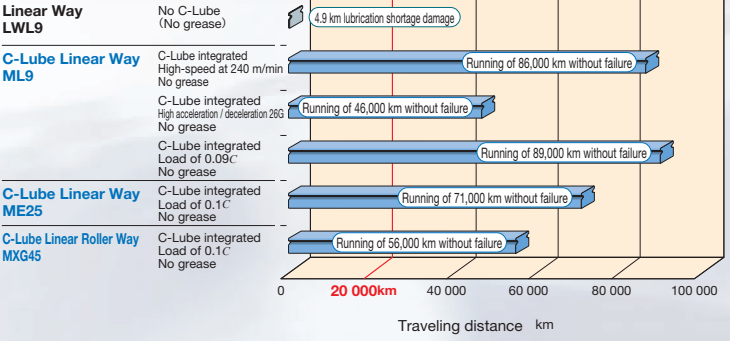


Maintenance free

This endures running over 20,000 km without oil feeding with lubrication oil in the C-Lube only.  
Furthermore, grease is pre-packed in the slide unit so long term maintenance free can be realized.

**Maintenance free is achieved until the end of device life!**  
\*1. Typical device life is assumed. Re-greasing may be necessary depending on use conditions.

Durability test result

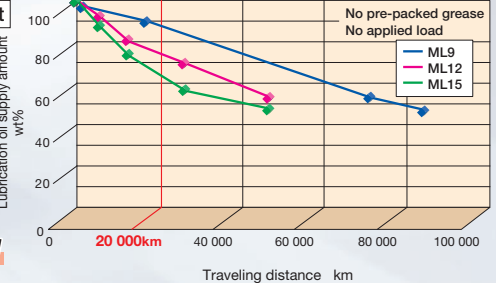


Eco-friendly

As lubrication oil in C-Lube is supplied by the amount necessary to maintain lubrication performance of the rolling guide, the consumption of lubrication oil is reduced and lubrication performance is maintained even when it run for a long period.

**Eco-friendly specification reducing usage of lubrication oil!**

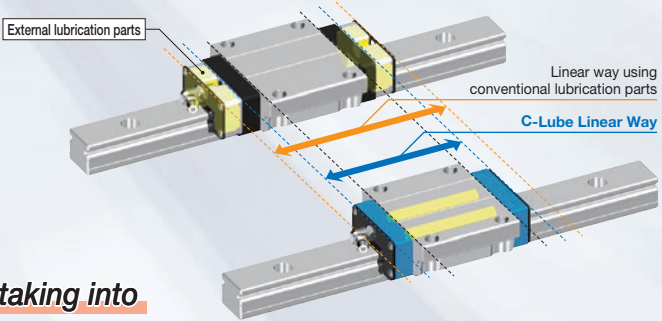
Oil supply test result



Compact

As C-Lube Linear Way and C-Lube Linear Roller Way are integrated with lubrication part C-Lube, their slide units are not long unlike types with external lubrication parts.  
Replacement of conventional parts is easy free from constraints of mounting space and stroke length.

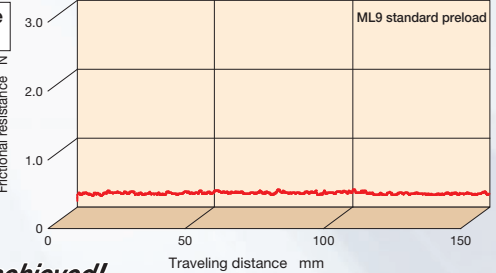
**Compact design taking into account compactness!**



Smooth

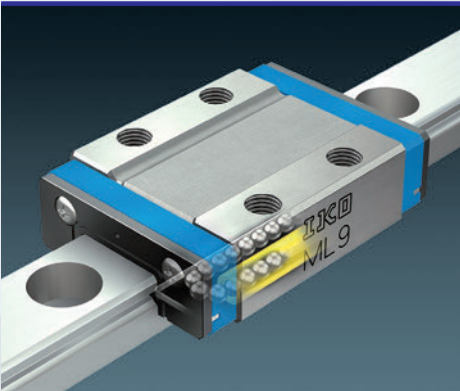
C-Lube Linear Way and C-Lube Linear Roller Way do not generate slide resistance unlike lubrication parts external to the slide unit that make contact with the track rail.  
Driving force follow-up property is superior and energy is saved by improvement of accuracy and reduction of friction loss.

Frictional resistance test result



**Light and smooth motion is achieved!**

# A variety of models and size variations



## Ball Type Miniature Series

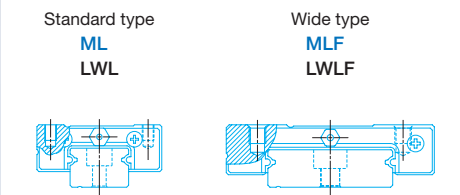
### C-Lube Linear Way ML C-Lube Linear Way MLV Linear Way L

Thanks to the structure with two rows of balls to contact with the way at four points, stable accuracy and rigidity can be achieved even in applications where load has variable direction and size or complex load is applied, despite its very small body.

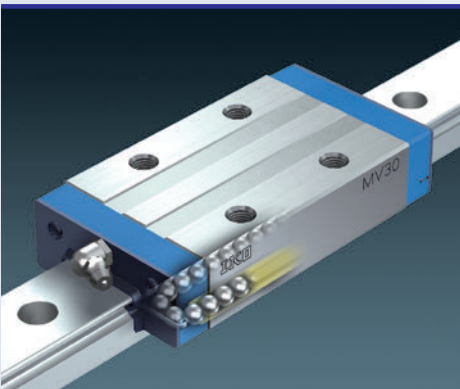


### Micro Linear Way L

As the lineup of track rail width from 1 mm to 6 mm is available, you can select an optimal product for the specifications of your machine and device. For LWL1, world's smallest size is realized: track rail width of 1 mm, slide unit width of 4 mm and assembly height of 2.5 mm.



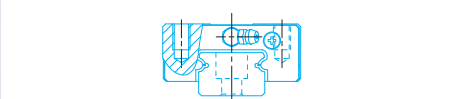
| Length of slide unit |            | Size          |                                  |
|----------------------|------------|---------------|----------------------------------|
| C                    | Short      | Standard type | 1, 2, 3, 5, 7, 9, 12, 15, 20, 25 |
|                      | Standard   |               |                                  |
|                      | Long       |               |                                  |
|                      | Extra long |               |                                  |
| No symbol            |            | Wide type     | 4, 6, 10, 14, 18, 24, 30, 42     |
| G                    |            |               |                                  |
| L                    |            |               |                                  |



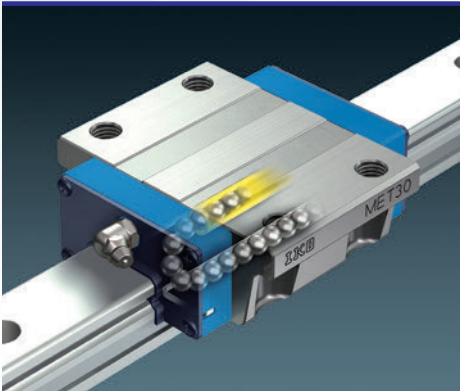
## Ball Type Low Profile/Light Weight Series

### C-Lube Linear Way MV

Despite its extra low profile and extra light weight, this linear motion rolling guide has the maximum load rating among the ball types while achieving high load capacity.



| Length of slide unit | Size       |
|----------------------|------------|
| Standard             | 20, 25, 30 |



## Ball Type Compact Series

### C-Lube Linear Way ME Linear Way E Low Decibel Linear Way E

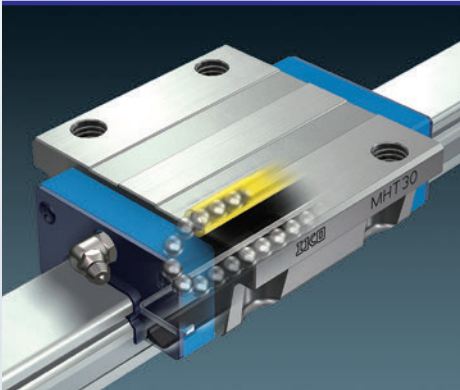
Versatile linear motion rolling guide that has achieved utility pursuing compactness in every aspect. Low decibel types with resin separator to prevent direct contact between balls are also available.

Flange type mounting from bottom  
**ME**  
LWE

Flange type mounting from top  
**MET**  
LWET

Block type mounting from top  
**MES**  
LWES

| Length of slide unit |          | Size                   |
|----------------------|----------|------------------------|
| C                    | Short    | 15, 20, 25, 30, 35, 45 |
| No symbol            | Standard |                        |
| G                    | Long     |                        |



## Ball Type High Rigidity Series

### C-Lube Linear Way MH Linear Way H

High rigidity linear motion rolling guides designed to evenly support high load capacity by incorporating large-diameter balls. Stable accuracy and rigidity can be achieved even in applications where load with variable direction and size and complex load are applied.

Flange type mounting from bottom  
**MH**  
LWH

Flange type mounting from top<sup>(1)</sup>  
**MHT**  
LWHT

Block type mounting from top  
**MHD**  
LWHD

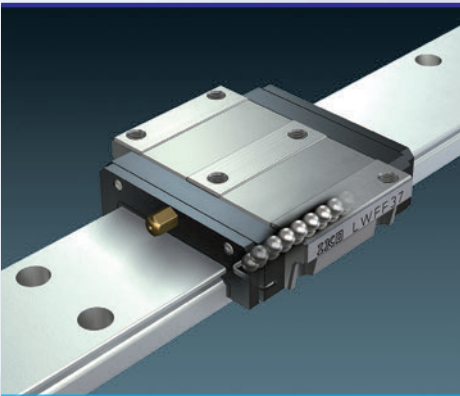
Compact block type mounting from top  
**MHS**  
LWHS

| Length of slide unit |            | Size                                      |
|----------------------|------------|-------------------------------------------|
| C                    | Short      |                                           |
| No symbol            | Standard   |                                           |
| G                    | Long       |                                           |
| L                    | Extra long |                                           |
| Size                 |            | 8, 10, 12, 15, 20, 25, 30, 35, 45, 55, 65 |

Note <sup>(1)</sup> Some models may be mounted from bottom.



A variety of models and size variations

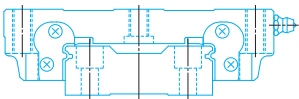


Ball Type Wide Type Series

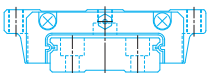
Linear Way F

As wide track rail is used and the distance between the load points is long, this is a linear motion rolling guide suitable to single-row use due to the structure resistant to across-the-width moment load. It is also resistant to complex load.

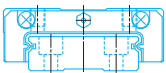
Flange type  
mounting from top / bottom  
LWFH



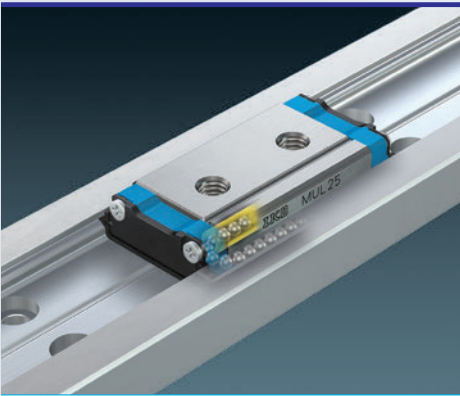
Flange type  
mounting from top / bottom  
LWFF



Block type  
mounting from top  
LWFS



| Length of slide unit |             |
|----------------------|-------------|
| No symbol            | Standard    |
|                      |             |
| Size                 |             |
| LWFH                 | 40,60,90    |
| LWFF                 | 33,37,42,69 |
| LWFS                 | 33,37,42    |

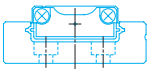


Ball Type U-Shaped Track Rail Series

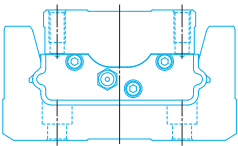
C-Lube Linear Way MUL  
Linear Way U

Linear motion rolling guide of the structure with way inside the track rail of U-shaped section and slide unit therein. With the U-shaped track rail, rigidity against the track rail moment load and torsion is significantly improved.

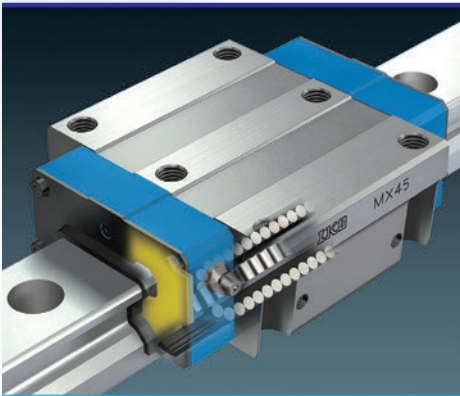
Small type  
MUL  
LWUL



Standard type  
LWU



| Length of slide unit |                          |
|----------------------|--------------------------|
| No symbol            | Standard                 |
|                      |                          |
| Size                 |                          |
| MUL                  | 25, 30                   |
| LWUL                 | 25, 30                   |
| LWU                  | 40, 50, 60, 86, 100, 130 |

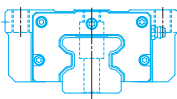


Roller Type

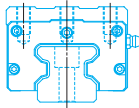
C-Lube Linear Roller Way Super MX  
Linear Roller Way Super X

Linear motion rolling guide that has achieved the highest level of performance in all characteristics utilizing the roller's superior characteristic, such as rigidity, load capacity, running accuracy and vibration damping property. With extra long unit with the maximum slide unit length, load capacity and rigidity are improved and running performance with super high accuracy is realized.

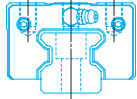
Flange type  
mounting from top / bottom  
MX<sup>(1)</sup>  
LRX<sup>(1)</sup>



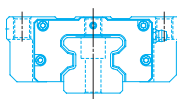
Block type  
mounting from top  
MXD  
LRXD



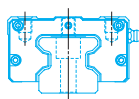
Compact block type  
mounting from top  
MXS  
LRXS



Low profile flange type  
mounting from top  
MXN



Low profile block type  
mounting from top  
MXNS



Note <sup>(1)</sup> Size 20 series allows only for mounting from top and model mounting from bottom is MXH and LRXH.

| Length of slide unit |           |      |            |
|----------------------|-----------|------|------------|
| C                    | No symbol | G    | L          |
| Short                | Standard  | Long | Extra long |
|                      |           |      |            |

| Size                                            |
|-------------------------------------------------|
| 10, 12, 15, 20, 25, 30, 35, 45, 55, 65, 85, 100 |

Four-row roller guide of world's smallest size  
Track rail width of 10 mm

Super high rigidity  
Super high load capacity  
High running performance  
Excellent frictional characteristics

Stainless steel made  
**LRXD10...SL**

Mechatronics Series

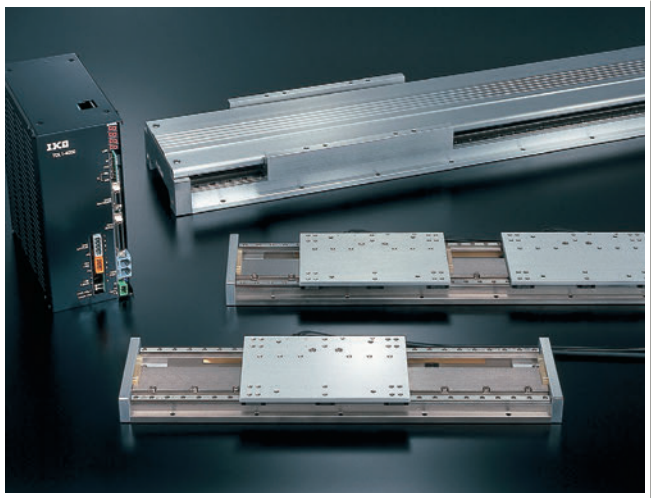
TU Series

IKO Precision Positioning Table TU is a compact and slim positioning table with good load balance and high resistance to complex loads, in which the side table is arranged inside the U-shape track rail. Six types with a track rail width of 25 ~ 130mm are available. Each slide table length can be selected as required. Different table specifications including ball screw, motor, sensor, etc. can be selected. This allows each user to configure the most suitable positioning table for each application. Abundant options meet diversified market needs such as a motor loopback specification, table with bellows, table with bridge cover, and table finished by black chrome surface treatment.



Linear Motor Table LT

The IKO Linear Motor Table LT is a compact and lightweight direct-drive positioning table with a very small sectional height in which an AC servo-motor and an optional linear scale are integrated in a moving table and a bed made of aluminum alloy. The IKO Linear Motor Table LT employs a C-shaped magnet yoke, and a coil board is sandwiched between two stator magnets. It provides a high thrust of 450N though its height is only 40 mm. The moving table is as light as 1.5 kg but provides high thrust. It permits high acceleration and deceleration exceeding 10 G. (In the case of LT150 CG.) Also, High Thrust Series LT...H outputs 900N thrust. Using advanced servo technology, this product achieves high static stability and high-speed stability.



Long-stroke Series

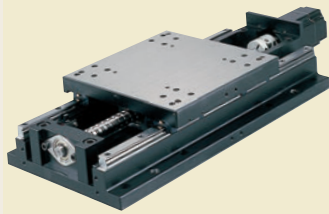
- Standard type which has been practically used in many fields.
- Stable characteristics in parallel use together with Linear Way



TSL...M

High-rigidity Series

- High reliability and high accuracy with component parts strictly selected
- High rigidity and large mounting weight



TSLH...M · CTLH...M

Super Precision Series

- XY configuration available for advanced inspection stage
- High positioning accuracy realized with IKO Roller technology and full closed loop controlling



TX...M CTX...M

Compact Series

- Compact structure with a small sectional height
- High reliability and high accuracy achieved by using Crossed Roller Way



TS · CT

High-speed Long Stroke Series

- High-speed type using a timing belt drive
- Stable and high traveling performance in parallel use together with Linear Way



TSLB

Precision Positioning Table

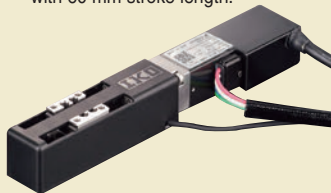
- Light weight precision positioning table made of high-strength aluminum alloy.
- Built-in C-Lube for long-term maintenance-free service.



TE...B

Micro Precision Positioning Table

- Very compact positioning table that is 20mm high(sectional) and 17mm wide driven by a ground ball screw.
- +/-0.5micron repeatability is achieved with 60 mm stroke length.



TM

Nano Linear

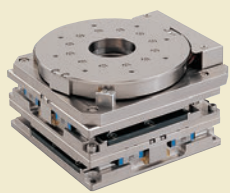
- Direct drive type with high speed and high response
- Maximum thrust of 25 N achieved with a sectional height of 14 mm



NT...V

Alignment Stage Direct Drive

- Ultra compact XY θ stage contributing to space saving
- High resolution and response realized with optical scale

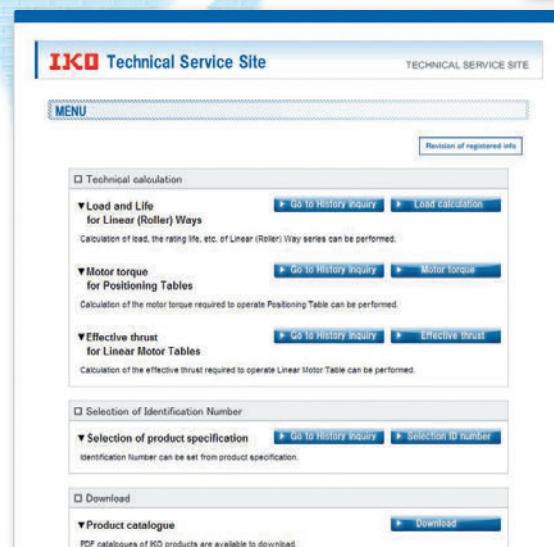
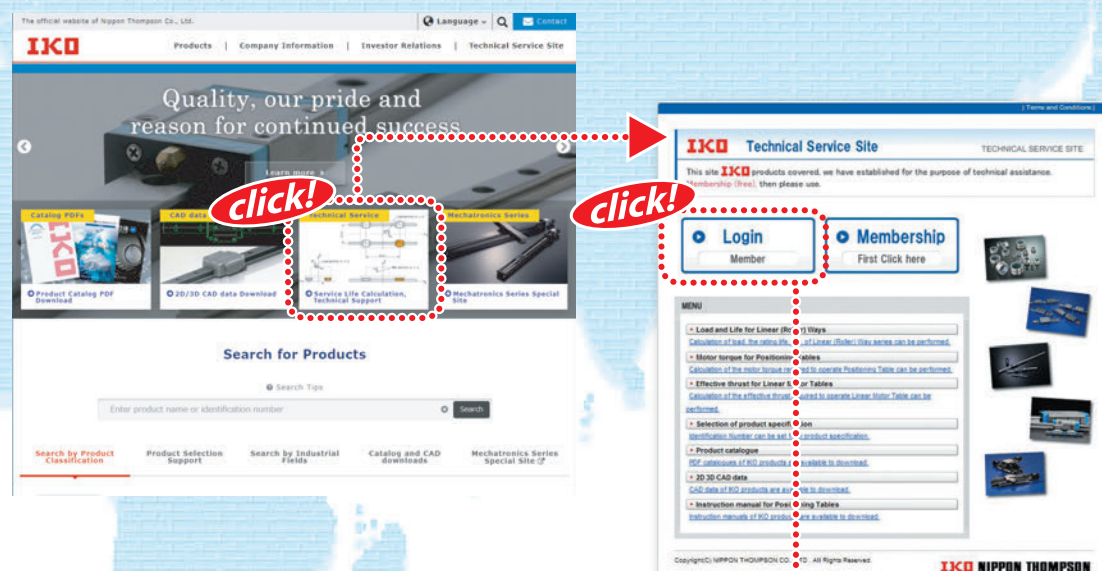


SA...DE

# IKO Introduction of Technical Service Site

"IKO Technical Service Site" can be accessed from our home page. The site provides various tools for selecting Linear Ways and Linear Roller Ways. Please utilize these tools for assistance when selecting products. Additionally the site also provides CAD data and product catalogs for the Needle Series, Linear Motion Rolling Guide Series, and Mechatronics Series for download. Please utilize them to improve your design efficiency.

<https://www.ikont.co.jp/eg/>



## 1. Technical calculations

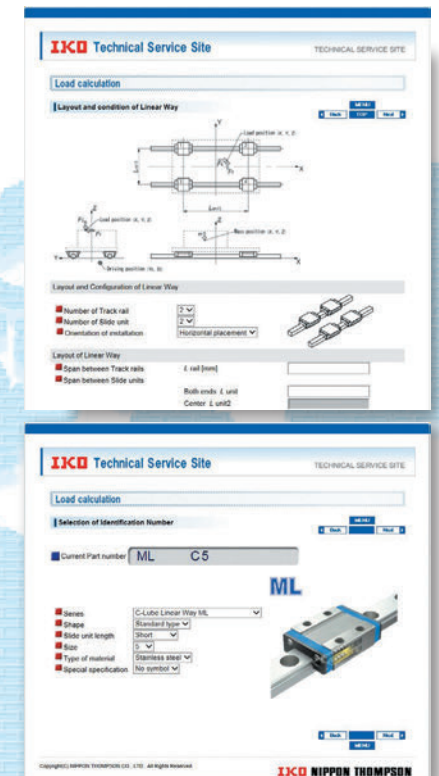
For Linear Way/Linear Roller Way load and life calculation, you can obtain the calculated load and the rating life by entering the operating conditions.

Also you can derive the motor torque required for operation and the effective thrust force during operation in the sections of motor torque calculation and calculation of effective thrust force of linear motor tables respectively, and output the calculation results in PDF format, as well as save the histories.

## 2. Selection of Identification Number

By selecting such specification as model code, dimensions, part code, material code, preload symbol, classification symbol, interchangeable code and supplemental code of Linear ways/Linear roller ways, you can easily specify the identification number used for ordering.

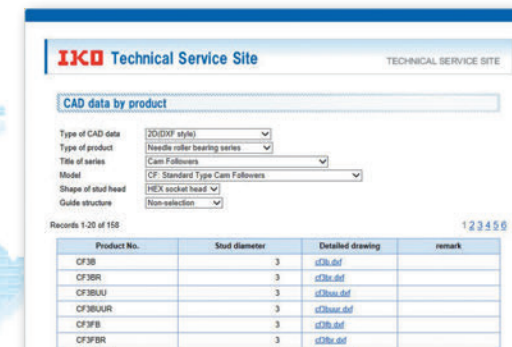
Also you can browse the CAD data of the selected products, calculate the load, and output the selection results in PDF format, as well as save the histories.



## 3. Downloading CAD data

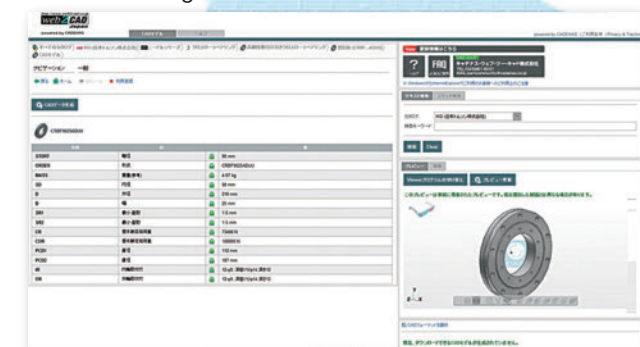
### 2-dimensional CAD data (DXF file)

There are two types of figures, brief figure and detailed figure. The brief figure shows only the external view lines, and the detailed figure shows the detailed lines. The drawing consists of three drawings: front view, side view and plain view. The scale shows only the original size (1:1), and it does not show dimension lines.



### 3-dimensional CAD data

It is linked to the mechanical parts CAD library "PART community". Entering the rail dimension and option contents to the detail, you can view the 2D/3D CAD data suitable for the specification for free of charge.



## 4. Downloading Catalog and Operation Manual

You can download product catalogs of needle series, linear motion rolling guide series and mechatronics series, operation manuals of precision positioning tables and various electrical components in PDF format, as well as support software for precision positioning tables. If you would like a copy of our catalog, please visit the IKO official website and apply for the catalog, or contact our regional office or sales office nearby.

Index of Model Codes

| A          |     |                                      |
|------------|-----|--------------------------------------|
| AR         | L21 | Cir-clips for Needle Roller Bearings |
| AS         | F7  | Thrust Bearings                      |
| AZ         | F11 | Thrust Bearings                      |
| AZK        | F11 | Thrust Bearings                      |
|            |     |                                      |
| B          |     |                                      |
| BA...Z     | B27 | Shell Type Needle Roller Bearings    |
| BAM        | B27 | Shell Type Needle Roller Bearings    |
| BAMW       | B45 | Shell Type Needle Roller Bearings    |
| BAW...Z    | B45 | Shell Type Needle Roller Bearings    |
| BHA...Z    | B27 | Shell Type Needle Roller Bearings    |
| BHAM       | B27 | Shell Type Needle Roller Bearings    |
| BR         | D47 | Machined Type Needle Roller Bearings |
| BR...UU    | D67 | Machined Type Needle Roller Bearings |
| BRI        | D51 | Machined Type Needle Roller Bearings |
| BRI...UU   | D71 | Machined Type Needle Roller Bearings |
|            |     |                                      |
| C          |     |                                      |
| CF...B     | I25 | Cam Followers                        |
| CF...BM    | I25 | Cam Followers                        |
| CF...BR    | I25 | Cam Followers                        |
| CF...BRM   | I25 | Cam Followers                        |
| CF...BUU   | I25 | Cam Followers                        |
| CF...BUUM  | I25 | Cam Followers                        |
| CF...BUUR  | I25 | Cam Followers                        |
| CF...BUURM | I25 | Cam Followers                        |
| CF...FB    | I29 | Cam Followers                        |
| CF...FBR   | I29 | Cam Followers                        |
| CF...FBUU  | I29 | Cam Followers                        |
| CF...FBUUR | I29 | Cam Followers                        |
| CF...FWBR  | I47 | Cam Followers                        |

|               |     |                      |
|---------------|-----|----------------------|
| CF...FWBUUR   | I47 | Cam Followers        |
| CF...G        | I53 | Cam Followers        |
| CF...VB       | I27 | Cam Followers        |
| CF...VBM      | I27 | Cam Followers        |
| CF...VBR      | I27 | Cam Followers        |
| CF...VBRM     | I27 | Cam Followers        |
| CF...VBUU     | I27 | Cam Followers        |
| CF...VBUUM    | I27 | Cam Followers        |
| CF...VBUUR    | I27 | Cam Followers        |
| CF...VBUURM   | I27 | Cam Followers        |
| CF...WBR      | I45 | Cam Followers        |
| CF...WBUUR    | I45 | Cam Followers        |
| CF...WBUUR/SG | I55 | C-Lube Cam Followers |
| CF-FU1        | I49 | Cam Followers        |
| CF-RU1        | I49 | Cam Followers        |
| CF-SFU...B    | I51 | Cam Followers        |
| CFE...B       | I35 | Cam Followers        |
| CFE...BR      | I35 | Cam Followers        |
| CFE...BUU     | I35 | Cam Followers        |
| CFE...BUUR    | I35 | Cam Followers        |
| CFE...VB      | I37 | Cam Followers        |
| CFE...VBR     | I37 | Cam Followers        |
| CFE...VBUU    | I37 | Cam Followers        |
| CFE...VBUUR   | I37 | Cam Followers        |
| CFES...B      | I43 | Cam Followers        |
| CFES...BR     | I43 | Cam Followers        |
| CFES...BUU    | I43 | Cam Followers        |
| CFES...BUUR   | I43 | Cam Followers        |
| CFKR          | I31 | Cam Followers        |
| CFKR...R      | I31 | Cam Followers        |
| CFKR...V      | I33 | Cam Followers        |
| CFKR...VR     | I33 | Cam Followers        |
| CFKR...VUU    | I33 | Cam Followers        |
| CFKR...VUUR   | I33 | Cam Followers        |

Index of Model Codes

|              |     |                               |
|--------------|-----|-------------------------------|
| CFKR...UU    | I31 | Cam Followers                 |
| CFKR...UUR   | I31 | Cam Followers                 |
| CFKRE        | I39 | Cam Followers                 |
| CFKRE...R    | I39 | Cam Followers                 |
| CFKRE...V    | I41 | Cam Followers                 |
| CFKRE...VR   | I41 | Cam Followers                 |
| CFKRE...VUU  | I41 | Cam Followers                 |
| CFKRE...VUUR | I41 | Cam Followers                 |
| CFKRE...UU   | I39 | Cam Followers                 |
| CFKRE...UUR  | I39 | Cam Followers                 |
| CFS          | I57 | Miniature Type Cam Followers  |
| CFS...F      | I59 | Miniature Type Cam Followers  |
| CFS...FW     | I63 | Miniature Type Cam Followers  |
| CFS...FV     | I59 | Miniature Type Cam Followers  |
| CFS...V      | I57 | Miniature Type Cam Followers  |
| CFS...W      | I61 | Miniature Type Cam Followers  |
| CFS...WV     | I61 | Miniature Type Cam Followers  |
| CL           | I22 | C-Lube Unit for Cam Followers |
| CR           | I69 | Cam Followers                 |
| CR...B       | I67 | Cam Followers                 |
| CR...BR      | I67 | Cam Followers                 |
| CR...BUU     | I67 | Cam Followers                 |
| CR...BUUR    | I67 | Cam Followers                 |
| CR...R       | I69 | Cam Followers                 |
| CR...UU      | I69 | Cam Followers                 |
| CR...UUR     | I69 | Cam Followers                 |
| CR...V       | I75 | Cam Followers                 |
| CR...VB      | I71 | Cam Followers                 |
| CR...VBS     | I73 | Cam Followers                 |
| CR...VBSR    | I73 | Cam Followers                 |
| CR...VBR     | I71 | Cam Followers                 |
| CR...VBUU    | I71 | Cam Followers                 |
| CR...VBUUR   | I71 | Cam Followers                 |
| CR...VR      | I75 | Cam Followers                 |

|             |      |                         |
|-------------|------|-------------------------|
| CR...VUU    | I75  | Cam Followers           |
| CR...VUUR   | I75  | Cam Followers           |
| CRB         | J19  | Crossed Roller Bearings |
| CRB...UU    | J19  | Crossed Roller Bearings |
| CRBC        | J19  | Crossed Roller Bearings |
| CRBC...UU   | J19  | Crossed Roller Bearings |
| CRBFV       | J17  | Crossed Roller Bearings |
| CRBHV...A   | J15  | Crossed Roller Bearings |
| CRBHV...AUU | J15  | Crossed Roller Bearings |
| CRBS        | J27  | Crossed Roller Bearings |
| CRBS...AUU  | J27  | Crossed Roller Bearings |
| CRBS...V    | J27  | Crossed Roller Bearings |
| CRBS...VUU  | J27  | Crossed Roller Bearings |
| CRBT...A    | J23  | Crossed Roller Bearings |
| CRBTF...A   | J25  | Crossed Roller Bearings |
| CRH...VB    | I79  | Cam Followers           |
| CRH...VBR   | I77  | Cam Followers           |
| CRH...VBUU  | I79  | Cam Followers           |
| CRH...VBUUR | I77  | Cam Followers           |
| CRY...V     | I105 | Roller Followers        |
| CRY...VR    | I103 | Roller Followers        |
| CRY...VUU   | I105 | Roller Followers        |
| CRY...VUUR  | I103 | Roller Followers        |

| D           |     |                                  |
|-------------|-----|----------------------------------|
| DS          | L4  | Seals for Needle Roller Bearings |
| G           |     |                                  |
| GE...E      | K15 | Spherical Bushings               |
| GE...EC     | K27 | Spherical Bushings               |
| GE...EC-2RS | K27 | Spherical Bushings               |
| GE...ES     | K15 | Spherical Bushings               |
| GE...ES-2RS | K15 | Spherical Bushings               |
| GE...G      | K19 | Spherical Bushings               |



Index of Model Codes

|             |     |                                                |
|-------------|-----|------------------------------------------------|
| GE···GS     | K19 | Spherical Bushings                             |
| GE···GS-2RS | K19 | Spherical Bushings                             |
| GS          | F7  | Thrust Bearings                                |
| GTR         | D9  | Machined Type Needle Roller Bearings           |
| GTRI        | D31 | Machined Type Needle Roller Bearings           |
| I           |     |                                                |
| IRB         | H10 | Inner Rings                                    |
| IRT         | H5  | Inner Rings                                    |
|             |     |                                                |
|             |     |                                                |
| K           |     |                                                |
| KT          | C5  | Needle Roller Cages for General Usage          |
| KT···EG     | C21 | Needle Roller Cages for Engine Connecting Rods |
| KTV···EG    | C22 | Needle Roller Cages for Engine Connecting Rods |
| KTW         | C9  | Needle Roller Cages for General Usage          |
|             |     |                                                |
|             |     |                                                |
| L           |     |                                                |
| LHS         | K51 | L-Balls                                        |
| LHSA        | K49 | L-Balls                                        |
| LRB         | H25 | Inner Rings                                    |
| LRBZ        | H25 | Inner Rings                                    |
| LRBZ···B    | H25 | Inner Rings                                    |
| LRT         | H13 | Inner Rings                                    |
| LRTZ        | H13 | Inner Rings                                    |
|             |     |                                                |
|             |     |                                                |
| N           |     |                                                |
| NA 48       | D41 | Machined Type Needle Roller Bearings           |
| NA 49       | D29 | Machined Type Needle Roller Bearings           |
| NA 49···UU  | D61 | Machined Type Needle Roller Bearings           |
| NA 69       | D29 | Machined Type Needle Roller Bearings           |
| NA 69···UU  | D61 | Machined Type Needle Roller Bearings           |
| NAF         | D89 | Needle Roller Bearings with Separable Cage     |

|               |      |                                            |
|---------------|------|--------------------------------------------|
| NAFW          | D89  | Needle Roller Bearings with Separable Cage |
| NAG 49        | E7   | Roller Bearings                            |
| NAG 49···UU   | E13  | Roller Bearings                            |
| NART···FR     | I97  | Roller Followers                           |
| NART···FUUR   | I97  | Roller Followers                           |
| NART···R      | I93  | Roller Followers                           |
| NART···UUR    | I93  | Roller Followers                           |
| NART···UUR/SG | I99  | C-Lube Roller Followers                    |
| NART···VR     | I93  | Roller Followers                           |
| NART···VUUR   | I93  | Roller Followers                           |
| NAS 50···UUNR | E19  | Roller Bearings                            |
| NAS 50···ZZNR | E19  | Roller Bearings                            |
| NAST          | I90  | Roller Followers                           |
| NAST···R      | I90  | Roller Followers                           |
| NAST···ZZ     | I91  | Roller Followers                           |
| NAST···ZZR    | I91  | Roller Followers                           |
| NAST···ZZUU   | I91  | Roller Followers                           |
| NAST···ZZUUR  | I91  | Roller Followers                           |
| NATA 59       | G9   | Combined Type Needle Roller Bearings       |
| NATB 59       | G9   | Combined Type Needle Roller Bearings       |
| NAU 49        | E7   | Roller Bearings                            |
| NAU 49···UU   | E13  | Roller Bearings                            |
| NAX           | G5   | Combined Type Needle Roller Bearings       |
| NAX···Z       | G5   | Combined Type Needle Roller Bearings       |
| NAXI          | G7   | Combined Type Needle Roller Bearings       |
| NAXI···Z      | G7   | Combined Type Needle Roller Bearings       |
| NBX           | G5   | Combined Type Needle Roller Bearings       |
| NBX···Z       | G5   | Combined Type Needle Roller Bearings       |
| NBXI          | G7   | Combined Type Needle Roller Bearings       |
| NBXI···Z      | G7   | Combined Type Needle Roller Bearings       |
| NTB           | F7   | Thrust Needle bearings                     |
| NUCF···BR     | I65  | Cam Followers                              |
| NURT          | I101 | Roller Followers                           |
| NURT···R      | I101 | Roller Followers                           |

Index of Model Codes

|             |     |                                            |
|-------------|-----|--------------------------------------------|
| O           |     |                                            |
| OS          | L3  | Seals for Needle Roller Bearings           |
|             |     |                                            |
|             |     |                                            |
| P           |     |                                            |
| PB          | K37 | PILLOBALLs                                 |
| PHS         | K38 | PILLOBALLs                                 |
| PHS···EC    | K43 | PILLOBALLs                                 |
| PHSA        | K42 | PILLOBALLs                                 |
| PHSB        | K40 | PILLOBALLs                                 |
| POS         | K39 | PILLOBALLs                                 |
| POSB        | K41 | PILLOBALLs                                 |
| POS···EC    | K44 | PILLOBALLs                                 |
| PRC         | K53 | PILLOBALLs                                 |
|             |     |                                            |
|             |     |                                            |
| R           |     |                                            |
| RNA 48      | D23 | Machined Type Needle Roller Bearings       |
| RNA 49      | D7  | Machined Type Needle Roller Bearings       |
| RNA 49···UU | D55 | Machined Type Needle Roller Bearings       |
| RNA 69      | D9  | Machined Type Needle Roller Bearings       |
| RNA 69···UU | D55 | Machined Type Needle Roller Bearings       |
| RNAF        | D83 | Needle Roller Bearings with Separable Cage |
| RNAFW       | D83 | Needle Roller Bearings with Separable Cage |
| RNAST       | I89 | Roller Followers                           |
| RNAST···R   | I89 | Roller Followers                           |
|             |     |                                            |
|             |     |                                            |
| S           |     |                                            |
| SB          | K11 | Spherical Bushings                         |
| SB···A      | K11 | Spherical Bushings                         |
| SBB         | K23 | Spherical Bushings                         |
| SBB···-2RS  | K23 | Spherical Bushings                         |
| SNA         | K58 | Super Flexible Nozzle                      |

|           |     |                                             |
|-----------|-----|---------------------------------------------|
| SNM       | K59 | Super Flexible Nozzle                       |
| SNPT      | K59 | Super Flexible Nozzle                       |
|           |     |                                             |
|           |     |                                             |
| T         |     |                                             |
| TA···Z    | B7  | Shell Type Needle Roller Bearings           |
| TAF       | D7  | Machined Type Needle Roller Bearings        |
| TAF···/SG | D77 | C-Lube Machined Type Needle Roller Bearings |
| TAFI      | D29 | Machined Type Needle Roller Bearings        |
| TAM       | B7  | Shell Type Needle Roller Bearings           |
| TAMW      | B21 | Shell Type Needle Roller Bearings           |
| TAW···Z   | B21 | Shell Type Needle Roller Bearings           |
| TLA···UU  | B49 | Shell Type Needle Roller Bearings           |
| TLA···Z   | B7  | Shell Type Needle Roller Bearings           |
| TLAM      | B7  | Shell Type Needle Roller Bearings           |
| TLAMW     | B17 | Shell Type Needle Roller Bearings           |
| TLAW···Z  | B17 | Shell Type Needle Roller Bearings           |
| TR        | D9  | Machined Type Needle Roller Bearings        |
| TRI       | D31 | Machined Type Needle Roller Bearings        |
| TRU       | E7  | Roller Bearings                             |
| TRU···UU  | E13 | Roller Bearings                             |
|           |     |                                             |
|           |     |                                             |
| W         |     |                                             |
| WR        | L19 | Cir-clips for Needle Roller Bearings        |
| WS        | F7  | Thrust Bearings                             |
|           |     |                                             |
|           |     |                                             |
| Y         |     |                                             |
| YB        | B27 | Shell Type Needle Roller Bearings           |
| YBH       | B29 | Shell Type Needle Roller Bearings           |
| YT        | B7  | Shell Type Needle Roller Bearings           |
| YTL       | B7  | Shell Type Needle Roller Bearings           |
|           |     |                                             |

# Oil Minimum

## IKO Gentle to The Earth

Nippon Thompson Co., Ltd. is working to develop global environment-friendly products.

It is committed to developing products that make its customers' machinery and equipment more reliable, thereby contributing to preserving the global environment.

This development stance manifests well in the keyword "Oil Minimum."

Our pursuit of Oil Minimum has led to the creation of IKO's proprietary family of lubricating parts as "C-Lube."

- IKO Linear Motion Rolling Guides are manufactured through a control system that alleviates their impact on the global environment to meet the quality requirements of ISO 14001 in compliance with the quality requirements level of ISO 9001 for quality improvement.
- The standard products listed in this catalog comply with the specifications of the ten hazardous materials cited in the European RoHS Directive.

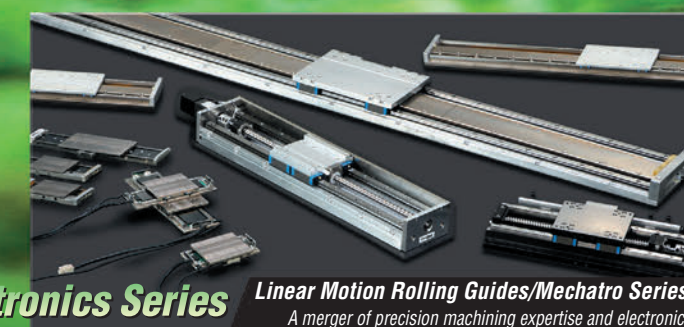
## IKO Products Underpin Sustain Technology Leaps

Nippon Thompson Co., Ltd. was the first Japanese manufacturer to develop needle bearings on its own and has since expanded into the arena of linear motion rolling guides (Linear Motion Series and Mechatro Series) on the support of its advanced expertise. The company now offers a vast assortment of ingenious products, including the world's first C-Lube Maintenance-Free Series, to address increasingly diversified customer needs and thus sustain technology leaps.

## C-Lube Maintenance-Free Series Products Evolving from the "Oil Minimum" Concept

We have developed lubricating parts impregnated with a large amount of lubricant as C-Lube Series to save the customer's oiling management workload and built them into bearings and linear motion rolling guides.

The C-Lube Series not only keeps products maintenance-free for long by giving them an optimal and minimal amount of a lubricant for an extended period of time but also contributes greatly to preserving the global environment.



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