



BEARINGS



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Gifu factory main entrance



Assembling process in a clean room

IKO

Needle Roller Bearing Series

CAT-1607E

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.

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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IKO



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:

❶ 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.

❷ Stable accuracy can be maintained for long periods.

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

❸ Machine reliability is improved.

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

❹ 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:

❶ 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.

❷ 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.

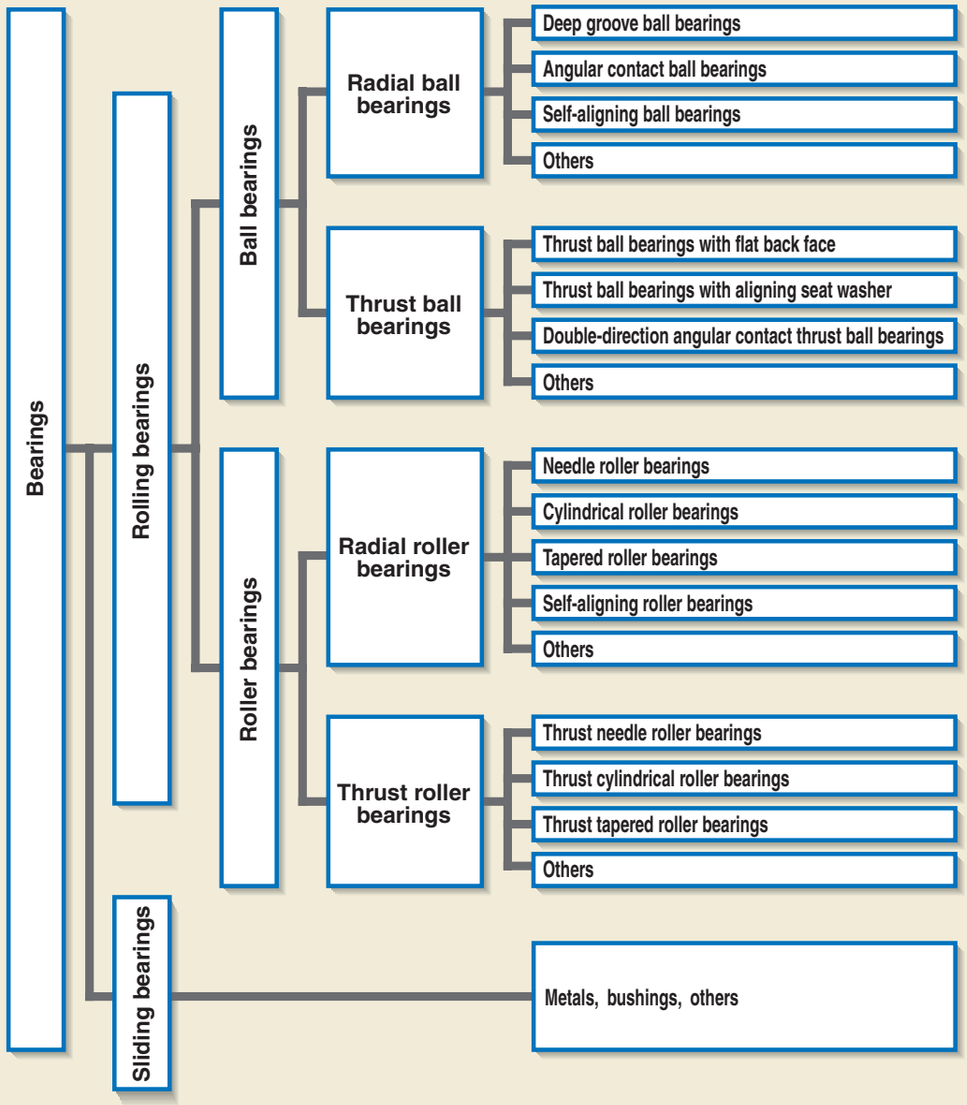
❸ Inertia is minimized.

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

❹ 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

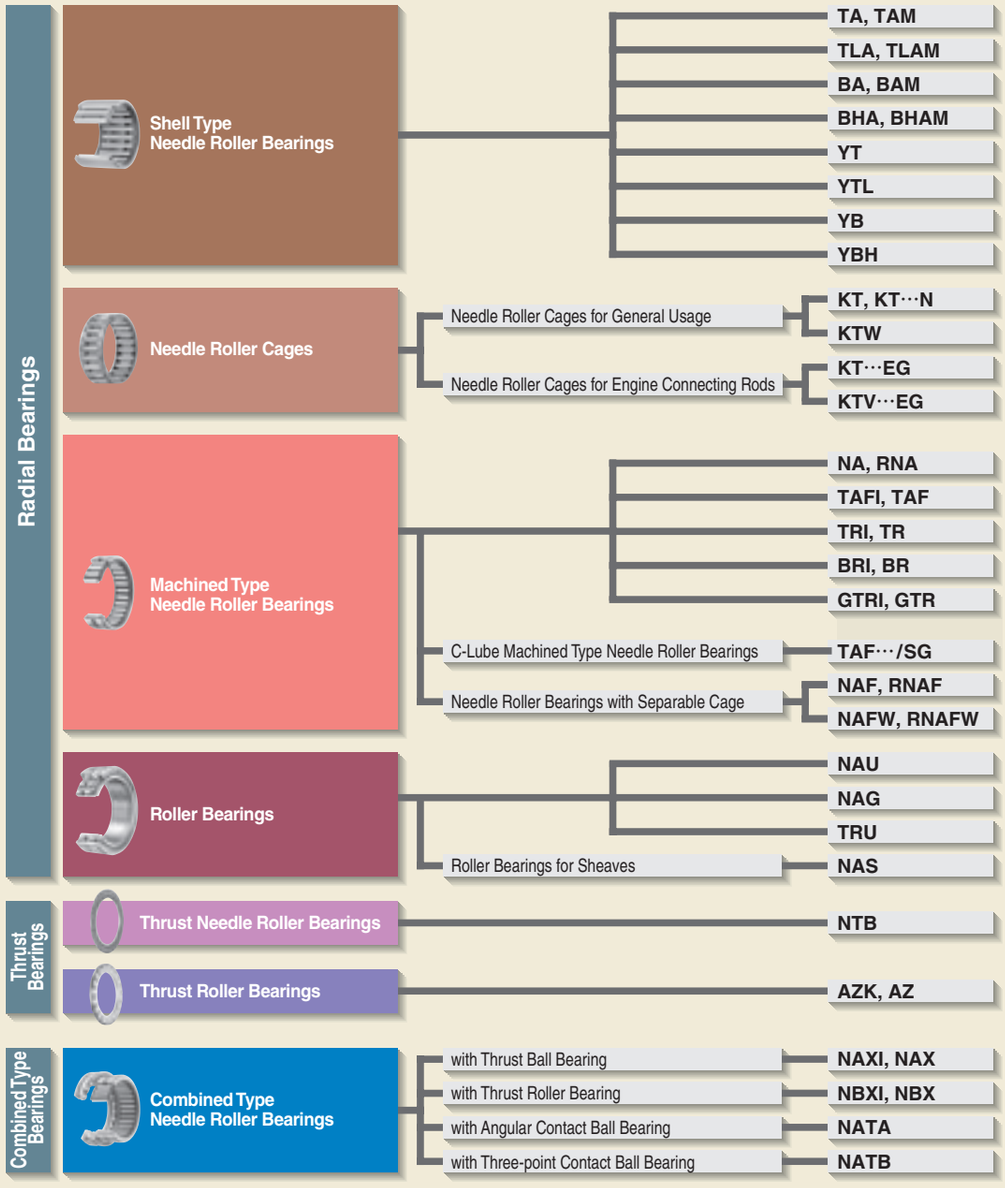


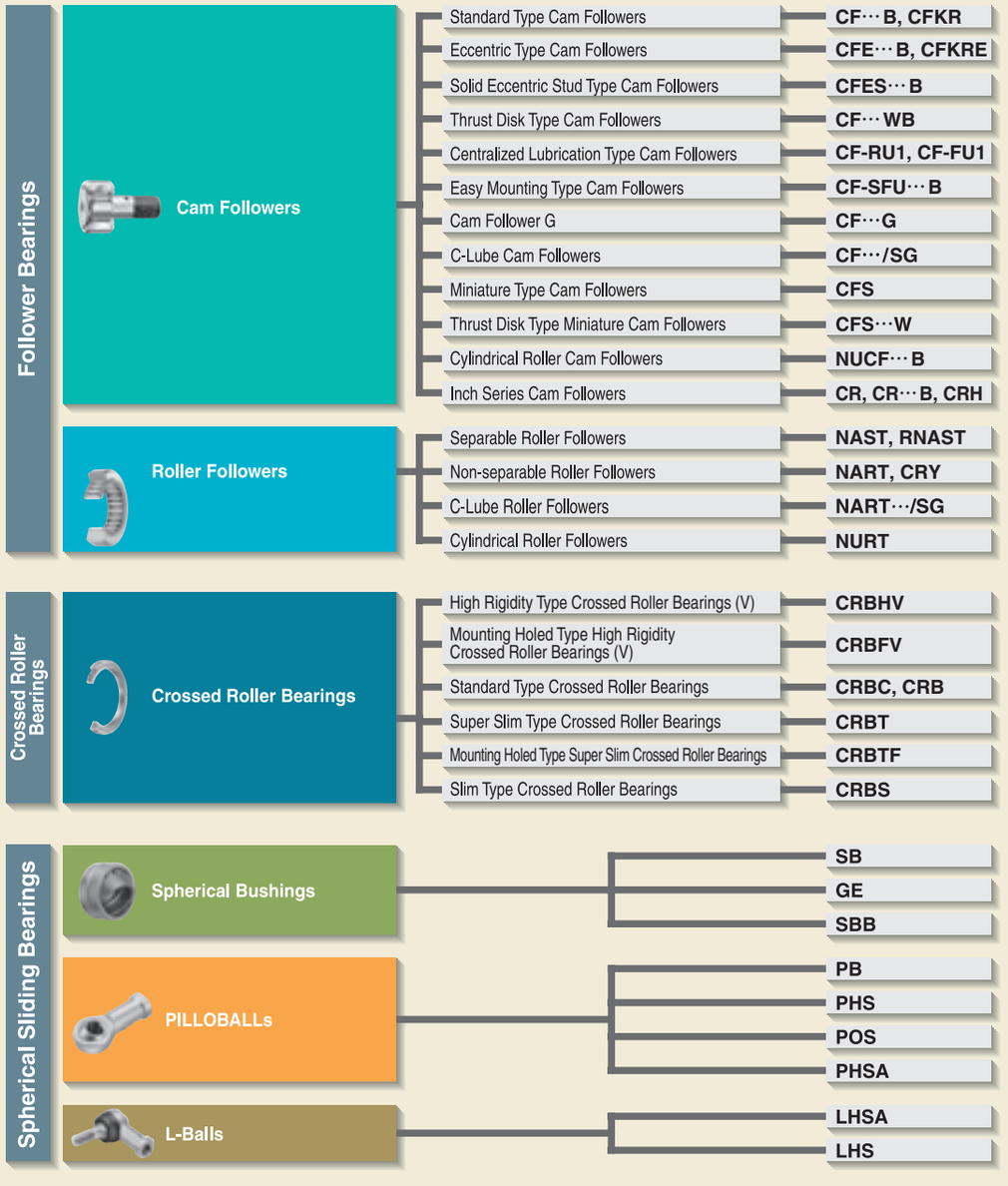
Types and Features of Bearings

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.

Classification of IKO Bearings





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 I83

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 studded 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

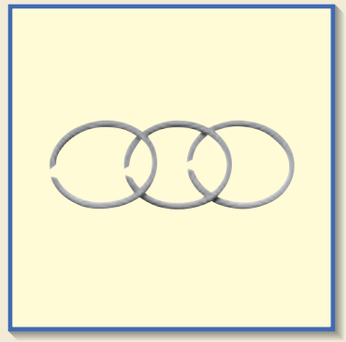
Seals for Needle Roller Bearings



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

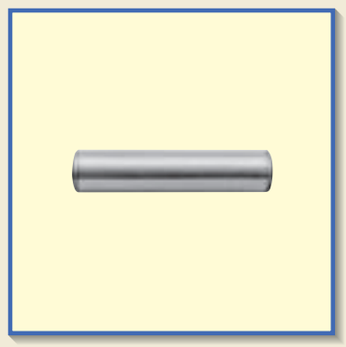
Cir-clips for Needle Roller Bearings



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



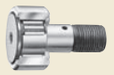
Needle Rollers are used for needle roller bearings and are rigid and highly accurate.
These needle rollers are widely used as rolling elements for bearings, and also as pins and shafts.

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		○	↓	○	○	△	I83～
	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

1 *Confirmation of requirements and operating conditions*
- Identify the machine and place where the bearing is to be used.
- Confirm the requirements for bearings such as required bearing performance, and also confirm the operating conditions and special environment conditions.

2 *Selection of bearing type*
- Select the bearing type suitable for the operating conditions by considering load direction and magnitude, rigidity, friction, allowable rotational speed, bearing space, etc.

See page A5

3 *Selection of bearing dimensions*
- Select the bearing dimensions by calculating bearing load, life, static safety factor, etc.

See page A17

4 *Selection of accuracy class, etc.*
- Select the accuracy as required by the machine or equipment.

See page A30

5 *Selection of radial clearance and fit*
- Select the radial clearance considering the fit, temperature, rotational speed, inclination of the inner and outer rings, etc.

See page A37

6 *Determination of bearing dimensions, accuracy, radial clearance and fit*

7 *Selection of lubrication and dust-proof methods*
- Select oil or grease lubrication.
- After selection of lubricant, in case of oil lubrication, select the oil application method.
- Select the sealing method according to the lubricant.

See page A49

8 *Design of surrounding part*
- Design the surrounding part based on how to mount or dismount and based on mounting dimensions.

See page A57

9 *Determination of final specifications of the bearing and the surrounding part*

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.

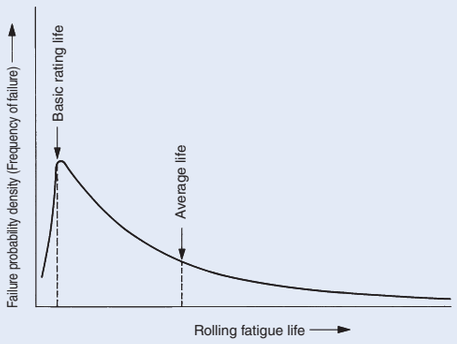


Fig. 1 Variation of rolling fatigue life

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:

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

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:

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

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

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

where, L_h : Basic rating life represented by service hours, h
n : Rotational speed, 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.

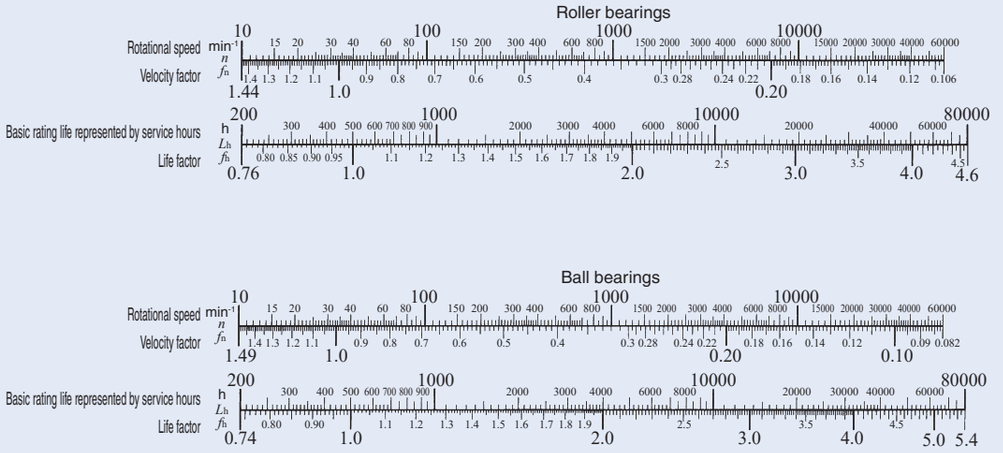


Fig. 2 Scales for rating life calculation

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 • Elevators		
Intermittent operation but for comparatively long periods	• Roll neck of rolling mills	• Small motors • Deck cranes • General cargo cranes • Passenger cars	• Factory motors • Machine tools • General gear units • Printing machines	• Crane sheaves • Compressors • Important gear units	
Operated in excess of 8 hours per day or continuously for an extended time		• Escalators	• Centrifugal separators • Blowers • Wood working machines • Plastic extruding machines		• Paper making machines
Continuous use for 24 hours and accidental stops not allowed					• Water supply equipment • Power station equipment

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

Life of oscillating bearing

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

$$L_{OC} = \frac{90}{\theta}\left(\frac{C}{P}\right)^{p} \cdots\cdots (5)$$

where, L_{OC} : Basic rating life of oscillating bearing, 10^6 cycles
2θ : 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 2θ 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.

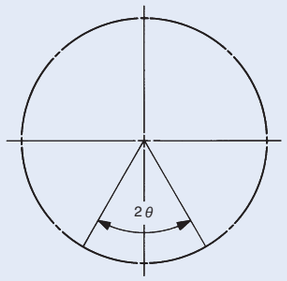


Fig. 3 Oscillating motion

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.

$$L_{na} = a_1 a_2 a_3 L_{10} \cdots\cdots (6)$$

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:

$$C_t = f_t C \cdots\cdots (7)$$

where, C_t : Basic dynamic load rating considering temperature rise, N
f_t : Temperature factor (See Fig. 4.)
C : Basic dynamic load rating, N

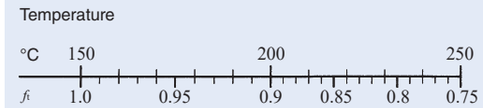


Fig. 4 Temperature factor

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:

$$C_H = f_H C \cdots\cdots (8)$$

where, C_H : Basic dynamic load rating considering hardness, N
f_H : Hardness factor (See Fig. 5.)
C : Basic dynamic load rating N

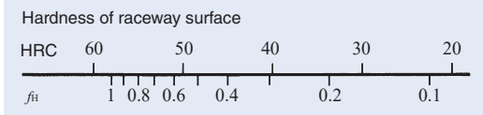


Fig. 5 Hardness factor

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

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.

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

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	≧ 3
For ordinary operation conditions	≧ 1.5
For ordinary operation conditions not requiring very smooth rotation When there is almost no rotation	≧ 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:

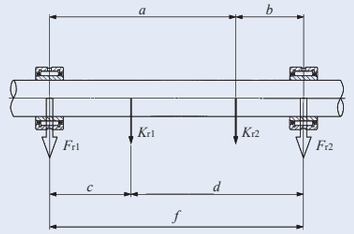
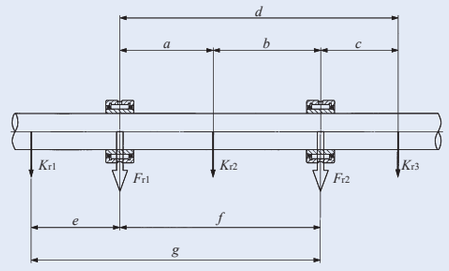
$$F = f_w F_c \quad \cdots\cdots(10)$$

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

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

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:

$$T=9550000\frac{H}{n} \quad \cdots\cdots(11)$$

$$K_t=\frac{T}{R} \quad \cdots\cdots(12)$$

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^{-1}
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.

$$K_r=f_b K_t \quad \cdots\cdots(13)$$

Table 7 Belt factor

Type of belt	f_b
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:

$$T=9550000\frac{H}{n} \quad \cdots\cdots(14)$$

$$K_t=\frac{T}{R} \quad \cdots\cdots(15)$$

$$K_s=K_t\tan\theta \quad \cdots\cdots(16)$$

$$K_c=\sqrt{K_t^2+K_s^2}=K_t\sec\theta \quad \cdots\cdots(17)$$

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^{-1}
R : Pitch circle radius of drive gear, mm
θ : Pressure angle of gear, deg.

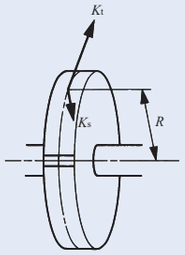


Fig. 6

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.

$$K_r=f_z K_c \quad \cdots\cdots(18)$$

Table 8 Gear factor

Type of gear	f_z
Precision gears (Pitch error and form error: Less than 0.02mm)	1.05～1.1
Ordinary machined gears (Pitch error and form error: 0.02～0.1mm)	1.1 ～1.3

Mean equivalent load corresponding to fluctuating load

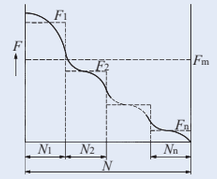
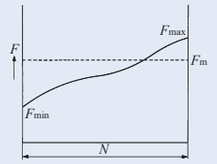
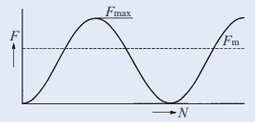
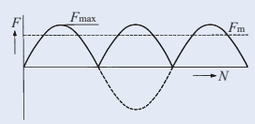
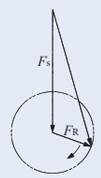
When the load applied to the bearing fluctuates, the bearing life is calculated by using the mean equivalent load F_m, which is a constant load that will give the bearing a life equal to that produced under the fluctuating load. The mean equivalent load is obtained from the following equation:

$$F_m=\sqrt[p]{\frac{1}{N}\int_0^N F_n^{\,p}\,dN} \quad \cdots\cdots(19)$$

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_m
Step load		$F_m=\sqrt[p]{\frac{1}{N}(F_1^{\,p}N_1+F_2^{\,p}N_2+\cdots+F_n^{\,p}N_n)}$ where, N_1 : Total number of revolutions under load F_1 rev. N_2 : Total number of revolutions under load F_2 rev. N_n : Total number of revolutions under load F_n rev.
Monotonously changing load		$F_m=\frac{1}{3}(2F_{max}+F_{min})$ where, F_{max} : Maximum value of fluctuating load, N F_{min} : Minimum value of fluctuating load, N
Sinusoidally fluctuating load		$F_m \fallingdotseq 0.65F_{max}$
		$F_m \fallingdotseq 0.75F_{max}$
Stationary load plus rotating load		$F_m=F_S+F_R-\frac{F_S F_R}{F_S+F_R}$ where, F_S : Stationary load, N F_R : Rotating load, N

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

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]

$$P_r = F_r \quad \cdots\cdots(20)$$

[For thrust bearings]

$$P_a = F_a \quad \cdots\cdots(21)$$

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]

$$P_{0r} = F_r \quad \cdots\cdots(22)$$

[For thrust bearings]

$$P_{0a} = F_a \quad \cdots\cdots(23)$$

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

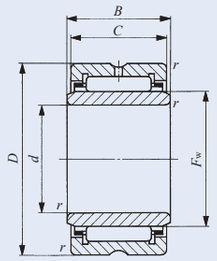


Fig. 7 Machined Type Needle Roller Bearing

Shell Type Needle Roller Bearing

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

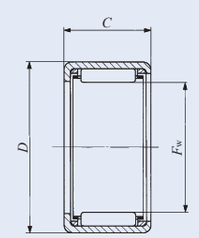


Fig. 8 Shell Type Needle Roller Bearing

Needle Roller Cage

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

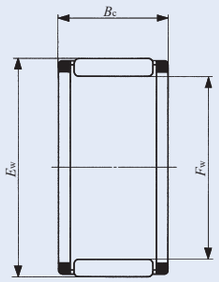


Fig. 9 Needle Roller Cage

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

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	❶
	Boundary dimensions	❷
Supplemental code	Material symbol	❸
	Cage symbol	❹
	Shield symbol Seal symbol,	❺
	Bearing ring shape symbol	❻
	Clearance symbol	❼
	Classification symbol	❽

❶Model code

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

❷Boundary 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

❸Material symbol

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

❹Cage symbol

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

❺Seal 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(1)	With ThrustDisk Seals
2RS	With seals on both sides

Note(1) ThrustDisk Seals are embedded on both sides.

❻Bearing ring shape symbol

Symbol	Descriptions
NR	With stop ring on outer surface of outer ring
OH(1)	With oil hole in bearing ring
J	No oil hole

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

❼Clearance symbol

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

❽Classification 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

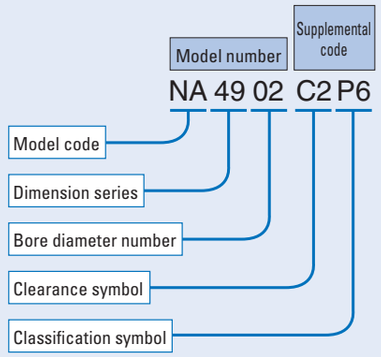
Bearing type	Model number	
	Model code	Indication of boundary dimensions
Shell Type Needle Roller Bearings	TA, TLA, YT, YTL	Roller set bore diameter + Outer ring width
	BA, BHA, YB, YBH	Roller set bore diameter + Outer ring width (1)
Needle Roller Cages for General Usage	KT, KTW	Roller set bore diameter + 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 (1)
	BRI	Bearing bore diameter + Bearing outside diameter + Outer ring width (1)
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 (1)
Roller Followers	NAST, NART, NURT	Bearing bore diameter
	CRY	Bearing outside diameter (1)
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 (1)
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(1) The nominal dimensions of inch series bearings are indicated in units of 1/16 inch.

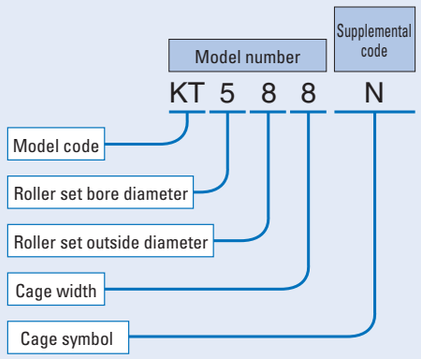
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Example of identification number

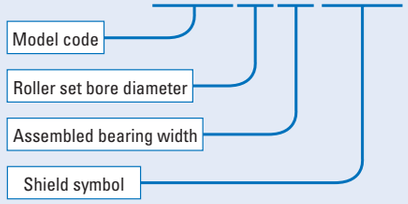
(a) Example of "Dimension series + Bore diameter number"



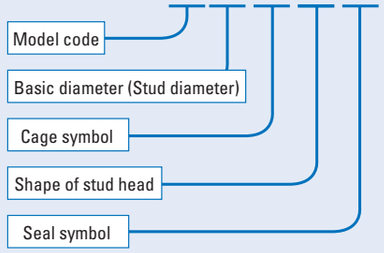
(b) Example of "Bore diameter or roller set bore diameter + Outside diameter or roller set outside diameter + width"



(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 Δ 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_{dp} 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).

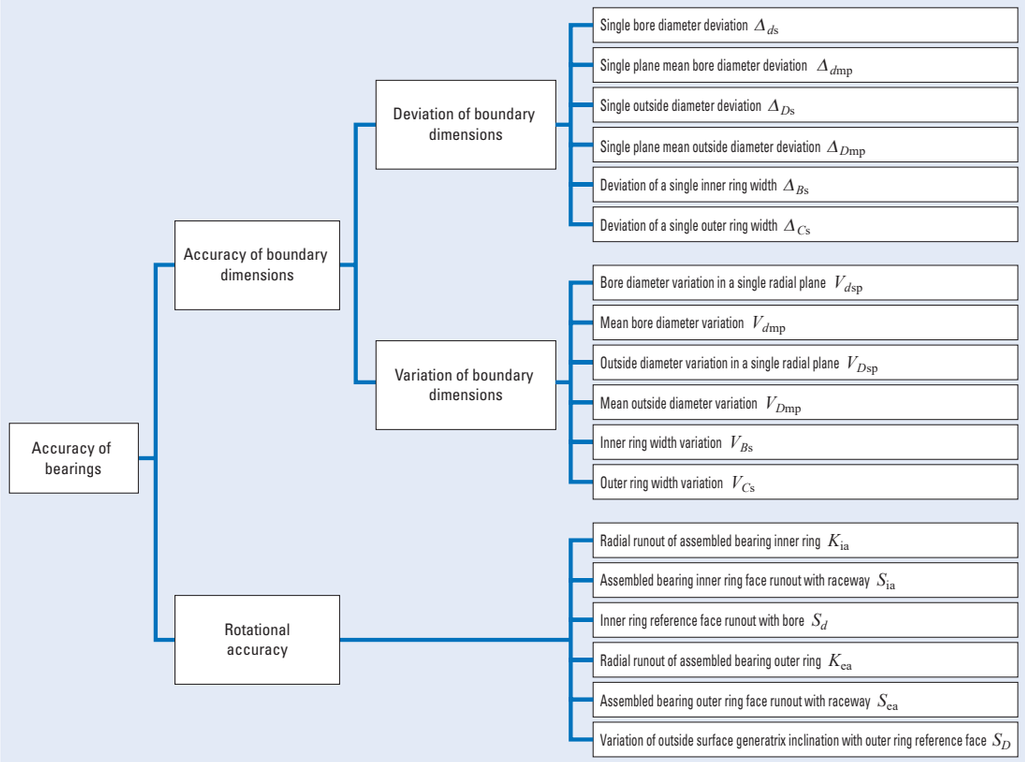


Fig. 11 Accuracy of bearings

Table 12 Tolerances for inner ring

unit: μm

d Nominal bearing bore diameter		Δ_{dmp} Single plane mean bore diameter deviation								Δ_{ds} Single bore diameter deviation		V_{dsp} Bore diameter variation in a single radial plane								V_{dmp} Mean bore diameter variation			
												Diameter series 8, 9(1)				Diameter series 0(2)							
mm		Class 0		Class 6		Class 5		Class 4		Class 4		Class 0	Class 6	Class 5	Class 4	Class 0	Class 6	Class 5	Class 4	Class 0	Class 6	Class 5	Class 4
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low	Max.				Max.				Max.			
2.5	10	0	- 8	0	- 7	0	- 5	0	- 4	0	- 4	10	9	5	4	8	7	4	3	6	5	3	2
10	18	0	- 8	0	- 7	0	- 5	0	- 4	0	- 4	10	9	5	4	8	7	4	3	6	5	3	2
18	30	0	- 10	0	- 8	0	- 6	0	- 5	0	- 5	13	10	6	5	10	8	5	4	8	6	3	2.5
30	50	0	- 12	0	- 10	0	- 8	0	- 6	0	- 6	15	13	8	6	12	10	6	5	9	8	4	3
50	80	0	- 15	0	- 12	0	- 9	0	- 7	0	- 7	19	15	9	7	19	15	7	5	11	9	5	3.5
80	120	0	- 20	0	- 15	0	- 10	0	- 8	0	- 8	25	19	10	8	25	19	8	6	15	11	5	4
120	180	0	- 25	0	- 18	0	- 13	0	- 10	0	- 10	31	23	13	10	31	23	10	8	19	14	7	5
180	250	0	- 30	0	- 22	0	- 15	0	- 12	0	- 12	38	28	15	12	38	28	12	9	23	17	8	6
250	315	0	- 35	0	- 25	0	- 18					44	31	18		44	31	14		26	19	9	
315	400	0	- 40	0	- 30	0	- 23					50	38	23		50	38	18		30	23	12	
400	500	0	- 45	0	- 35							56	44			56	44			34	26		
500	630	0	- 50	0	- 40							63	50			63	50			38	30		
630	800	0	- 75																				
800	1000	0	- 100																				
1000	1250	0	- 125																				
1250	1600	0	- 160																				
1600	2000	0	- 200																				

K_{ia} Radial runout of assembled bearing inner ring				S_d Inner ring reference face runout with bore		S_{ia}(3) Assembled bearing inner ring face runout with raceway		Δ_{Bs} Deviation of a single inner ring width								V_{Bs} Inner ring width variation				d Nominal bearing bore diameter	
Class 0	Class 6	Class 5	Class 4	Class 5	Class 4	Class 5	Class 4	Class 0		Class 6		Class 5		Class 4		Class 0	Class 6	Class 5	Class 4	mm	
Max.				Max.		Max.		High	Low	High	Low	High	Low	High	Low	Max.				Over	Incl.
10	6	4	2.5	7	3	7	3	0	- 120	0	- 120	0	- 40	0	- 40	15	15	5	2.5	2.5	10
10	7	4	2.5	7	3	7	3	0	- 120	0	- 120	0	- 80	0	- 80	20	20	5	2.5	10	18
13	8	4	3	8	4	8	4	0	- 120	0	- 120	0	- 120	0	- 120	20	20	5	2.5	18	30
15	10	5	4	8	4	8	4	0	- 120	0	- 120	0	- 120	0	- 120	20	20	5	3	30	50
20	10	5	4	8	5	8	5	0	- 150	0	- 150	0	- 150	0	- 150	25	25	6	4	50	80
25	13	6	5	9	5	9	5	0	- 200	0	- 200	0	- 200	0	- 200	25	25	7	4	80	120
30	18	8	6	10	6	10	7	0	- 250	0	- 250	0	- 250	0	- 250	30	30	8	5	120	180
40	20	10	8	11	7	13	8	0	- 300	0	- 300	0	- 300	0	- 300	30	30	10	6	180	250
50	25	13		13		15		0	- 350	0	- 350	0	- 350			35	35	13		250	315
60	30	15		15		20		0	- 400	0	- 400	0	- 400			40	40	15		315	400
65	35							0	- 450	0	- 450					50	45			400	500
70	40							0	- 500	0	- 500					60	50			500	630
80								0	- 750							70				630	800
90								0	- 1000							80				800	1000
100								0	- 1250							100				1000	1250
120								0	- 1600							120				1250	1600
140								0	- 2000							140				1600	2000

Note(1) Applicable to all series except NAS series
(2) Applicable to NAS series
(3) Applicable to NATA and NATB series

Table 13 Tolerances for outer ring

unit: μm

D Nominal bearing outside diameter		Δ_{Dmp} Single plane mean outside diameter deviation								Δ_{Ds} Single outside diameter deviation		V_{Dsp}(1) Outside diameter variation in a single radial plane											
												Open bearing								Bearing with seal or shield			
												Diameter series 8, 9(2)				Diameter series 0(3)				Diameter series 0(3)			
mm		Class 0		Class 6		Class 5		Class 4		Class 4		Class 0	Class 6	Class 5	Class 4	Class 0	Class 6	Class 5	Class 4	Class 6			
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low	Max.				Max.				Max.			
2.5	6	0	- 8	0	- 7	0	- 5	0	- 4	0	- 4	10	9	5	4	8	7	4	3	9			
6	18	0	- 8	0	- 7	0	- 5	0	- 4	0	- 4	10	9	5	4	8	7	4	3	9			
18	30	0	- 9	0	- 8	0	- 6	0	- 5	0	- 5	12	10	6	5	9	8	5	4	10			
30	50	0	- 11	0	- 9	0	- 7	0	- 6	0	- 6	14	11	7	6	11	9	5	5	13			
50	80	0	- 13	0	- 11	0	- 9	0	- 7	0	- 7	16	14	9	7	13	11	7	5	16			
80	120	0	- 15	0	- 13	0	- 10	0	- 8	0	- 8	19	16	10	8	19	16	8	6	20			
120	150	0	- 18	0	- 15	0	- 11	0	- 9	0	- 9	23	19	11	9	23	19	8	7	25			
150	180	0	- 25	0	- 18	0	- 13	0	- 10	0	- 10	31	23	13	10	31	23	10	8	30			
180	250	0	- 30	0	- 20	0	- 15	0	- 11	0	- 11	38	25	15	11	38	25	11	8				
250	315	0	- 35	0	- 25	0	- 18	0	- 13	0	- 13	44	31	18	13	44	31	14	10				
315	400	0	- 40	0	- 28	0	- 20	0	- 15	0	- 15	50	35	20	15	50	35	15	11				
400	500	0	- 45	0	- 33	0	- 23					56	41	23		56	41	17					
500	630	0	- 50	0	- 38	0	- 28					63	48	28		63	48	21					
630	800	0	- 75	0	- 45	0	- 35					94	56	35		94	56	26					
800	1000	0	- 100	0	- 60							125	75			125	75						
1000	1250	0	- 125																				
1250	1600	0	- 160																				
1600	2000	0	- 200																				
2000	2500	0	- 250																				

V_{Dmp} Mean outside diameter variation				K_{ea} Radial runout of assembled bearing outer ring				S_D Variation of outside surface generatrix inclination with outer ring reference face		S_{ea}(4) Assembled bearing outer ring face runout with raceway		Δ_{Cs} Deviation of a single outer ring width		V_{Cs} Outer ring width variation				D Nominal bearing outside diameter	
Class 0	Class 6	Class 5	Class 4	Class 0	Class 6	Class 5	Class 4	Class 5	Class 4	Class 5	Class 4	Class 0, 6, 5, 4		Class 0	Class 6	Class 5	Class 4	mm	
Max.				Max.				Max.		Max.		High	Low	Max.				Over	Incl.
6	5	3	2	15	8	5	3	8	4	8	5					5	2.5	2.5	6
6	5	3	2	15	8	5	3	8	4	8	5					5	2.5	6	18
7	6	3	2.5	15	9	6	4	8	4	8	5					5	2.5	18	30
8	7	4	3	20	10	7	5	8	4	8	5					5	2.5	30	50
10	8	5	3.5	25	13	8	5	8	4	10	5					6	3	50	80
11	10	5	4	35	18	10	6	9	5	11	6					8	4	80	120
14	11	6	5	40	20	11	7	10	5	13	7					8	5	120	150
19	14	7	5	45	23	13	8	10	5	14	8					8	5	150	180
23	15	8	6	50	25	15	10	11	7	15	10					10	7	180	250
26	19	9	7	60	30	18	11	13	8	18	10					11	7	250	315
30	21	10	8	70	35	20	13	13	8	20	13					13	8	315	400
34	25	12		80	40	23		15		23						15		400	500
38	29	14		100	50	25		18		25						18		500	630
55	34	18		120	60	30		20		30						20		630	800
75	45			140	75													800	1000
				160														1000	1250
				190														1250	1600
				220														1600	2000
				250														2000	2500

Note(1) Classes 0 and 6 are applicable to outer rings without stop rings.
(2) Applicable to all series except NAS series
(3) Applicable to NAS series
(4) Applicable to NATA and NATB series

Same as the tolerance values of Δ_{Bs} for d of the same bearing

Same as the tolerance values of V_{Bs} for d of the same bearing

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

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

F_w Nominal roller set bore diameter mm		$\Delta_{Fws\,min}$ 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

$r_{s\,min}$ Smallest permissible single chamfer dimension	d Nominal bore diameter		$r_{s\,max}$ 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.)

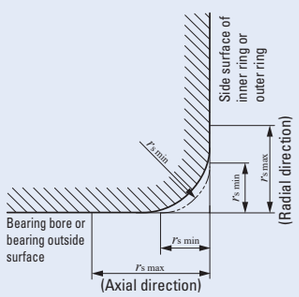
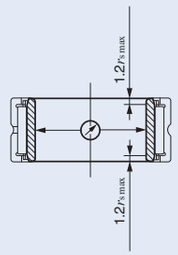
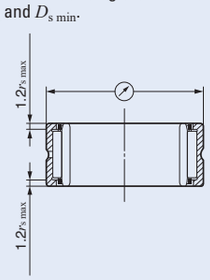


Fig. 12 Permissible values for chamfer dimensions

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. 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} Mean bore diameter in a single plane	Calculated mean value of the maximum and minimum values of the single bore diameter within a radial plane. $d_{mp} = \frac{d_{sp\,max} + d_{sp\,min}}{2}$ d_{sp} : Single bore diameter in a single plane
		Δ_{dmp} Deviation of mean bore diameter in a single plane	Deviation of mean bore diameter in a single plane and nominal bore diameter. $\Delta_{dmp} = d_{mp} - d$ d : Nominal bearing bore diameter
		V_{dsp} Variation of bore diameter in a single plane	Deviation of the maximum and minimum values of the single bore diameter within a radial plane. $V_{dsp} = d_{sp\,max} - d_{sp\,min}$
		V_{dmp} Variation of mean bore diameter	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. $V_{dmp} = d_{mp\,max} - d_{mp\,min}$
		Δ_{ds} Deviation of a single bore diameter	Deviation of single bore diameter and nominal bore diameter. $\Delta_{ds} = d_s - d$ d_s : Single bore diameter (distance between two parallel straight lines touching the intersection of the single bore diameter surface and the radial plane)
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} Mean outside diameter in a single plane	Calculated mean value of the maximum and minimum values of the single outside diameter within a radial plane. $D_{mp} = \frac{D_{sp\,max} + D_{sp\,min}}{2}$ D_{sp} : Single outside diameter in a single plane
		Δ_{Dmp} Deviation of mean outside diameter in a single plane	Deviation of mean outside diameter in a single plane and nominal outside diameter. $\Delta_{Dmp} = D_{mp} - D$ D : Nominal bearing outside diameter
		V_{Dsp} Variation of outside diameter in a single plane	Deviation of the maximum and minimum values of the single outside diameter within a radial plane. $V_{Dsp} = D_{sp\,max} - D_{sp\,min}$
		V_{Dmp} Variation of mean outside diameter	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. $V_{Dmp} = D_{mp\,max} - D_{mp\,min}$
		Δ_{Ds} Deviation of a single outside diameter	Deviation of single outside diameter and nominal outside diameter. $\Delta_{Ds} = D_s - D$ D_s : Single outside diameter (distance between two parallel straight lines touching the intersection of the single outside diameter surface and the radial plane)

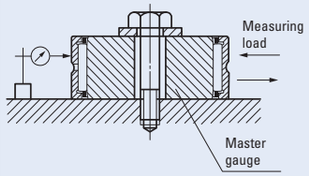
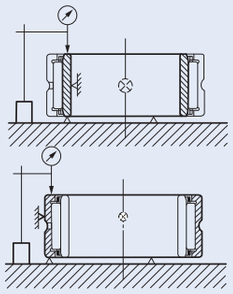
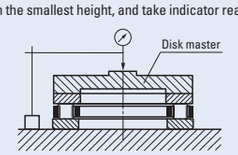
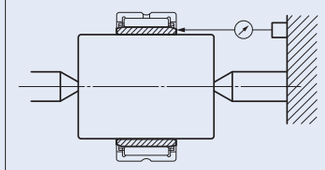
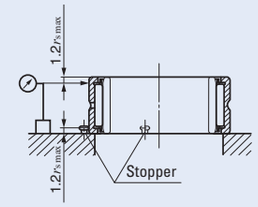
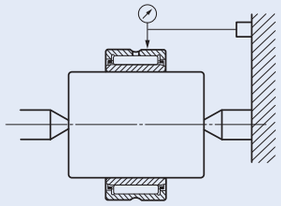
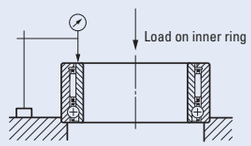
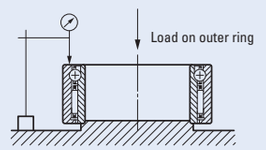
Measurement methods		Accuracy and definitions	
Single bore diameter of rolling element complement	Fasten the master gauge to a surface plate. Position the bearing on the master gauge and apply the indicator in the radial direction near the middle of the width on the ring outside surface. Measure the 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} 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.
		$F_{ws\,min}$ Smallest single bore diameter of roller complement	In radial bearings without inner rings, the minimum value of the single bore diameter of roller complement. 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 $C_{s\,min}$).	Δ_{Bs} Deviation of a single inner ring width	Deviation of single inner ring width and nominal inner ring width. $\Delta_{Bs} = B_s - B$
		V_{Bs} Variation of inner ring width	Deviation of the maximum and minimum values of the single inner ring width for individual inner rings. $V_{Bs} = B_{s\,max} - B_{s\,min}$
Outer ring width		Δ_{Cs} Deviation of a single outer ring width	Deviation of single outer ring width and nominal outer ring width. $\Delta_{Cs} = C_s - C$
		V_{Cs} Variation of outer ring width	Deviation of the maximum and minimum values of the single outer ring width for individual outer rings. $V_{Cs} = C_{s\,max} - C_{s\,min}$
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. 	Δ_{Ts} Deviation of the actual bearing height	Deviation of actual bearing height and nominal bearing height of the thrust bearing. $\Delta_{Ts} = T_s - T$ T_s : Actual bearing height T : Nominal bearing height

Table 17 Measurement methods for rotational accuracy

Accuracy	Measurement methods	
S_d **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 **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} **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} **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} **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} **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.	

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

Clearance

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).

❶Table 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.

❷In 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.

❸For 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 Nominal bore diameter 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. When a loose fit is required for both inner and outer rings. 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.

$$\Delta_C = \Delta_F + \Delta_E \quad \cdots\cdots(24)$$

where, Δ_C : Amount of reduction of the radial clearance, mm
Δ_F : Amount of expansion of the outside diameter of inner ring, mm
Δ_E : Amount of shrinkage of the bore diameter of outer ring, mm

❶Amount of expansion of the outside diameter of inner ring

· With solid shaft

$$\Delta_F = \Delta_{de}\frac{d}{F} \quad \cdots\cdots(25)$$

· With hollow shaft

$$\Delta_F = \Delta_{de}\frac{d}{F}\frac{1-(d_i/d)^2}{1-(d/F)^2\,(d_i/d)^2} \quad \cdots\cdots(26)$$

where, Δ_{de} : Effective interference of inner ring, mm
d : Bore diameter of inner ring, mm
F : Outside diameter of inner ring, mm
d_i : Bore diameter of hollow shaft, mm

❷Amount of shrinkage of the bore diameter of outer ring

· With steel housing $(D_0 = \infty)$

$$\Delta_E = \Delta_{De}\frac{E}{D} \quad \cdots\cdots(27)$$

· With steel housing $(D_0 \neq \infty)$

$$\Delta_E = \Delta_{De}\frac{E}{D}\frac{1-(D/D_0)^2}{1-(E/D)^2\,(D/D_0)^2} \quad \cdots\cdots(28)$$

where, Δ_{De} : Effective interference of outer ring, mm
D : Outside diameter of outer ring, mm
E : Bore diameter of outer ring, mm
D_0 : 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:

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

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

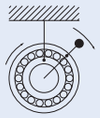
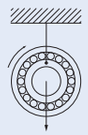
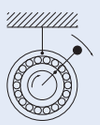
The temperature difference Δ_t is considered to be 5 ~ 10°C under normal operating conditions and 15 ~ 20°C at high rotational speeds. Therefore, when the temperature difference is great, a correspondingly larger radial internal clearance must be selected.

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		Rotating conditions	Fit: Inner ring	Fit: Outer ring
Rotating load on inner ring Stationary load on outer ring		Inner ring : Rotating Outer ring : Stationary Load direction : Fixed	Interference fit	Clearance fit
		Inner ring : Stationary Outer ring : Rotating Load direction : Rotating with outer ring		
Rotating load on outer ring Stationary load on inner ring		Inner ring : Stationary Outer ring : Rotating Load direction : Fixed	Clearance fit	Interference fit
		Inner ring : Rotating Outer ring : Stationary 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 Outer ring : Rotating or stationary Load direction : Not fixed	Interference fit	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.

❶ 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.

❷ 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 $F_r \leqq 0.2C_0$

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

· When $F_r > 0.2C_0$

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

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

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

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

where, Δ_{dT} : Reduction amount of inner ring interference due to temperature difference, mm
Δ_T : Temperature difference between the inside of the bearing and the outside of the housing, °C
α : Coefficient of linear expansion for bearing steel
$\fallingdotseq 12.5 \times 10^{-6}$ 1/°C
d : Bore diameter of inner ring, mm

❹ 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

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

· For machined shaft

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

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

❺ 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) Δ_{df} is expressed by the following equation which is deduced from equations (30) or (31), (32) and (33).

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

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 (1)	Application examples (Reference)
Rotating load on outer ring	Heavy load on thin housing, large shock load	P7 (2)	Flywheels
	Heavy load, normal load	N7 (2)	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(1) 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.
(2) Care should be taken so that the radial internal clearance is not too small.
Remark Light load, normal load and heavy load represent $P \leqq 0.06C$, $0.06C < P \leqq 0.12C$, 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 Over	Shaft dia. mm Incl.	Tolerance class of shaft (1)	Application examples (Reference)
Stationary load on inner ring	Light load, normal load, low or medium rotating speed	All shaft diameters		g6	Wheels on dead axles Control lever gears Rope sheaves Tension pulleys
	Heavy load, medium rotating speed			h6	
	Especially smooth operation and accuracy are required.			h5	
Rotating load on inner ring or Directionally indeterminate load	Light load	— 50 100 200	50 100 200 —	j5 k5 m6 (2) n6 (3)	Electric appliances, Precision machinery Machine tools, Pumps Blowers, Transportation vehicles
	Normal load	— 50 150 200	50 150 200 —	k5 (4) m5, m6 (2) n6 (3) p6 (3)	General bearing applications Pumps, Transmission gearboxes, Wood working machinery, Internal combustion engines
	Heavy load Shock load	— 150	150 —	n6 (3) p6 (3)	Industrial vehicles, Construction machinery Crushers

Notes(1) This table applies to solid steel shafts.
(2) It is necessary to examine the reduction of radial internal clearances caused by the expansion of inner rings after mounting.
(3) It is necessary to use bearings with radial internal clearances greater than CN clearance.
(4) 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 Nominal roller set bore diameter mm		Radial internal clearance		
		Smaller than CN clearance	CN clearance	Larger than CN clearance
Over	Incl.	Tolerance class of shaft (1)		
—	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(1) 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 Nominal outside diameter mm		Δ Dmp Single plane mean outside diameter deviation		G7	H7	J7	K6	K7	M7	N7	P7
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 Nominal bore diameter mm		Δ dmp Single plane mean bore diameter deviation		g6	h5	h6	j5	k5	m5	m6	n6	p6
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	140 160 180	0	-25	-39 ~ 11	-18 ~ 25	-25 ~ 25	-11 ~ 32	3 ~ 46	15 ~ 58	15 ~ 65	27 ~ 77	43 ~ 93
180	200 225 250	0	-30	-44 ~ 15	-20 ~ 30	-29 ~ 30	-13 ~ 37	4 ~ 54	17 ~ 67	17 ~ 76	31 ~ 90	50 ~ 109
250	280 315	0	-35	-49 ~ 18	-23 ~ 35	-32 ~ 35	-16 ~ 42	4 ~ 62	20 ~ 78	20 ~ 87	34 ~ 101	56 ~ 123
315	355 400	0	-40	-54 ~ 22	-25 ~ 40	-36 ~ 40	-18 ~ 47	4 ~ 69	21 ~ 86	21 ~ 97	37 ~ 113	62 ~ 138
400	450 500	0	-45	-60 ~ 25	-27 ~ 45	-40 ~ 45	-20 ~ 52	5 ~ 77	23 ~ 95	23 ~ 108	40 ~ 125	68 ~ 153

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 mm		Tolerance class (1)		
		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(1) 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 (1) or 0.3 × IT5 (1)	0.3 × IT6 (1) or 0.3 × IT5 (1)	0.3 × IT7 (1) or 0.3 × IT6 (1)	0.3 × IT7 (1) or 0.3 × IT6 (1)
Cylindricity	0.5 × IT6 (2) or 0.5 × IT5 (2)	0.3 × IT6 (1) or 0.3 × IT5 (1)	0.5 × IT7 (2) or 0.5 × IT6 (2)	0.3 × IT7 (1) or 0.3 × IT6 (1)
Surface roughness μm R_a (μm R_y)	0.8 (3.2)	0.2 (3) (0.8)	1.6 (6.3)	0.2 (3) (0.8)
Hardness	—	58 ~ 64HRC (4)	—	58 ~ 64HRC (4)

Notes(1) 30% or less of the dimensional tolerance for shafts or housing bores is recommended.
(2) 50% or less of the dimensional tolerance for shafts or housing bores is recommended.
(3) When required accuracy is not critical, a surface roughness within 0.8 μm R_a (3.2 μm R_y) is allowable.
(4) An appropriate thickness of the hardened layer is required.
Remark For tolerance class IT, see Table 27.

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

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.

$$E_{ht} \geqq 0.8D_w(0.1 + 0.002D_w) \quad \cdots\cdots\cdots\cdots(36)$$

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.

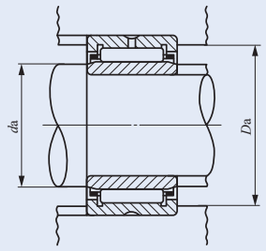


Fig. 13 Dimensions related to mounting

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

unit: mm

$r_{s\,min}$ Smallest permissible single chamfer dimension	$r_{as\,max}$ Largest permissible single corner radius of shafts and housings
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

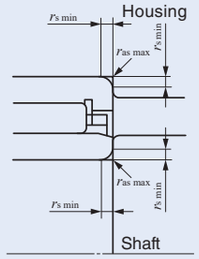
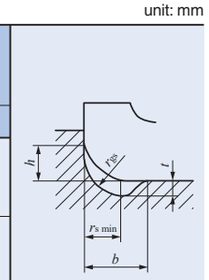


Table 29 Fillet relief dimensions for ground shafts and housings

unit: mm

$r_{s\,min}$ Smallest permissible single chamfer dimension	Fillet relief dimensions		
	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.

❶ 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.

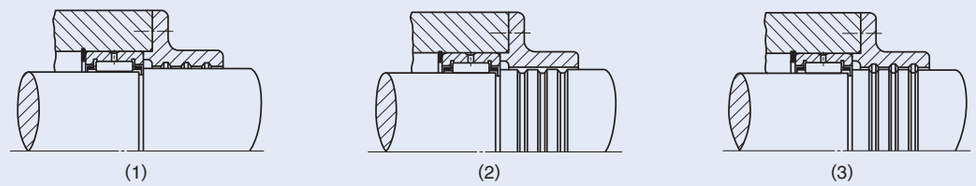


Fig. 14

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

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

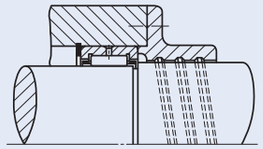


Fig. 15

❷ 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.

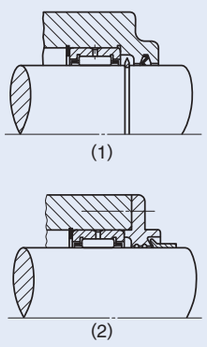


Fig. 16

❸ 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.

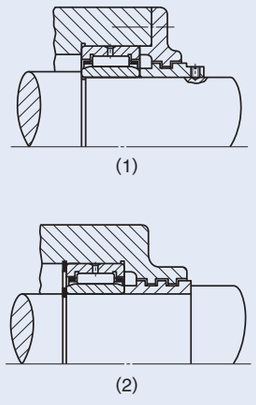


Fig. 17

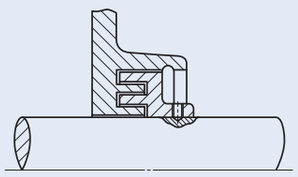


Fig. 18

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.

❶ 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 ℃
Synthetic rubber	Nitrile rubber	− 25 ～+ 120
	Acrylic rubber	− 15 ～+ 130
	Silicon rubber	− 50 ～+ 180
	Fluoro rubber	− 10 ～+ 180
Tetrafluoethylene resin		− 50 ～+ 220

Table 33 Peripheral speed and surface roughness of shaft

Peripheral speed m ／ s		Surface roughness
Over	Incl.	μ mR_a(μ mR_y)
—	5	0.8(3.2)
5	10	0.4(1.6)
10	—	0.2(0.8)

❷ 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.

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

Lubrication

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.

❶ 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.

❷ 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.

❸ 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.

❹ Rust prevention
The lubricant prevents rust formation on the inside and outside surfaces of the bearing.

❺ 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

Item	Grease lubrication (1)	Oil lubrication
Sealing structure, Housing structure	Simple	Slightly complicated
Temperature	High temperature not allowed	High temperature allowed (Cooling effect by circulation)
Rotational speed	Low and medium speeds	High speed allowed
Load	Low and medium loads	High load allowed
Maintenance	Easy	Elaborate (Pay special attention to oil leaks.)
Lubricant replacement	Slightly complicated	Simple
Lubrication performance	Good	Very good
Dust filtration	Difficult	Simple
Entry of dust and dirt	Easy measures for protection	Dust and dirt can be removed by filtering in circulating lubrication.

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

Grease lubrication

❶ 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.

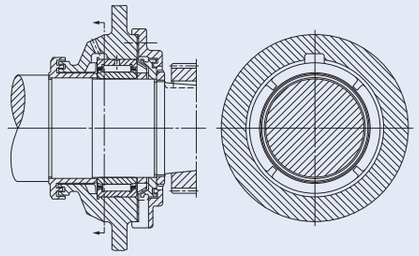
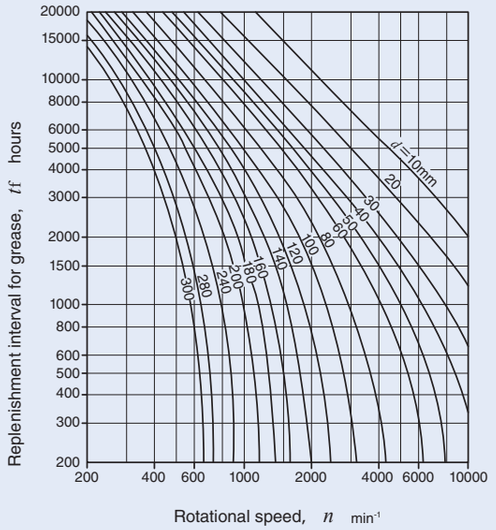


Fig. 19

❷ 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 grease replenishment intervals as a general guideline. The values obtained from this diagram apply under normal load conditions when the machine body is stationary and forces such as inertia are not acting on it, and the operating temperature on the outer surface of the 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 F_w is used for d.

Fig. 20 Interval for replenishment of grease

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

Oil lubrication

❶ 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.

❷ 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.

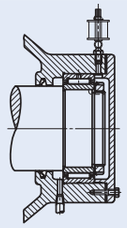


Fig. 21 Oil drip lubrication

❸ 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.

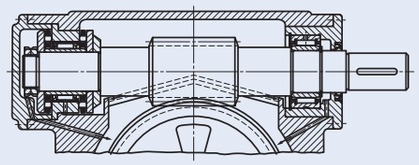


Fig. 22 Oil splash lubrication

❹ 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.

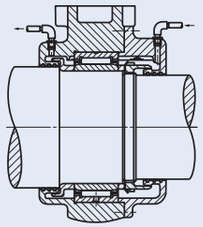


Fig. 23 Oil circulating lubrication

❺ 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.

❻ 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^{-1}) 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.

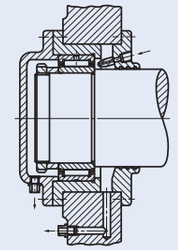


Fig. 24 Oil jet lubrication

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) / Item	Calcium grease (Cup grease)	Sodium grease (Fiber grease)	Aluminum grease (Mobile grease)	Mixed base grease	Barium grease	Lithium grease			Non-soap base grease (Non-soap 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 ℃	80 ～ 90	150 ～ 180	70 ～ 90	160 ～ 190	150 ～ 180	170 ～ 190	170 ～ 190	200 ～ 250	200 ～	None
Operating temperature range ℃	− 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.	

❶ 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.

❷ 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.

❸ 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

❹ 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.

❺ 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 Roller bearings	13 mm²/s or more
Crossed roller bearings	20 mm²/s or more
Thrust needle roller bearings Thrust roller bearings	32 mm²/s or more

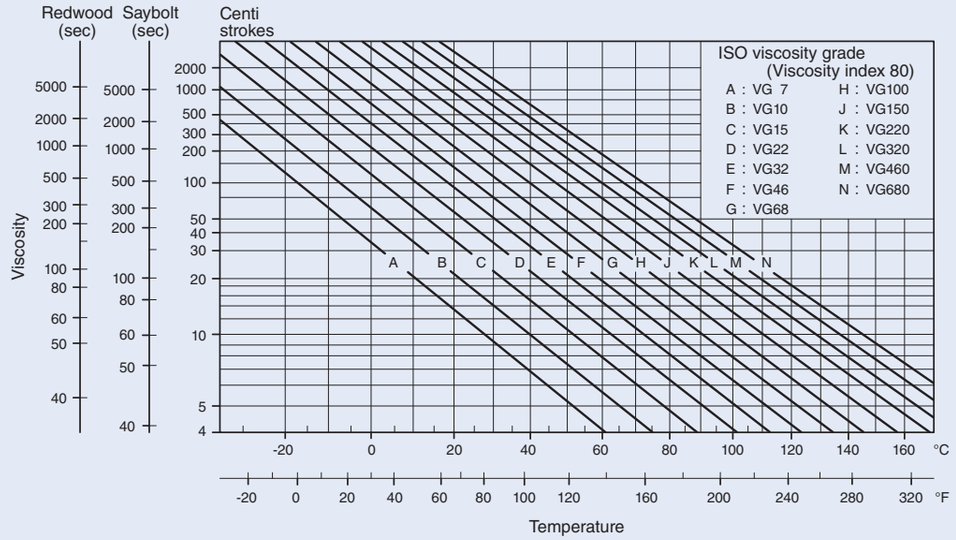


Fig. 25 Relationship between viscosity and temperature of lubricating oil

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℃	Refrigerator oil ◀——▶											
	0 ~ 50℃	Bearing oil ◀——▶											
		Turbine oil ◀——▶											
	50 ~ 80℃	Bearing oil ◀——▶											
		Turbine oil ◀——▶											
	80 ~ 110℃	Bearing oil ◀——▶											
		Turbine oil ◀——▶										Gear oil ◀——▶	
$d_m n$ value Load		Large ◀——▶ Small											
		Small ◀——▶ Large											

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^{-1}).

C-Lube Bearing

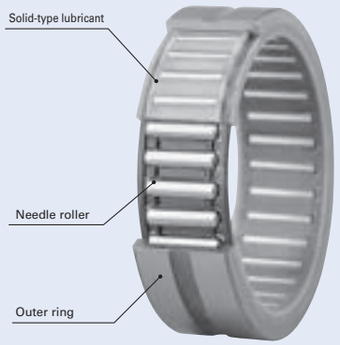
IKO C-Lube Bearing is a bearing that is lubricated with a newly developed thermosetting solid-type lubricant. A large amount of lubricating oil and fine particles of ultra high molecular weight polyolefin resin are solidified by heat treatment to fill the inner space of the bearing. As the bearing rotates, 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 I101.
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, set the n values using the values in Table 39 or less as guidelines.



Structure of C-Lube Bearing

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

Representative model		$d_m n$ (1), $d_1 n$ (2), dn (3)
	Main model code	
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 (4)	NART···/SG	dn = 8 000

Notes(1) $d_m n$ = (bore diameter of bearing [mm] + outside diameter of bearing [mm]) /2 × rotational speed [min^{-1}]
(2) $d_1 n$ = stud diameter [mm] × rotational speed [min^{-1}]
(3) dn = inner ring bore diameter [mm] × rotational speed [min^{-1}]
(4) The dn value 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 $M = \mu P \frac{d}{2}$ ·····(37)
- Thrust bearings $M = \mu P \frac{d_m}{2}$ ·····(38)

where, M : Frictional torque, N-mm
μ : 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	μ
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.

Operating Temperature Range

The allowable operating temperature range for needle roller bearings is generally -20 ～ +120°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°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.

❶ 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.

❷ 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.

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

❹ 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.

❺ Precautions regarding oil components.
Rust prevention oil or grease is used for bearings. Therefore, oil may drip or spatter depending on the operating conditions. Consider installing a shielding plate if necessary.

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.

❶ 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.

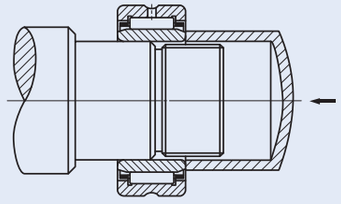


Fig. 26

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.

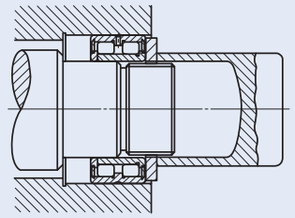


Fig. 27

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.

❷ 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°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.

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

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
Δ_{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.

❶ 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

❷ 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.

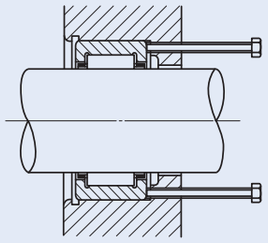


Fig. 28

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.

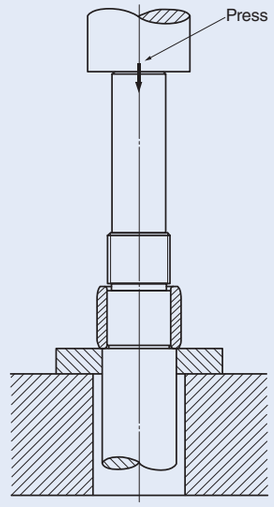


Fig. 29

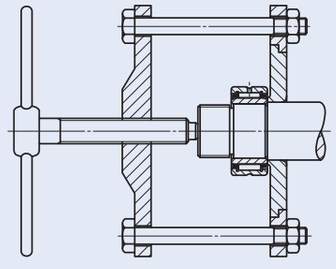


Fig. 30

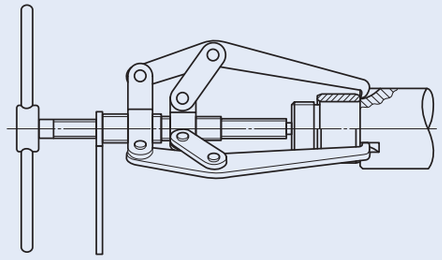


Fig. 31

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.

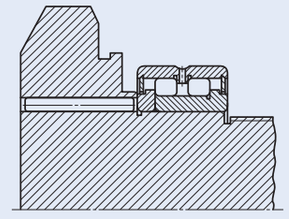


Fig. 32

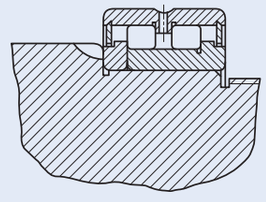


Fig. 33

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

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 Correct selection of lubricant
Galling	Galling on raceway surfaces and rolling surfaces of rollers	Poor lubrication in early stage Grease consistency too hard High acceleration at start	Selection of softer grease, Avoiding quick acceleration
	Galling between roller end faces and collar guide surfaces	Poor lubrication, Poor mounting, Large axial load	Correct selection of lubricant Correct mounting
Breakage	Cracks in outer or inner ring	Excessive shock load, Too much interference. Poor cylindricity of shaft. Too large fillet radius, Development of thermal cracks, Development of flaking	Reevaluation of load conditions, Correction of fit, 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 Shock to collar when mounting, Dropped by careless handling	Careful handling and mounting
	Broken cage	Abnormal load to cage by poor mounting, Poor lubrication	Minimizing mounting errors, 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, 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, Use of clean lubricant
Abnormal wear	False brinelling (Phenomenon like brinelling)	Vibration when the bearing is stationary such as during transportation, Oscillating motion with small amplitude	Fixing of shaft and housing, Use of lubricating oil, Application of preload to reduce vibration
	Fretting Localized wear of fitted surfaces accompanied by red-brown wear particles	Sliding between fitted surfaces	Increase of interference, 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 Use of clean lubricant
	Creep Wear on fitted surfaces	Sliding between fitted surfaces, Insufficient tightening of sleeve	Increase of interference, 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, Rechecking of fit and bearing clearance Rechecking of mounting dimensions and related parts
Electric corrosion	Ripples on raceway surfaces	Melting by sparks due to electric current	Insulation of bearing, Grounding to avoid electric current
Rust, corrosion	Rust or corrosion on bearing inside surfaces or on fitted surfaces	Condensation of vapor in air, Penetration of corrosive substances	Careful storage if under high temperature and high humidity, Protection against rust, Improvement of sealing

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

IKO

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 I83

C-Lube Roller Followers NART···/SG I101

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

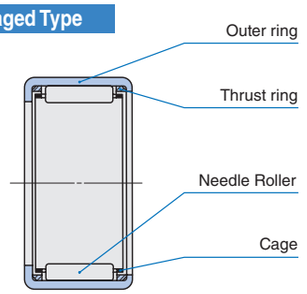
IKO Shell Type Needle Roller Bearings are light-weight bearings with large load ratings. They employ a shell type outer ring made from a thin special-steel plate which is accurately drawn, carburized and quenched, thus providing the lowest sectional height among the needle roller bearings.

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.

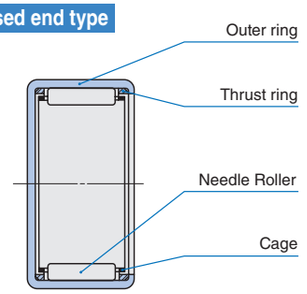
Since these bearings are press-fitted into the housing, no fixtures for axial positioning are needed. They are ideal for use in mass-produced articles that require economy, and have a wide variety of applications.

Structures of Shell Type Needle Roller Bearings

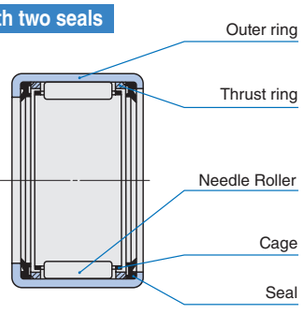
Standard Caged Type



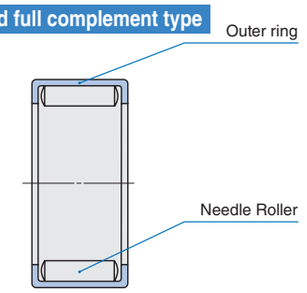
Caged and closed end type



Caged type with two seals



Grease retained full complement type



Types

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

Table 1 Type of bearing

Series	Type	Caged			Full complement
		Standard	Closed end	With seals (1)	Grease retained
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(1) 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 $F_w \leqq 22$, 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

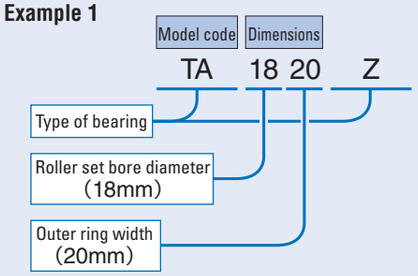
This type has full complement rollers which extend to the full width of the outer ring raceway. It can, therefore, withstand heavy bearing loads and is most suitable for low and medium rotational speeds as well as rocking motions. As lubricating grease is prepacked with the rollers, the bearing can be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

Identification Number

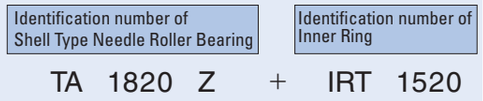
The identification number of Shell Type Needle Roller Bearings consists of a model code and dimensions. Examples of the arrangement are shown below.
When using with inner rings, the assembled inner rings shown in the dimension tables are used. An example in this case is also shown below. Inner rings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

Examples of identification number

Example 1



Example 2 (With inner ring)



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 Nominal roller set bore diameter	Ring gauge		Plug gauge	
	TA···Z(1)	TLA···Z(2)	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(3) 17.977(3)	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(4) 27.991(4)	25.972	20.007	20.028
21	28.991	—	21.007	21.028
22	28.991(5) 29.991(5)	27.972	22.007	22.028
24	30.989(6) 31.989(6)	—	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(1) Also applicable to TAM and YT
(2) Also applicable to TLAM, YTL, TLA···UU
(3) The upper value is for TLA 1210Z model, and the lower value is for TLA 1212Z model.
(4) The lower value is for TA 202820Z model, and the upper value is for models other than TA 202820Z model.
(5) The lower value is for TA 223016Z and TA 223020Z models, and the upper value is for models other than those models.
(6) 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 Nominal roller set bore diameter	Ring gauge		Plug gauge	
	BA···Z(1)	BHA···Z(2)	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(1) Also applicable to BAM and YB
(2) 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

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

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 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.

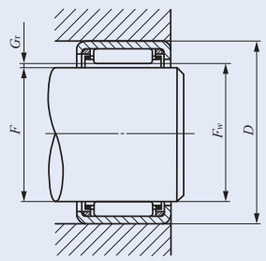
Table 4 Recommended fit

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

Note(1) 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

unit: mm



D : Housing bore diameter
F_w : Roller set bore diameter
F : Shaft diameter
G_r : Radial clearance

Calculation procedure	Example of TLA 2020 Z
❶ Dimension of roller set bore diameter of bearing after it has been press-fitted into the ring gauge. Dimension of ring gauge (D_0): See Tables 2.1 and 2.2 on page B4. Max. value of roller set bore dia. ($F_{w\,max}$): No-go dimension of plug gauge Min. value of roller set bore dia. ($F_{w\,min}$): Go dimension of plug gauge	From Table 2.1 on page B4 D_0 =25.972 $F_{w\,max}$ =20.028 $F_{w\,min}$ =20.007
❷ Dimension of housing bore Max. value of housing bore (D_{max}): See the dimension table. Min. value of housing bore (D_{min}): See the dimension table.	From the dimension table on page B14, D_{max} =25.993 D_{min} =25.972
❸ Dimension of roller set bore diameter of bearing after it has been press-fitted into the housing bore Max. value of roller set bore dia.($F_{we\,max}$)=($D_{max}-D_0$) +$F_{w\,max}$ Min. value of roller set bore dia.($F_{we\,min}$)=($D_{min}-D_0$) +$F_{w\,min}$	From the equations, $F_{we\,max}$ =20.049 $F_{we\,min}$ =20.007
❹ Dimension of shaft Max. value of shaft dia. (F_{max}): See the dimension table. Min. value of shaft dia. (F_{min}): See the dimension table.	From the dimension table on page B14, F_{max} =20.000 F_{min} =19.987
❺ Radial clearance after mounting Max. value of radial clearance($G_{r\,max}$)=$F_{we\,max}-F_{min}$ Min. value of radial clearance($G_{r\,min}$)=$F_{we\,min}-F_{max}$	From the equations, $G_{r\,max}$ =0.062 $G_{r\,min}$ =0.007 The radial clearance after mounting becomes 0.007~0.062 mm.

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.

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.

Table 6 Bearings with prepacked grease

○ : With prepacked grease × : Without prepacked grease

Series \ 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	×	×	–	○

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_a. However, when the operating condition is not severe, a surface roughness 0.8 μ mR_a 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.

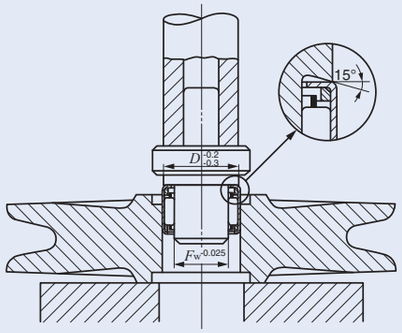


Fig.1 Example of mounting tool

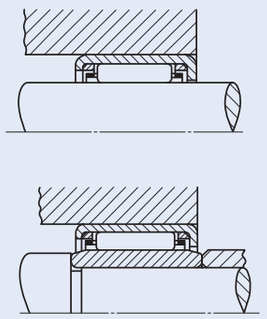
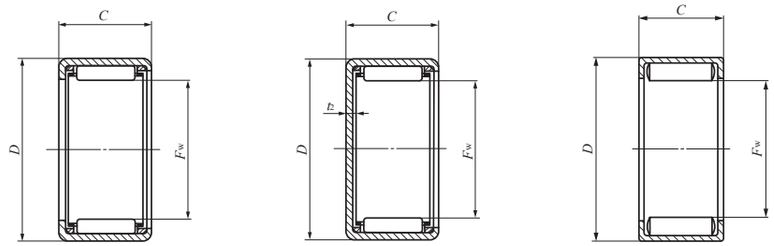


Fig.2 Mounting examples

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

SHELL TYPE NEEDLE ROLLER BEARINGS





TA···Z TLA···Z　　TAM TLAM　　YT YTL

Shaft dia. 4 — 10mm

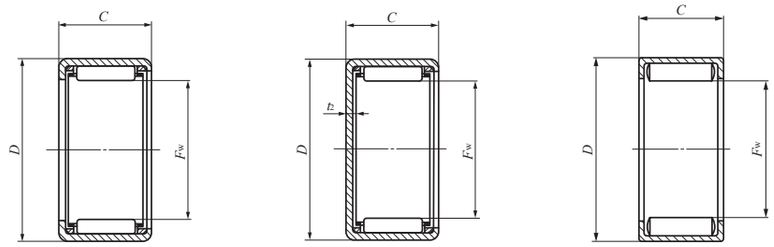
Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g					Shaft dia. h6		Housing bore dia. J7		Housing bore dia. N7					
											F_w	D	C	t_2 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
4	—	—	—	—	TLA 48 Z	1.54	TLAM 48	1.67	—	—	4	8	8	1	4.000	3.992	—	—	7.996	7.981	1 350	1 010	75 000	—
	—	—	—	—	—	—	—	—	YTL 48	1.73	4	8	8	—							3 010	2 900	40 000	—
5	—	—	—	—	TLA 59 Z	1.9	TLAM 59	2	—	—	5	9	9	1	5.000	4.992	—	—	8.996	8.981	1 880	1 600	65 000	—
	—	—	—	—	—	—	—	—	YTL 59	2.4	5	9	9	—							4 320	4 750	30 000	—
6	—	—	—	—	TLA 69 Z	2.2	TLAM 69	2.3	—	—	6	10	9	1	6.000	5.992	—	—	9.996	9.981	2 100	1 900	55 000	—
7	—	—	—	—	TLA 79 Z	2.5	TLAM 79	2.7	—	—	7	11	9	1	7.000	6.991	—	—	10.995	10.977	2 490	2 450	50 000	—
8	—	—	—	—	TLA 810 Z	3.1	TLAM 810	3.3	—	—	8	12	10	1	8.000	7.991	—	—	11.995	11.977	3 320	3 670	45 000	—
	TA 810 Z	6.7	TAM 810	7.1	—	—	—	—	—	—	8	15	10	1.3	8.000	7.991	15.010	14.992	—	—	3 470	2 880	45 000	—
	TA 815 Z	9.7	TAM 815	10.1	—	—	—	—	—	—	8	15	15	1.3							5 780	5 570	45 000	—
	TA 820 Z	12.9	TAM 820	13.3	—	—	—	—	—	—	8	15	20	1.3							8 340	8 920	45 000	—
	—	—	—	—	—	—	—	—	YT 810	7.7	8	15	10	—							7 530	7 950	19 000	—
9	—	—	—	—	TLA 910 Z	3.4	TLAM 910	3.6	—	—	9	13	10	1	9.000	8.991	—	—	12.995	12.977	3 500	4 040	45 000	—
	—	—	—	—	TLA 912 Z	4	TLAM 912	4.3	—	—	9	13	12	1							4 460	5 510	45 000	—
	TA 912 Z	8.7	TAM 912	9.2	—	—	—	—	—	—	9	16	12	1.3	9.000	8.991	16.010	15.992	—	—	5 140	4 880	45 000	—
	TA 916 Z	11.4	TAM 916	11.9	—	—	—	—	—	—	9	16	16	1.3							6 960	7 210	45 000	—
	—	—	—	—	—	—	—	—	YT 912	10.1	9	16	12	—							9 690	11 200	17 000	—
10	—	—	—	—	TLA 1010 Z	3.7	TLAM 1010	4	—	—	10	14	10	1	10.000	9.991	—	—	13.995	13.977	3 870	4 740	40 000	IRT 710
	—	—	—	—	TLA 1012 Z	4.4	TLAM 1012	4.8	—	—	10	14	12	1							4 920	6 460	40 000	IRT 712
	—	—	—	—	TLA 1015 Z	5.5	TLAM 1015	5.9	—	—	10	14	15	1							6 390	9 040	40 000	IRT 715
	TA 1010 Z	7.9	TAM 1010	8.5	—	—	—	—	—	—	10	17	10	1.3	10.000	9.991	17.010	16.992	—	—	4 150	3 780	40 000	IRT 710
	TA 1012 Z	9.3	TAM 1012	10	—	—	—	—	—	—	10	17	12	1.3							5 590	5 540	40 000	IRT 712
	TA 1015 Z	11.5	TAM 1015	12.2	—	—	—	—	—	—	10	17	15	1.3							6 920	7 300	40 000	IRT 715
	TA 1020 Z	15.4	TAM 1020	16	—	—	—	—	—	—	10	17	20	1.3							9 990	11 700	40 000	—

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.

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

SHELL TYPE NEEDLE ROLLER BEARINGS





TA···Z TLA···Z　　TAM TLAM　　YT YTL

Shaft dia. 12 — 15mm

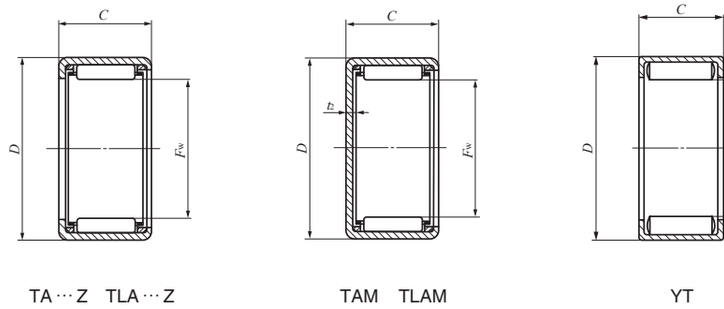
Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g					Shaft dia. h6		Housing bore dia. J7		Housing bore dia. N7					
											F_w	D	C	t_2 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
12	—	—	—	—	**TLA 1210 Z**	4.3	**TLAM 1210**	4.7	—	—	12	16	10	1	12.000	11.989	—	—	15.995	15.977	4 350	5 810	35 000	**IRT 810**
	—	—	—	—	—	—	—	—	**YTL 1210**	5.1	12	16	10	—							7 470	11 800	13 000	**IRT 810**
	—	—	—	—	**TLA 1212 Z**	8.6	**TLAM 1212**	9.4	—	—	12	18	12	1.3	12.000	11.989	—	—	17.995	17.977	6 420	7 490	35 000	**IRT 812**
	TA 1212 Z	10.5	**TAM 1212**	11.5	—	—	—	—	—	—	12	19	12	1.3							6 000	6 310	35 000	**IRT 812**
	TA 1215 Z	13.1	**TAM 1215**	14	—	—	—	—	—	—	12	19	15	1.3							7 440	8 320	35 000	**IRT 815**
	TA 1220 Z	17.3	**TAM 1220**	18.3	—	—	—	—	—	—	12	19	20	1.3	12.000	11.989	19.012	18.991	—	—	10 700	13 300	35 000	—
	TA 1225 Z	21.5	**TAM 1225**	22.5	—	—	—	—	—	—	12	19	25	1.3							13 800	18 300	35 000	—
	—	—	—	—	—	—	—	—	**YT 1212**	12.8	12	19	12	—							11 800	15 200	13 000	**IRT 812**
13	—	—	—	—	**TLA 1312 Z**	9.2	**TLAM 1312**	10.1	—	—	13	19	12	1.3	13.000	12.989	—	—	18.993	18.972	6 760	8 170	30 000	**IRT 1012**
14	—	—	—	—	**TLA 1412 Z**	9.8	**TLAM 1412**	10.8	—	—	14	20	12	1.3	14.000	13.989	—	—	19.993	19.972	7 080	8 840	30 000	**IRT 1012-2**
	—	—	—	—	**TLA 1416 Z**	13.2	**TLAM 1416**	14.3	—	—	14	20	16	1.3							8 950	12 000	30 000	**IRT 1016-2**
	TA 1416 Z	18.4	**TAM 1416**	19.6	—	—	—	—	—	—	14	22	16	1.3	14.000	13.989	22.012	21.991	—	—	10 500	12 000	30 000	**IRT 1016-2**
	TA 1420 Z	23	**TAM 1420**	24	—	—	—	—	—	—	14	22	20	1.3							13 900	17 200	30 000	**IRT 1020-2**
15	—	—	—	—	**TLA 1512 Z**	10.4	**TLAM 1512**	11.5	—	—	15	21	12	1.3	15.000	14.989	—	—	20.993	20.972	7 380	9 520	25 000	**IRT 1212**
	—	—	—	—	**TLA 1516 Z**	14	**TLAM 1516**	15.2	—	—	15	21	16	1.3							9 330	12 900	25 000	**IRT 1216**
	—	—	—	—	**TLA 1522 Z**	19.1	**TLAM 1522**	20.5	—	—	15	21	22	1.3							13 600	20 900	25 000	**IRT 1222**
	TA 1510 Z	10.8	**TAM 1510**	12.3	—	—	—	—	—	—	15	22	10	1.3	15.000	14.989	22.012	21.991	—	—	5 290	5 680	25 000	**IRT 1010-1**
	TA 1512 Z	12.9	**TAM 1512**	14.3	—	—	—	—	—	—	15	22	12	1.3							7 120	8 310	25 000	**IRT 1012-1**
	TA 1515 Z	15.9	**TAM 1515**	17.3	—	—	—	—	—	—	15	22	15	1.3							8 830	11 000	25 000	**IRT 1015-1**
	TA 1520 Z	21	**TAM 1520**	22.5	—	—	—	—	—	—	15	22	20	1.3							12 700	17 600	25 000	**IRT 1020-1**
	TA 1525 Z	25	**TAM 1525**	26.5	—	—	—	—	—	—	15	22	25	1.3							16 300	24 200	25 000	**IRT 1025-1**

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.

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

SHELL TYPE NEEDLE ROLLER BEARINGS





TA ··· Z TLA ··· Z　　TAM TLAM　　YT

Shaft dia. 16 — 19mm

Shaft dia. mm	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) 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	—	—	—	—	—	—

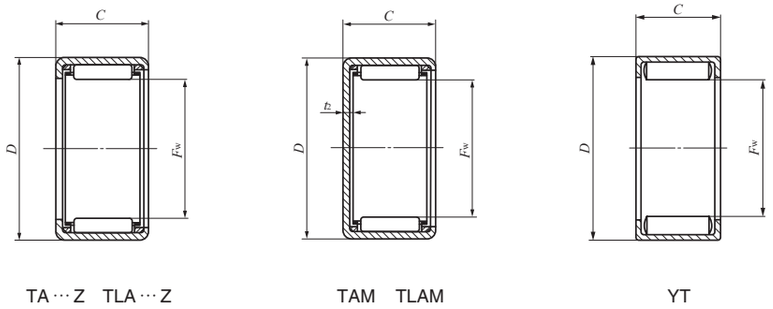
Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7		Housing bore dia. N7					
F_w	D	C	t_2 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
16	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	18.000	17.989	25.012	24.991	—	—	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							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**

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

SHELL TYPE NEEDLE ROLLER BEARINGS





TA ··· Z TLA ··· Z　　TAM TLAM　　YT

Shaft dia. 20 — 21mm

Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g	F_w	D	C	t_2 Max.	Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. J7 Max.	Housing bore dia. J7 Min.	Housing bore dia. N7 Max.	Housing bore dia. N7 Min.	C N	C_0 N	min^{-1}	
20	—	—	—	—	TLA 2012 Z	13.2	TLAM 2012	15.2	—	—	20	26	12	1.3	20.000	19.987	—	—	25.993	25.972	8 740	12 900	20 000	—
	—	—	—	—	TLA 2016 Z	17.8	TLAM 2016	19.9	—	—	20	26	16	1.3							11 100	17 500	20 000	IRT 1716
	—	—	—	—	TLA 2020 Z	22	TLAM 2020	24	—	—	20	26	20	1.3							14 500	24 700	20 000	IRT 1720
	—	—	—	—	TLA 2030 Z	33	TLAM 2030	35	—	—	20	26	30	1.3							22 300	42 900	20 000	IRT 1730
	TA 2015 Z	20	TAM 2015	22.5	—	—	—	—	—	—	20	27	15	1.3	20.000	19.987	27.012	26.991	—	—	10 400	14 600	20 000	IRT 1515-2
	TA 2020 Z	26.5	TAM 2020	29	—	—	—	—	—	—	20	27	20	1.3							15 000	23 400	20 000	IRT 1520-2
	TA 2025 Z	33	TAM 2025	35.5	—	—	—	—	—	—	20	27	25	1.3							19 200	32 200	20 000	IRT 1525-2
	TA 2030 Z	39.5	TAM 2030	42	—	—	—	—	—	—	20	27	30	1.3							23 100	41 000	20 000	IRT 1530-2
	—	—	—	—	—	—	—	—	YT 2015	23.5	20	27	15	—							18 400	30 900	7 500	IRT 1515-2
	—	—	—	—	—	—	—	—	YT 2025	41	20	27	25	—							30 000	58 300	7 500	IRT 1525-2
	TA 202820 Z	30	TAM 202820	32.5	—	—	—	—	—	—	20	28	20	1.3	20.000	19.987	28.012	27.991	—	—	16 900	24 300	20 000	IRT 1520-2
	—	—	—	—	—	—	—	—	YT 202820	37.5	20	28	20	—							26 800	44 600	7 500	IRT 1520-2
21	TA 2116 Z	25	TAM 2116	28	—	—	—	—	—	—	21	29	16	1.3	21.000	20.987	29.012	28.991	—	—	13 300	18 100	19 000	IRT 1716-1
	TA 2120 Z	31.5	TAM 2120	34.5	—	—	—	—	—	—	21	29	20	1.3							17 600	25 900	19 000	IRT 1720-1
	—	—	—	—	—	—	—	—	YT 2116	31	21	29	16	—							22 100	35 200	7 000	IRT 1716-1
	—	—	—	—	—	—	—	—	YT 2120	39	21	29	20	—							27 500	46 800	7 000	IRT 1720-1

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

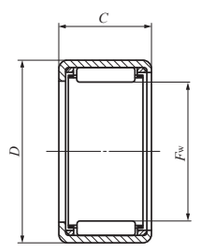
SHELL TYPE NEEDLE ROLLER BEARINGS



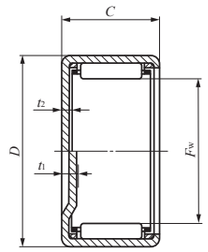
Shaft dia. 22 — 24mm

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

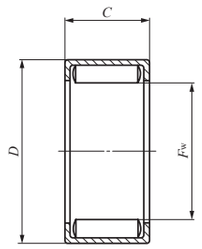
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
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TA···Z TLA···Z



TAM TLAM
t_1 ($F_w \geqq 24$)
t_2 ($F_w \leqq 22$)



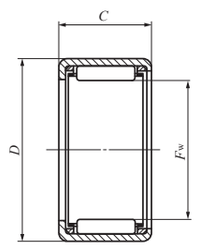
YT

Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7		Housing bore dia. N7					
F_w	D	C	t_1, t_2 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
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	**IRT 1716-2**
22	28	20	1.3							15 300	27 300	18 000	**IRT 1720-2**
22	29	10	1.3							6 650	8 500	18 000	**IRT 1710-2**
22	29	15	1.3							11 100	16 400	18 000	**IRT 1715-2**
22	29	20	1.3	22.000	21.987	29.012	28.991	—	—	16 000	26 300	18 000	**IRT 1720-2**
22	29	25	1.3							19 700	34 300	18 000	**IRT 1725-2**
22	29	30	1.3							23 800	43 700	18 000	**IRT 1730-2**
22	30	16	1.3							13 200	18 200	18 000	**IRT 1716-2**
22	30	20	1.3	22.000	21.987	30.012	29.991	—	—	17 500	26 100	18 000	**IRT 1720-2**
22	30	16	—							22 600	36 800	7 000	**IRT 1716-2**
22	30	20	—							28 200	48 900	7 000	**IRT 1720-2**
24	31	20	3.4							17 000	29 200	16 000	**IRT 2020**
24	31	28	3.4	24.000	23.987	31.014	30.989	—	—	24 500	46 700	16 000	**IRT 2028**
24	31	28	—							36 800	79 900	6 500	**IRT 2028**
24	32	16	3.4							14 200	20 500	16 000	**IRT 2016**
24	32	20	3.4	24.000	23.987	32.014	31.989	—	—	18 800	29 400	16 000	**IRT 2020**
24	32	16	—							23 700	40 100	6 500	**IRT 2016**
24	32	20	—							29 500	53 200	6 500	**IRT 2020**

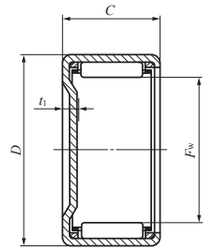
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS

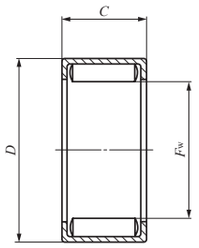




TA ··· Z TLA ··· Z



TAM TLAM



YT YTL

Shaft dia. 25 — 28mm

Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g	F_w	D	C	t_1 Max.	Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. J7 Max.	Housing bore dia. J7 Min.	Housing bore dia. N7 Max.	Housing bore dia. N7 Min.	C N	C_0 N	min^{-1}	
25	—	—	—	—	**TLA 2512 Z**	19.7	**TLAM 2512**	23.5	—	—	25	32	12	2.8							9 440	13 900	15 000	—
	—	—	—	—	**TLA 2516 Z**	26	**TLAM 2516**	29.5	—	—	25	32	16	2.8							12 800	20 500	15 000	—
	—	—	—	—	**TLA 2520 Z**	32	**TLAM 2520**	36	—	—	25	32	20	2.8	25.000	24.987	—	—	31.992	31.967	16 900	29 300	15 000	**IRT 2020-1**
	—	—	—	—	**TLA 2526 Z**	41.5	**TLAM 2526**	45.5	—	—	25	32	26	2.8							22 600	42 500	15 000	**IRT 2026-1**
	—	—	—	—	**TLAW2538Z**	58.5	**TLAMW2538**	62	—	—	25	32	38	2.8							28 900	58 500	15 000	**IRT 2038-1**
	—	—	—	—	—	—	—	—	**YTL 2526**	51.5	25	32	26	—							35 000	75 800	6 000	**IRT 2026-1**
	TA 2510 Z	19.1	**TAM 2510**	23	—	—	—	—	—	—	25	33	10	3.4							7 990	9 900	15 000	**IRT 2010-1**
	TA 2515 Z	28.5	**TAM 2515**	32.5	—	—	—	—	—	—	25	33	15	3.4							13 400	19 300	15 000	**IRT 2015-1**
	TA 2520 Z	36.5	**TAM 2520**	40.5	—	—	—	—	—	—	25	33	20	3.4	25.000	24.987	33.014	32.989	—	—	19 500	31 100	15 000	**IRT 2020-1**
	TA 2525 Z	45.5	**TAM 2525**	49	—	—	—	—	—	—	25	33	25	3.4							24 100	40 800	15 000	**IRT 2025-1**
	TA 2530 Z	54.5	**TAM 2530**	58.5	—	—	—	—	—	—	25	33	30	3.4							29 100	52 000	15 000	**IRT 2030-1**
	—	—	—	—	—	—	—	—	**YT 2510**	22.5	25	33	10	—							15 500	23 600	6 000	**IRT 2010-1**
	—	—	—	—	—	—	—	—	**YT 2515**	33	25	33	15	—							22 700	38 300	6 000	**IRT 2015-1**
	—	—	—	—	—	—	—	—	**YT 2520**	45	25	33	20	—	25.000	24.987	33.014	32.989	—	—	30 200	55 400	6 000	**IRT 2020-1**
	—	—	—	—	—	—	—	—	**YT 2525**	57	25	33	25	—							37 200	72 500	6 000	**IRT 2025-1**
26	**TA 2616 Z**	30.5	**TAM 2616**	34.5	—	—	—	—	—	—	26	34	16	3.4							15 200	22 900	15 000	**IRT 2216**
	TA 2620 Z	38	**TAM 2620**	42.5	—	—	—	—	—	—	26	34	20	3.4							20 100	32 800	15 000	**IRT 2220**
	—	—	—	—	—	—	—	—	**YT 2616**	37	26	34	16	—	26.000	25.987	34.014	33.989	—	—	24 700	43 300	6 000	**IRT 2216**
	—	—	—	—	—	—	—	—	**YT 2620**	46.5	26	34	20	—							30 800	57 500	6 000	**IRT 2220**
28	—	—	—	—	**TLA 2816 Z**	28.5	**TLAM 2816**	33.5	—	—	28	35	16	2.8	28.000	27.987	—	—	34.992	34.967	13 800	23 500	13 000	—
	—	—	—	—	**TLA 2820 Z**	35.5	**TLAM 2820**	40.5	—	—	28	35	20	2.8							18 300	33 600	13 000	**IRT 2220-1**
	TA 2820 Z	45	**TAM 2820**	50	—	—	—	—	—	—	28	37	20	3.4							21 200	32 300	13 000	**IRT 2220-1**
	TA 2830 Z	67.5	**TAM 2830**	72.5	—	—	—	—	—	—	28	37	30	3.4	28.000	27.987	37.014	36.989	—	—	33 000	56 900	13 000	**IRT 2230-1**
	—	—	—	—	—	—	—	—	**YT 2820**	56.5	28	37	20	—							34 700	61 700	5 500	**IRT 2220-1**

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

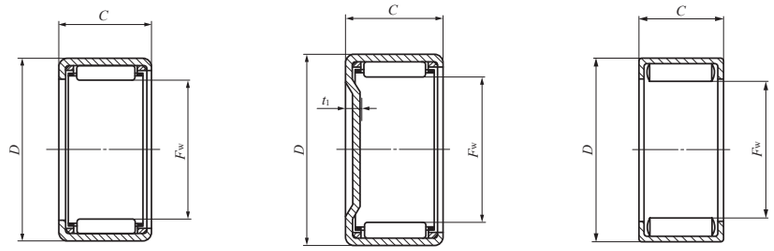
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS





TA ··· Z TLA ··· Z　　TAM TLAM　　YT

Shaft dia. 29 — 35mm

Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g	F_w	D	C	t_1 Max.	Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. J7 Max.	Housing bore dia. J7 Min.	Housing bore dia. N7 Max.	Housing bore dia. N7 Min.	C N	C_0 N	min^{-1}	
29	**TA 2920 Z**	47	**TAM 2920**	52	—	—	—	—	—	—	29	38	20	3.4							22 000	34 200	13 000	**IRT 2520**
	TA 2930 Z	70	**TAM 2930**	75.5	—	—	—	—	—	—	29	38	30	3.4	29.000	28.987	38.014	37.989	—	—	34 200	60 300	13 000	**IRT 2530**
	—	—	—	—	—	—	—	—	**YT 2920**	58.5	29	38	20	—							35 500	64 100	5 000	**IRT 2520**
30	—	—	—	—	**TLA 3012 Z**	23.5	**TLAM 3012**	29	—	—	30	37	12	2.8							10 400	16 600	12 000	—
	—	—	—	—	**TLA 3016 Z**	30.5	**TLAM 3016**	36	—	—	30	37	16	2.8							14 100	24 500	12 000	—
	—	—	—	—	**TLA 3018 Z**	34.5	**TLAM 3018**	40	—	—	30	37	18	2.8							16 400	29 800	12 000	—
	—	—	—	—	**TLA 3020 Z**	38	**TLAM 3020**	43.5	—	—	30	37	20	2.8	30.000	29.987	—	—	36.992	36.967	18 600	35 100	12 000	**IRT 2520-1**
	—	—	—	—	**TLA 3026 Z**	49	**TLAM 3026**	54.5	—	—	30	37	26	2.8							24 800	50 900	12 000	**IRT 2526-1**
	—	—	—	—	**TLAW3038 Z**	69	**TLAMW3038**	74.5	—	—	30	37	38	2.8							31 900	70 200	12 000	**IRT 2538-1**
	TA 3013 Z	36.5	**TAM 3013**	42.5	—	—	—	—	—	—	30	40	13	3.4							13 500	16 800	12 000	—
	TA 3015 Z	42	**TAM 3015**	47.5	—	—	—	—	—	—	30	40	15	3.4							16 800	22 400	12 000	**IRT 2515-1**
	TA 3020 Z	54.5	**TAM 3020**	60	—	—	—	—	—	—	30	40	20	3.4	30.000	29.987	40.014	39.989	—	—	24 500	36 300	12 000	**IRT 2520-1**
	TA 3025 Z	68	**TAM 3025**	73.5	—	—	—	—	—	—	30	40	25	3.4							31 600	50 300	12 000	**IRT 2525-1**
	TA 3030 Z	80	**TAM 3030**	85.5	—	—	—	—	—	—	30	40	30	3.4							36 700	60 700	12 000	**IRT 2530-1**
32	**TA 3220 Z**	57.5	**TAM 3220**	63.5	—	—	—	—	—	—	32	42	20	3.4							25 400	38 600	11 000	**IRT 2820**
	TA 3230 Z	86	**TAM 3230**	97.5	—	—	—	—	—	—	32	42	30	3.4	32.000	31.984	42.014	41.989	—	—	39 500	68 400	11 000	**IRT 2830**
	—	—	—	—	—	—	—	—	**YT 3220**	71.5	32	42	20	—							39 900	70 100	4 500	**IRT 2820**
35	—	—	—	—	**TLA 3512 Z**	27	**TLAM 3512**	34.5	—	—	35	42	12	2.8							11 600	20 000	10 000	**IRT 3012**
	—	—	—	—	**TLA 3516 Z**	35	**TLAM 3516**	42.5	—	—	35	42	16	2.8	35.000	34.984	—	—	41.992	41.967	15 700	29 600	10 000	—
	—	—	—	—	**TLA 3520 Z**	43.5	**TLAM 3520**	51	—	—	35	42	20	2.8							20 700	42 300	10 000	**IRT 3020**
	TA 3512 Z	38.5	**TAM 3512**	46	—	—	—	—	—	—	35	45	12	3.4							14 800	19 900	10 000	**IRT 3012**
	TA 3515 Z	48	**TAM 3515**	56	—	—	—	—	—	—	35	45	15	3.4							18 500	26 500	10 000	**IRT 3015**
	TA 3520 Z	62.5	**TAM 3520**	70	—	—	—	—	—	—	35	45	20	3.4	35.000	34.984	45.014	44.989	—	—	27 000	43 100	10 000	**IRT 3020**
	TA 3525 Z	78	**TAM 3525**	85.5	—	—	—	—	—	—	35	45	25	3.4							34 800	59 700	10 000	**IRT 3025**
	TA 3530 Z	97	**TAM 3530**	105	—	—	—	—	—	—	35	45	30	3.4							40 600	72 600	10 000	**IRT 3030**

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

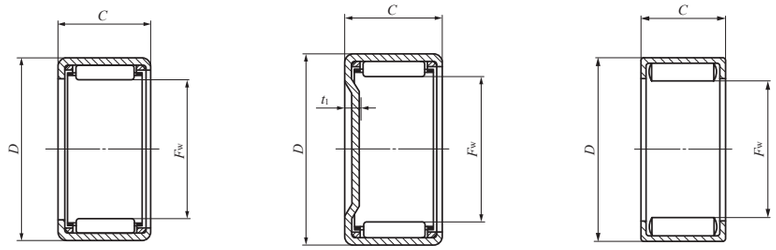
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS





TA ··· Z TLA ··· Z　　TAM TLAM　　YT

Shaft dia. 37 — 45mm

Shaft dia. mm	Identification number										
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) 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

Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7		N7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
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	45.000	44.984	—	—	51.991	51.961	17 800	37 800	7 500	—
45	52	20	2.8							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**

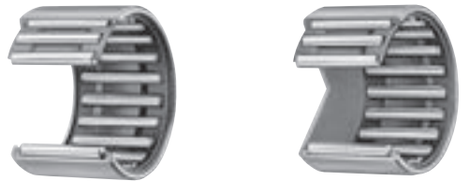
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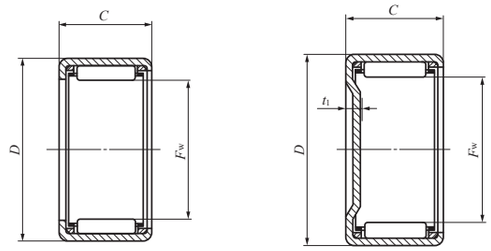
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS





TA ··· Z TLA ··· Z　　TAM TLAM

Shaft dia. 50 — 62mm

Shaft dia. mm	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) 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	—	—	—	—	—	—

Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7		N7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
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							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	50.000	49.984	62.018	61.988	—	—	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							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	55.000	54.981	67.018	66.988	—	—	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							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	60.000	59.981	72.018	71.988	—	—	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**

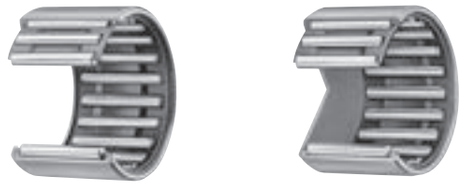
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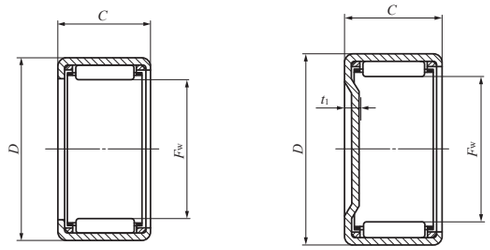
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1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS





TA···Z　　TAM

Shaft dia. 65 — 70mm

Shaft dia. mm	Identification number										Boundary dimensions mm				Standard mounting dimensions mm						Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g	F_w	D	C	t_1 Max.	Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. J7 Max.	Housing bore dia. J7 Min.	Housing bore dia. N7 Max.	Housing bore dia. N7 Min.	C N	C_0 N	min^{-1}	
65	TA 6525 Z	169	TAM 6525	197	—	—	—	—	—	—	65	77	25	3.4	65.000	64.981	77.018	76.988	—	—	56 500	116 000	4 000	IRT 5525
	TA 6530 Z	205	TAM 6530	230	—	—	—	—	—	—	65	77	30	3.4							68 500	149 000	4 000	IRT 5530
	TAW 6545 Z	290	TAMW 6545	315	—	—	—	—	—	—	65	77	45	3.4							88 300	207 000	4 000	IRT 5545
	TAW 6550 Z	330	TAMW 6550	355	—	—	—	—	—	—	65	77	50	3.4							101 000	246 000	4 000	IRT 5550
70	TA 7025 Z	181	TAM 7025	215	—	—	—	—	—	—	70	82	25	3.4	70.000	69.981	82.022	81.987	—	—	58 500	124 000	3 500	IRT 6025
	TA 7030 Z	220	TAM 7030	250	—	—	—	—	—	—	70	82	30	3.4							70 900	159 000	3 500	IRT 6030
	TA 7040 Z	290	TAM 7040	320	—	—	—	—	—	—	70	82	40	3.4							92 000	222 000	3 500	IRT 6040
	TAW 7050 Z	350	TAMW 7050	380	—	—	—	—	—	—	70	82	50	3.4							105 000	262 000	3 500	IRT 6050

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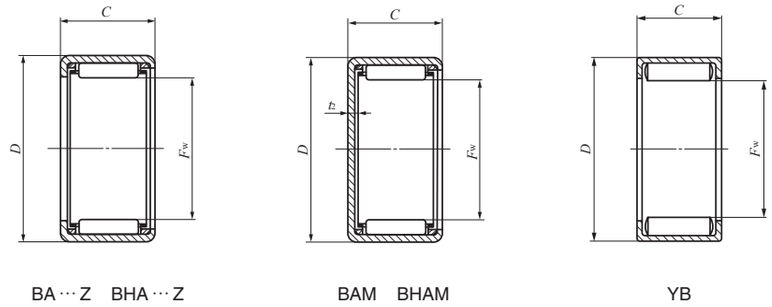
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series





BA ··· Z BHA ··· Z　　BAM BHAM　　YB

Shaft dia. 3.969 — 9.525mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
3.969 (5/32)	—	—	—	—	—	—	—	—	**YB 2.5 2.5**	0.64
	—	—	—	—	—	—	—	—	**YB 2.5 4**	0.96
4.762 (3/16)	—	—	—	—	—	—	—	—	**YB 34**	1.6
6.350 (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 (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 (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	—	—

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_2 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
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	6.350	6.341	11.122	11.104	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					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	7.938	7.929	12.710	12.692	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					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	9.525	9.516	14.298	14.280	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					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)	—	9.525	9.516	14.298	14.280	4 470	5 360	16 000	—
9.525 (3/8)	14.288 (9/16)	9.52(.375)	—					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	—

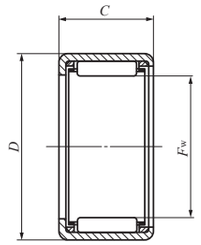
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
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1mm=0.03937inch

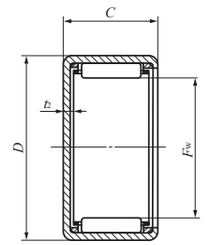
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

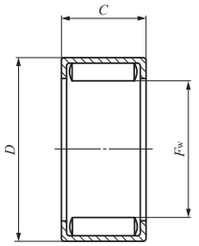




BA ··· Z BHA ··· Z



BAM BHAM



YB YBH

Shaft dia. 11.112 — 12.700mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
11.112 (7/16)	**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	—	—
	—	—	—	—	—	—	—	—	**YBH 78**	10.5
12.700 (1/2)	**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

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

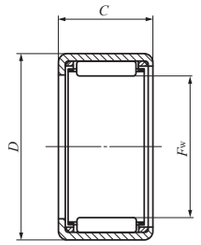
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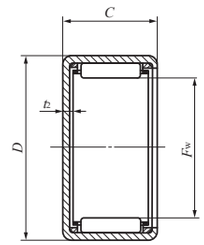
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

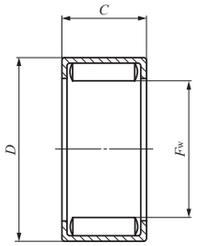




BA ··· Z BHA ··· Z



BAM BHAM



YB YBH

Shaft dia. 14.288 — 15.875mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
14.288 (9/16)	**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	—	—
15.875 (5/8)	**BA 105 Z**	5.3	**BAM 105**	6.5	—	—	—	—	—	—
	BA 107 Z	7.6	**BAM 107**	8.7	—	—	—	—	—	—
	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

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

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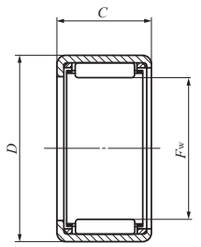
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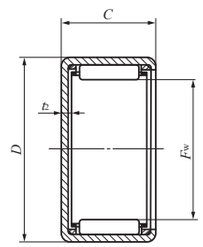
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

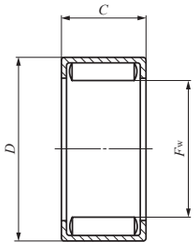




BA ··· Z BHA ··· Z



BAM BHAM



YB

Shaft dia. 17.462 — 19.050mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
17.462 (11/16)	**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 (3/4)	**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	—	—

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

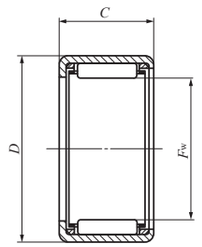
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided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

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

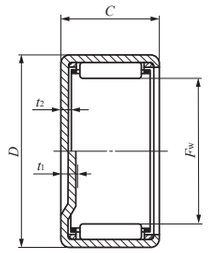
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

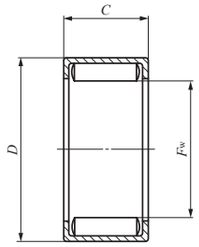




BA ··· Z BHA ··· Z



BAM BHAM
t_1 ($F_w \geqq 22.225$)
t_2 ($F_w \leqq 20.638$)



YB YBH

Shaft dia. 20.638 — 22.225mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
20.638 (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 (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

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 t_2 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
20.638 (13/16)	26.988 (1 1/16)	9.52(.375)	1.3					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	20.638	20.625	27.000	26.979	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					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	20.638	20.625	28.587	28.566	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					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	22.225	22.212	28.587	28.566	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					14 300	19 500	18 000	—
22.225 (7/8)	30.162 (1 3/16)	19.05(.750)	3.4	22.225	22.212	30.176	30.151	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**

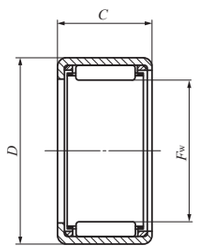
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1mm=0.03937inch

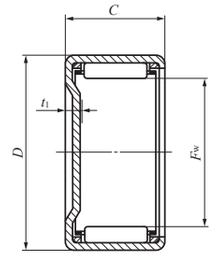
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

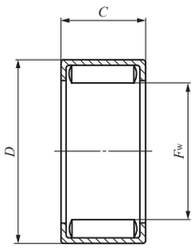




BA ··· Z BHA ··· Z



BAM BHAM



YB YBH

Shaft dia. 23.812 — 26.988mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
23.812 (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 (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 (1 1/16)	**BA 1710 Z**	23.5	**BAM 1710**	26.5	—	—	—	—	—	—
	BA 1716 Z	37	**BAM 1716**	40.5	—	—	—	—	—	—

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
23.812 (15/16)	30.162 (1 3/16)	12.70(.500)	2.8					8 000	11 400	16 000	—
23.812 (15/16)	30.162 (1 3/16)	15.88(.625)	2.8	23.812	23.799	30.176	30.151	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					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	25.400	25.387	31.764	31.739	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	25.400	25.387	33.352	33.327	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	—

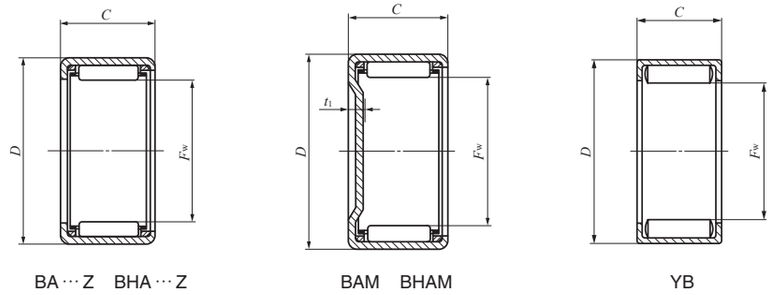
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series





BA ··· Z BHA ··· Z　　BAM BHAM　　YB

Shaft dia. 28.575 — 30.162mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
28.575 (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	—	—
30.162 (1 3/16)	**BA 1910 Z**	32.5	**BAM 1910**	37.5	—	—	—	—	—	—
	BA 1916 Z	52	**BAM 1916**	57	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	**YB 1910**	42.5

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
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)	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	—

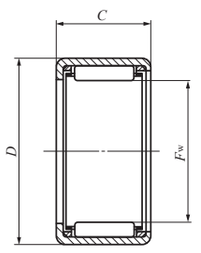
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided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

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

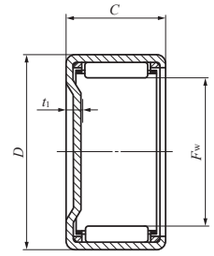
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

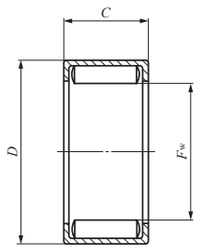




BA ··· Z BHA ··· Z



BAM BHAM



YB

Shaft dia. 31.750 — 33.338mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
31.750 (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 (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	—	—	—	—	—	—

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
31.750 (1 1/4)	38.100 (1 1/2)	12.70(.500)	2.8					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	31.750	31.734	38.114	38.089	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)	—					31 800	72 500	4 500	**IRB 1612**
31.750 (1 1/4)	38.100 (1 1/2)	25.40(1.000)	—	31.750	31.734	38.114	38.089	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					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	31.750	31.734	41.289	41.264	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					11 100	15 800	11 000	**IRB 168-1**
33.338 (1 5/16)	41.275 (1 5/8)	15.88(.625)	2.8	33.338	33.322	41.289	41.264	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**

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

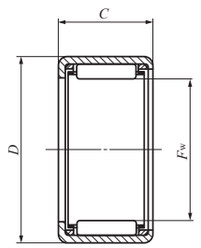
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

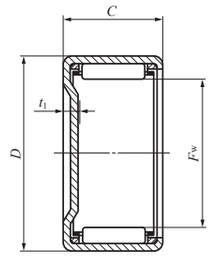




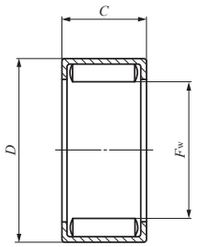




BA ··· Z BHA ··· Z



BAM BHAM



YB

Shaft dia. 34.925 — 38.100mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
34.925 (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	—	—
38.100 (1 1/2)	**BA 248 Z**	38.5	**BAM 248**	47.5	—	—	—	—	—	—
	BA 2410 Z	48.5	**BAM 2410**	57.5	—	—	—	—	—	—
	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

Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
34.925 (1 3/8)	41.275 (1 5/8)	12.70(.500)	2.8					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	34.925	34.909	41.289	41.264	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					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	34.925	34.909	44.464	44.439	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					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	38.100	38.084	47.639	47.614	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)	—					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)	—	38.100	38.084	47.639	47.614	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**

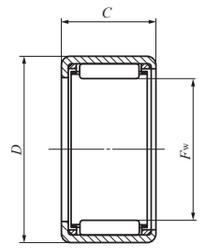
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

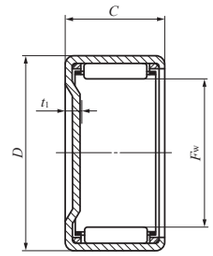
SHELL TYPE NEEDLE ROLLER BEARINGS

Inch Series

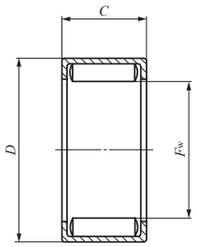




BA ··· Z BHA ··· Z



BAM BHAM



YB

Shaft dia. 41.275 — 52.388mm

Shaft dia. mm (inch)	Identification number: Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
41.275 (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 (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
	—	—	—	—	BHA 2824 Z	195	BHAM 2824	210	—	—
47.625 (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 (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	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	YB 3216	130
52.388 (2 1/16)	—	—	—	—	BHA 3312 Z	104	BHAM 3312	122	—	—
	—	—	—	—	BHA 3316 Z	139	BHAM 3316	157	—	—
	—	—	—	—	BHA 3324 Z	205	BHAM 3324	225	—	—

Boundary dimensions mm(inch) F_w	D	C	t_1 Max.	Standard mounting dimensions mm: Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. J7 Max.	Housing bore dia. J7 Min.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}	Assembled inner ring
41.275 (1 5/8)	50.800 (2)	12.70(.500)	2.8					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	41.275	41.259	50.818	50.788	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					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	44.450	44.434	53.993	53.963	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					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	47.625	47.609	57.168	57.138	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					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	50.800	50.781	60.343	60.313	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					36 400	62 100	6 000	—
52.388 (2 1/16)	64.294 (2 17/32)	25.40(1.000)	3.4	52.388	52.369	64.312	64.282	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	—

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.

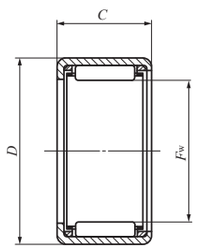
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

SHELL TYPE NEEDLE ROLLER BEARINGS

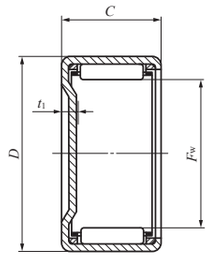
Inch Series







BA ··· Z



BAM

Shaft dia. 53.975 — 69.850mm

Shaft dia. mm (inch)	Identification number									
	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Standard	Mass (Ref.) g	Closed end	Mass (Ref.) g	Grease retained	Mass (Ref.) g
53.975 (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 (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 (2 5/8)	**BA 4216 Z**	133	**BAM 4216**	161	—	—	—	—	—	—
69.850 (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	—	—	—	—	—	—

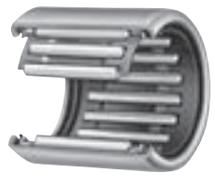
Boundary dimensions mm(inch)				Standard mounting dimensions mm				Basic dynamic load rating	Basic static load rating	Allowable rotational speed(1)	Assembled inner ring
				Shaft dia. h6		Housing bore dia. J7					
F_w	D	C	t_1 Max.	Max.	Min.	Max.	Min.	C N	C_0 N	min^{-1}	
53.975(2 1/8)	63.500(2 1/2)	12.70(.500)	2.8					16 100	26 600	5 500	—
53.975(2 1/8)	63.500(2 1/2)	25.40(1.000)	2.8	53.975	53.956	63.518	63.488	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					28 500	56 700	5 000	—
57.150(2 1/4)	66.675(2 5/8)	25.40(1.000)	2.8	57.150	57.131	66.693	66.663	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					25 000	50 800	3 500	—
69.850(2 3/4)	79.375(3 1/8)	19.05(.750)	2.8	69.850	69.831	79.393	79.363	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**

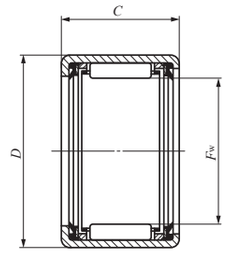
Note(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remark Shell Type Grease Retained Full Complement Needle Roller Bearings are provided with prepacked grease. Standard type and closed end type bearings are not provided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

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

SHELL TYPE NEEDLE ROLLER BEARINGS

With seals





TLA ··· UU

Shaft dia. 12 — 50mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	D	C	Standard mounting dimensions mm Shaft dia. h6 Max.	Shaft dia. h6 Min.	Housing bore dia. N7 Max.	Housing bore dia. N7 Min.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
12	**TLA 1216 UU**	11.7	12	18	16	12.000	11.989	17.995	17.977	6 420	7 490	14 000
14	**TLA 1416 UU**	13.3	14	20	16	14.000	13.989	19.993	19.972	7 080	8 840	12 000
15	**TLA 1516 UU**	14	15	21	16	15.000	14.989	20.993	20.972	7 380	9 520	11 000
16	**TLA 1616 UU**	14.8	16	22	16	16.000	15.989	21.993	21.972	7 670	10 200	11 000
18	**TLA 1816 UU**	16.3	18	24	16	18.000	17.989	23.993	23.972	8 230	11 500	9 000
20	**TLA 2016 UU** **TLA 2020 UU**	17.8 22.5	20 20	26 26	16 20	20.000	19.987	25.993	25.972	8 740 11 100	12 900 17 500	9 000 9 000
22	**TLA 2216 UU** **TLA 2220 UU**	19.4 25	22 22	28 28	16 20	22.000	21.987	27.993	27.972	9 230 11 700	14 300 19 300	8 000 8 000
25	**TLA 2516 UU** **TLA 2520 UU**	26 33	25 25	32 32	16 20	25.000	24.987	31.992	31.967	9 440 12 800	13 900 20 500	7 000 7 000
28	**TLA 2820 UU**	36.5	28	35	20	28.000	27.987	34.992	34.967	13 800	23 500	6 000
30	**TLA 3016 UU** **TLA 3020 UU**	30.5 39	30 30	37 37	16 20	30.000	29.987	36.992	36.967	10 400 14 100	16 600 24 500	5 500 5 500
35	**TLA 3516 UU** **TLA 3520 UU**	35 45	35 35	42 42	16 20	35.000	34.984	41.992	41.967	11 600 15 700	20 000 29 600	5 000 5 000
40	**TLA 4016 UU** **TLA 4020 UU**	39.5 50.5	40 40	47 47	16 20	40.000	39.984	46.992	46.967	12 400 16 700	22 800 33 700	4 500 4 500
45	**TLA 4520 UU**	56	45	52	20	45.000	44.984	51.991	51.961	17 800	37 800	4 000
50	**TLA 5026 UU**	89	50	58	26	50.000	49.984	57.991	57.961	28 800	64 100	3 500

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

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

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.

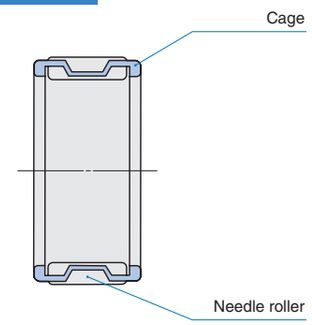
When combined with shafts and housing bores that are heat treated and accurately ground as raceway surfaces, Needle Roller Cages for General Usage are particularly useful in small spaces.

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.

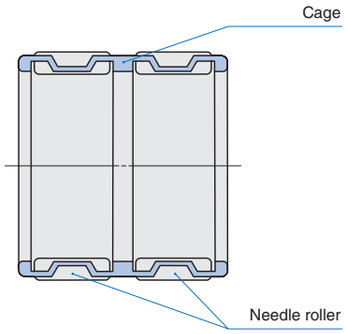
Structures of Needle Roller Cages for General Usage

High carbon steel cage type

KT

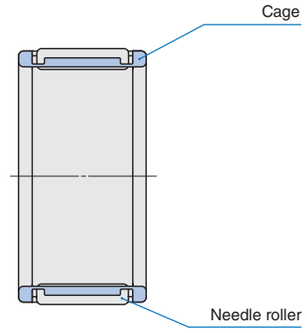


KTW



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

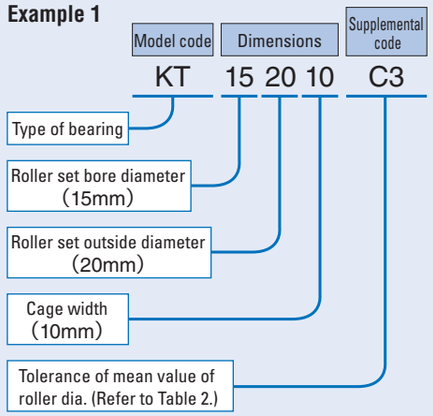
Item	Model of bearing	
	Single row needle roller	Double row needle roller
High carbon steel cage type	KT	KTW
Synthetic resin cage type	KT···N	–

Identification Number

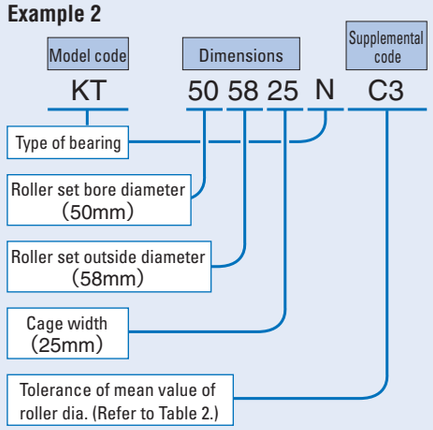
The identification number of Needle Roller Cages for General Usage consists of a model code, dimensions and any supplemental codes. The arrangement examples are shown below.

Examples of identification number

Example 1



Example 2



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 ～ -0.55 mm.

Table 2 Diameter tolerances of needle rollers unit: μm

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 \ Shaft	Tolerance class of shaft	
	$F_w \leqq 68$mm	$F_w > 68$mm
When high operating accuracy is required. 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 μmR_a or less are desirable. However, when the operating conditions are not severe, a surface roughness 0.8 μmR_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°C. The maximum allowable temperature for synthetic resin cage types is +110 ℃, and +100 ℃ 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.

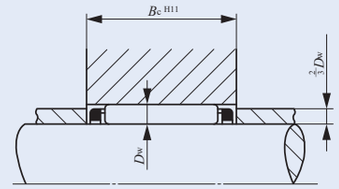


Fig.1

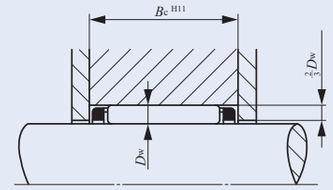


Fig.2

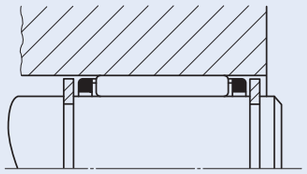


Fig.3

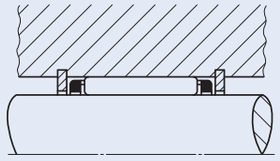


Fig.4

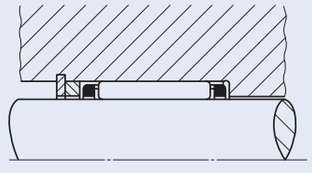


Fig.5

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE



High carbon steel cage type

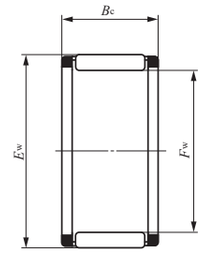


Synthetic resin cage type

Shaft dia. 3 — 14mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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
9	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
10	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
	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(1) 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. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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
	KT 121820	13.2	12	18	20	13 700	14 400	40 000
13	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

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE

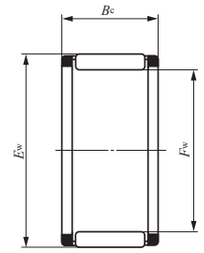


High carbon steel cage type

Shaft dia. 15 — 18mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



KT

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE

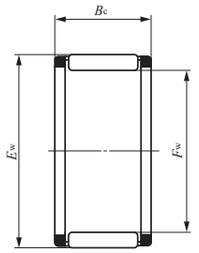


High carbon steel cage type

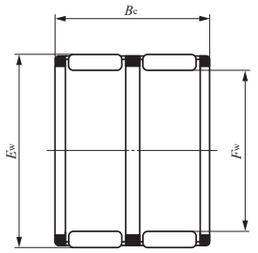
Shaft dia. 20 — 24mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



KT



KTW

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE



High carbon steel cage type



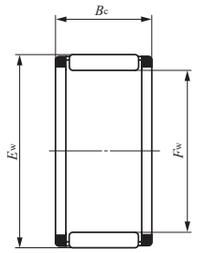


Synthetic resin cage type

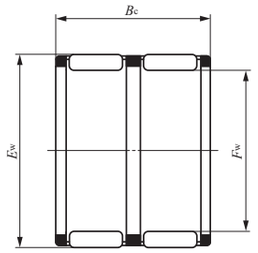
Shaft dia. 25 — 32mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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(1) 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. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min^{-1}
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

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE



High carbon steel cage type



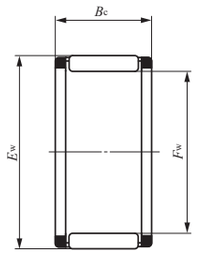


Synthetic resin cage type

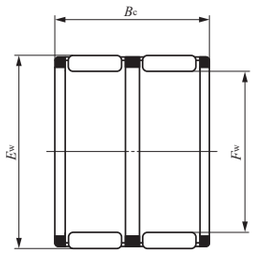
Shaft dia. 35 — 52mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) 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(1) 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. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) 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
	KT 455527	90.5	45	55	27	50 300	78 200	11 000
48	KT 485320	37	48	53	20	26 800	57 600	10 000
	KT 485420	46	48	54	20	30 600	60 400	10 000
50	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

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

NEEDLE ROLLER CAGES FOR GENERAL USAGE

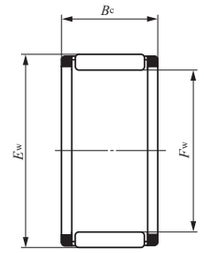


High carbon steel cage type

Shaft dia. 55 — 100mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min⁻¹
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(1) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 50% of this value is allowable.



KT

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(1) min⁻¹
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

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

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

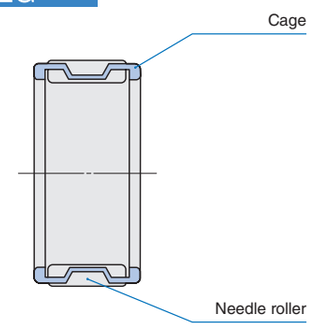
In Needle Roller Cages for Engine Connecting Rods, the types shown in Table 1 are available.

Table 1 Types

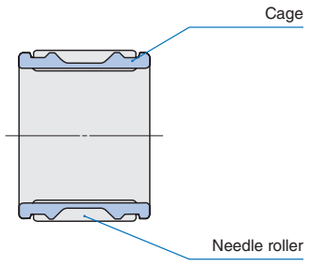
Type	For big end	For small end
Model code	KT···EG	KTV···EG

Structures of Needle Roller Cages for Engine Connecting Rods

KT···EG

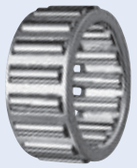


KTV···EG



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 bellow.), 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.



High-load capacity and high-rigidity cage KTZ ··· EG

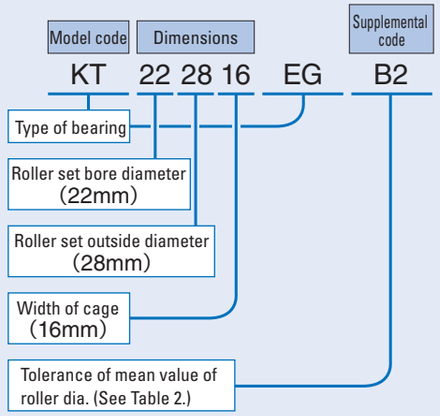
Needle Roller Cages for Small End KTV···EG

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.

Examples of identification number



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 ～− 0.2 mm ■ : − 0.1 ～− 0.3 mm

Table 2 Tolerances of needle roller diameter unit: μm

Class	Classification symbol(1)	Tolerance of mean value of roller dia. (2)
Standard	B 2	0 ～− 2
	B 4	− 2 ～− 4
Semi-standard	B 6	− 4 ～− 6
	B 8	− 6 ～− 8
	B10	− 8 ～− 10

Notes(1) The classification symbol is indicated at the end of the identification number.
(2) 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.

❶ 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.

❷ 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.

❸ 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 μmR_a or less, and the surface roughness of the connecting rod large end and small end bores be 0.2 μmR_a or less.

❹ Accuracy
Circularity and cylindricity of connecting rod, piston pin and crank pin are as shown in Table 4.

❺ 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: μm

Shaft dia. mm Over	Shaft dia. mm Incl.	Big end	Small end
—	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 μm

Table 4 Accuracy of connecting rod, piston pin and crank pin unit: μm

Range of dia. mm Over	Range of dia. mm Incl.	Crank pin diameter d_1 Piston pin diameter d_2 Circularity MAX.	Crank pin diameter d_1 Piston pin diameter d_2 Cylindricity MAX.	Big end bore D_1 Small end bore D_2 Circularity MAX.	Big end bore D_1 Small end bore D_2 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.

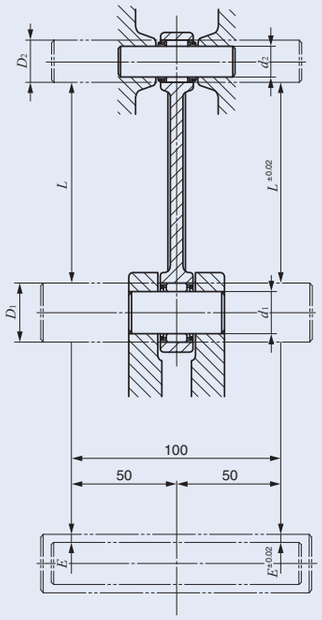


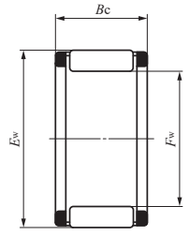
Fig.1

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

NEEDLE ROLLER CAGES FOR ENGINE CONNECTING RODS

Needle Roller Cages for Big End





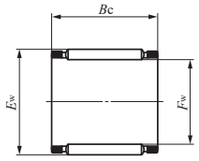
KT ··· EG

Shaft dia. 8 — 32mm

Shaft dia. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N
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. mm	Identification number	Mass (Ref.) g	Boundary dimensions mm F_w	E_w	B_c	Basic dynamic load rating C N	Basic static load rating C_0 N	Cage guide type
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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

●Machined Type Caged Needle Roller Bearings
●Machined Type Guide Needle Roller Bearings

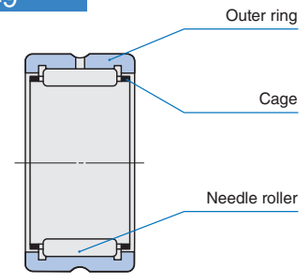


Structure and Features

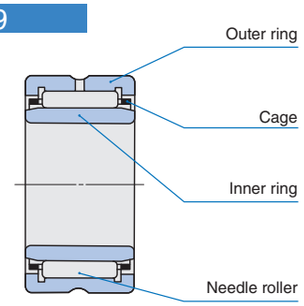
IKO Machined Type Needle Roller Bearings are bearings with a low sectional height and large load ratings. The outer ring has high rigidity and can easily be used even for light alloy housings. These bearings are available in metric series and inch series, both of which have the caged type and the full 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

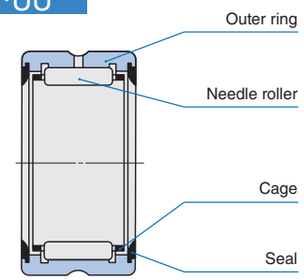
RNA49



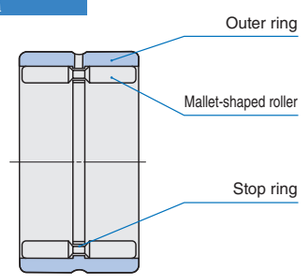
NA49



RNA49···UU



GTR



Types

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

Table 1.1 Type of bearing (Standard type)

Series \ Type		Caged Needle Roller Bearings		Guide Needle Roller Bearings	
		Without inner ring	With inner ring(1)	Without inner ring	With inner ring(1)
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)

Series \ Type			Caged Needle Roller Bearings		Guide Needle Roller Bearings	
			Without inner ring	With inner ring(1)	Without inner ring	With inner ring(1)
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	—	—	—	—

Note(1) For Machined Type Needle Roller Bearings with Inner Rings, the Needle Roller Bearings and Inner Rings will be delivered separately. If product is needed as one unit, please contact IKO.

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

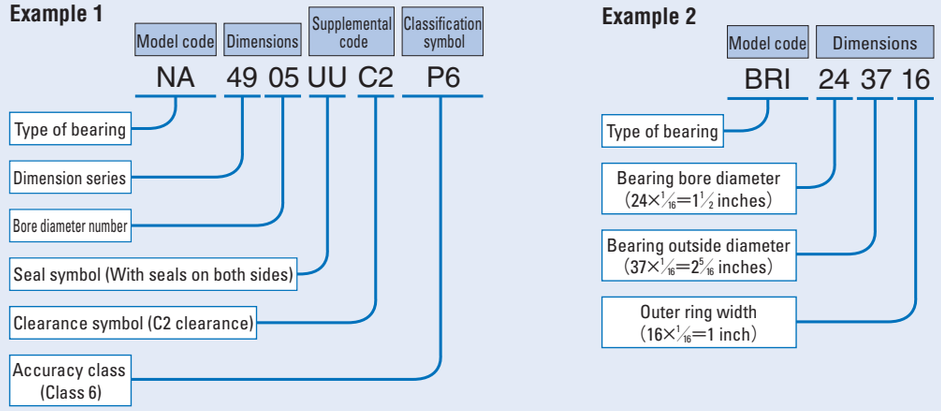
These bearings are full complement type bearings and use mallet-shaped rollers which are guided accurately by the guide rail located at the center of the outer ring raceway and the guide groove of the mallet-shaped roller. This minimizes skewing (tilting of the roller from its rotating axis), which is 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



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

unit: μm

d or D Nominal bearing bore dia. or outside dia. mm		Δ_{dmp} Single plane mean bore diameter deviation		Δ_{Dmp} Single plane mean outside diameter deviation		Δ_{Bs} (Δ_{Cs}) Deviation of a single inner (or outer) ring width		K_{ia} Radial runout of assembled bearing inner ring	K_{ea} Radial runout of assembled bearing 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 Δ_{dmp}, Δ_{Bs}, Δ_{Cs} and K_{ia}, and D for Δ_{Dmp} and K_{ea}

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

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

F_w Nominal roller set bore diameter mm		$\Delta_{Fws\,min}$ Deviation of smallest single roller 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: μm

F_w Nominal roller set bore diameter 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

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 ○: With prepacked grease ×: 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	×	—	—
	Inch series	BR, BRI	×	○	—
Guide Needle Roller Bearings	Metric series	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 6.1 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	$F_w \leqq 26$	0	—	—
			$26 < F_w$	1	—	—
	Inch series	BR, BRI	$F_w \leqq 69.850$	1	1	—
			$69.850 < F_w$	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.

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	$d \leqq 76.200$	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.

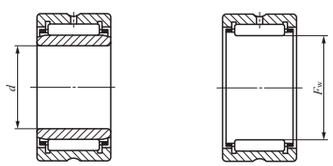
Mounting

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	Without inner ring
d=10 ～ 75mm	Fw=14 ～ 85mm
NA 4900 ～ 4915	RNA 4900 ～ 4915
NA 6901 ～ 6915	RNA 6901 ～ 6915
TAFI 102216 ～ 7510535	TAF 142216 ～ 8510535
TRI 153320 ～ 7510845	TR 203320 ～ 8310845



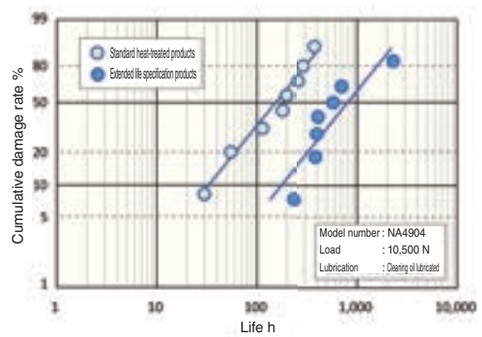


Fig. 1 Life Test Result

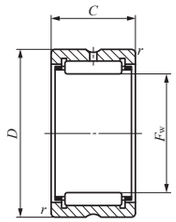
Remark This table shows the result of life testing under load conditions at 50% of the basic dynamic rating. The Extended Life Specification with special heat treatment lasted 5 times longer or more in L10 life compared to the standard heat-treated products.

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

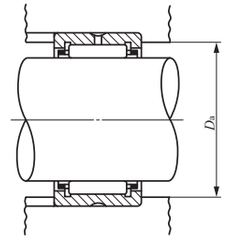
MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 TAF
RNA69 ($F_w \leqq 35$)



Shaft dia. 5 — 15mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min^{-1}
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

Notes(1) Minimum allowable value of chamfer dimension r
(2) 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.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





Shaft dia. 16 — 22mm

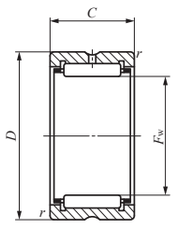
Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
16	**RNA 4901**	—	—	—	—	—	18.1
	—	—	—	**TAF 162416**	—	—	23
	—	—	—	**TAF 162420**	—	—	29
	—	**RNA 6901**	—	—	—	—	30
17	—	—	—	**TAF 172516**	—	—	24.5
	—	—	—	**TAF 172520**	—	—	30.5
18	**RNA 49/14**	—	—	—	—	—	19.9
	—	—	—	**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([1]) Minimum allowable value of chamfer dimension r

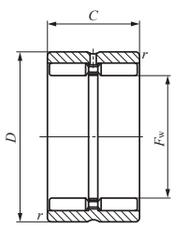
([2]) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

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.

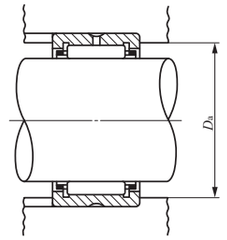
2. No grease is prepacked. Perform proper lubrication.



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



GTR



Boundary dimensions mm F_w	D	C	$r_{s\,min}$ ([1])	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed([2]) min^{-1}
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

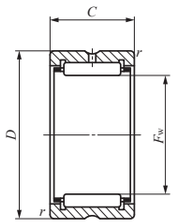
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

MACHINED TYPE NEEDLE ROLLER BEARINGS

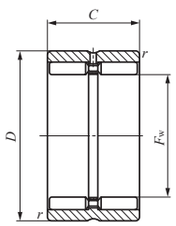
Without Inner Ring



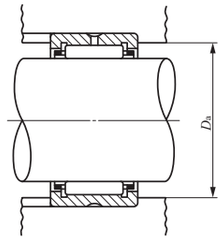




RNA49 TAF TR
RNA69 ($F_w \leqq 35$)



GTR



Shaft dia. 24 — 30mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min^{-1}
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

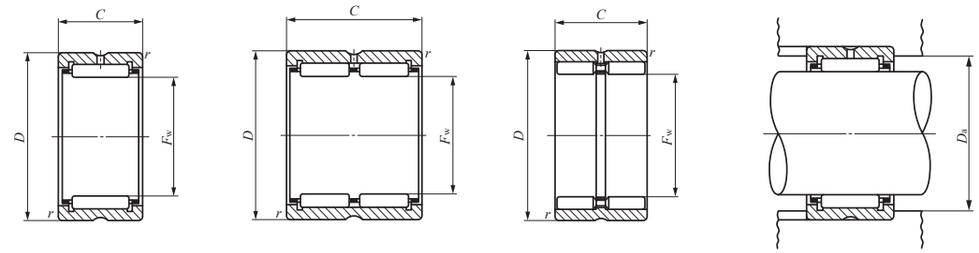
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. TAF series with a roller set bore diameter F_w of 26 mm or less have no oil hole. In others, the outer ring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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





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

RNA69

GTR

Shaft dia. 32 — 40mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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
	—	—	—	—	—	**GTR 354830**	163
37	—	—	—	**TAF 374720**	—	—	77.5
	—	—	—	**TAF 374730**	—	—	117
38	—	—	—	**TAF 384820**	—	—	79
	—	—	—	**TAF 384830**	—	—	119
	—	—	—	—	**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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(2) min^{-1}
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

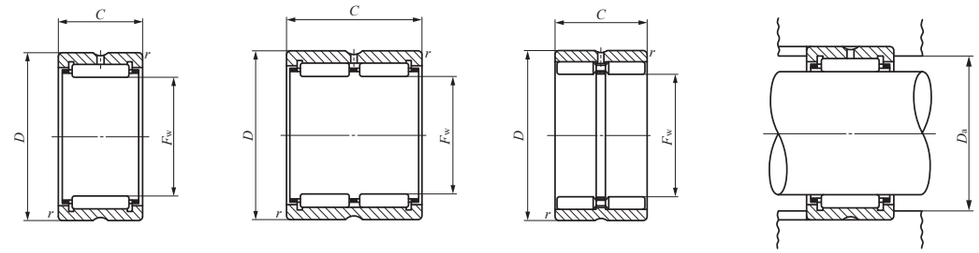
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 TAF TR　　RNA69　　GTR

Shaft dia. 42 — 50mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min^{-1}
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

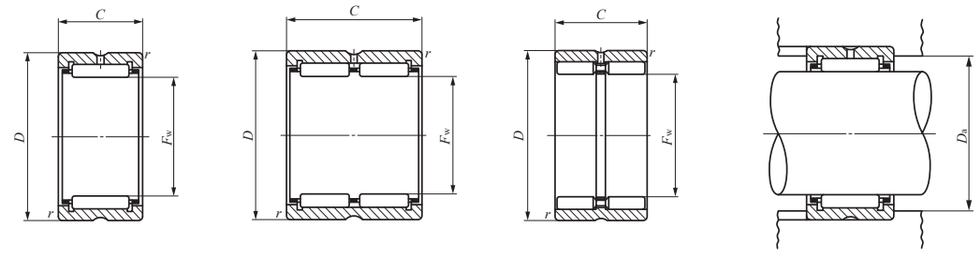
Notes(1)　Minimum allowable value of chamfer dimension r
(2)　Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 TAF TR　　RNA69　　GTR

Shaft dia. 52 — 68mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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
	—	—	—	—	—	**GTR 587745**	590
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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min^{-1}
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

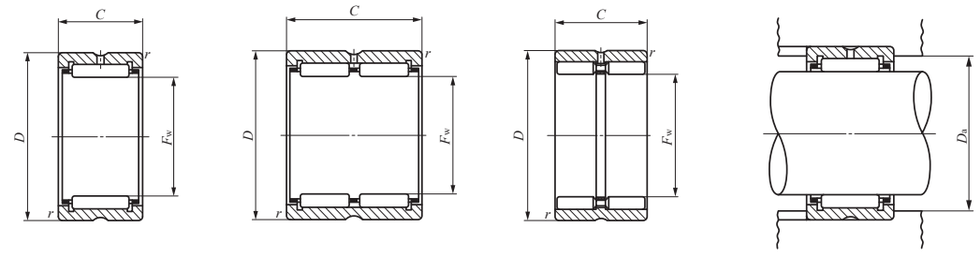
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 TAF TR　　RNA69　　GTR

Shaft dia. 70 — 85mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
70	—	—	—	**TAF 708525**	—	—	280
	—	—	—	**TAF 708535**	—	—	395
	RNA 49/62	—	—	—	—	—	320
	—	—	—	—	**TR 708945**	—	605
	—	—	—	—	—	**GTR 708945**	690
72	**RNA 4913**	—	—	—	—	—	325
	—	**RNA 6913**	—	—	—	—	585
73	—	—	—	**TAF 739025**	—	—	335
	—	—	—	**TAF 739035**	—	—	475
75	—	—	—	**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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min^{-1}
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

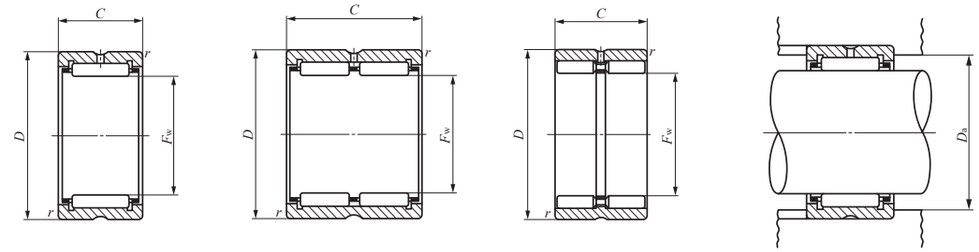
Notes(1) Minimum allowable value of chamfer dimension *r*
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 TAF TR　　RNA69　　GTR

Shaft dia. 90 — 105mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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
	—	—	—	—	—	**GTR 9512045**	1 230
100	—	—	—	**TAF 10012026**	—	—	525
	RNA 4917	—	—	—	—	—	705
	—	—	—	**TAF 10012036**	—	—	725
	—	**RNA 6917**	—	—	—	—	1 300
	—	—	—	—	**TR 10012550**	—	1 290
	—	—	—	—	—	**GTR 10012550**	1 440
105	—	—	—	**TAF 10512526**	—	—	545
	RNA 4918	—	—	—	—	—	740
	—	—	—	**TAF 10512536**	—	—	760
	—	**RNA 6918**	—	—	—	—	1 360

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(2) min^{-1}
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

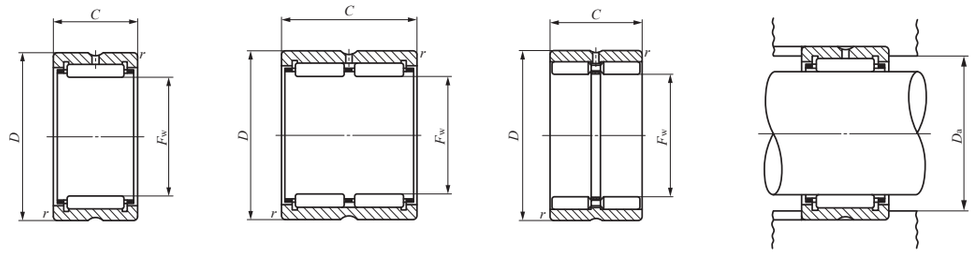
Notes(1) Minimum allowable value of chamfer dimension *r*
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring





RNA49 RNA48
TAF TR

RNA69

GTR

Shaft dia. 110 — 170mm

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

Boundary dimensions mm F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(2) min^{-1}
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

Notes(1) Minimum allowable value of chamfer dimension *r*
(2) 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.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

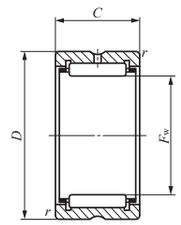
Without Inner Ring

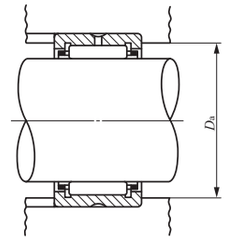


Shaft dia. 175 — 350mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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 4948	— —	RNA 4848 —	— —	— —	— —	5 670 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(1) Minimum allowable value of chamfer dimension *r*
(2) 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 F_w	D	C	$r_{s\,min}$ (1)	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(2) min^{-1}
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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

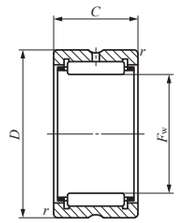
Without Inner Ring

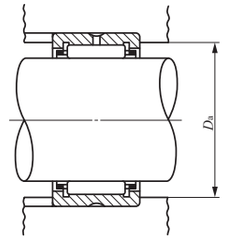


Shaft dia. 360 — 490mm

Shaft dia. mm	Identification number RNA 49	RNA 69	RNA 48	TAF	TR	GTR	Mass (Ref.) g
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([1]) Minimum allowable value of chamfer dimension r
([2]) 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

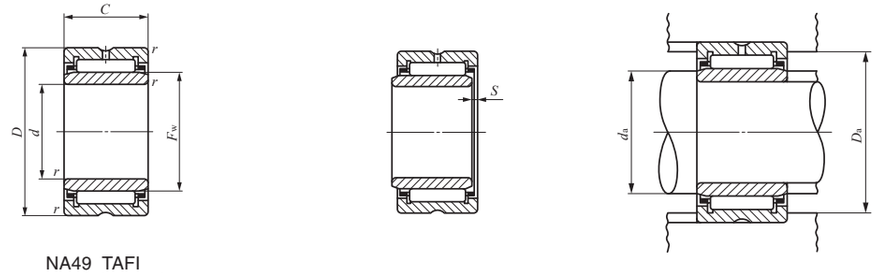
Boundary dimensions mm F_w	D	C	$r_{s\,min}$ ([1])	Standard mounting dimension D_a Max. mm	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed([2]) min^{-1}
360	440	118	3	427	1 170 000	2 830 000	750
370	420	80	2.1	409	651 000	2 140 000	700
380	460	118	3	447	1 220 000	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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring





NA49 TAFI
NA69 ($d \leqq 30$)

Shaft dia. 5 — 12mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) 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.

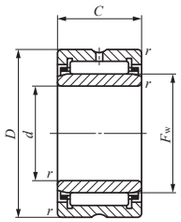
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

MACHINED TYPE NEEDLE ROLLER BEARINGS

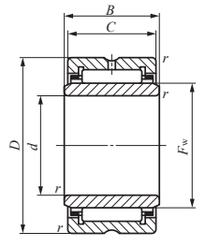
With Inner Ring



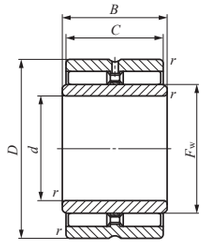




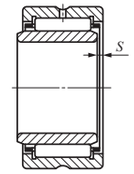
NA49 TAFI
NA69 ($d \leqq 30$)

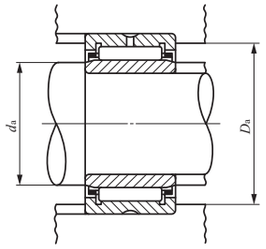


TRI



GTRI





Shaft dia. 15 — 22mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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
	—	—	—	—	—	**GTRI 203820**	110	20
	—	—	—	—	—	**GTRI 203825**	138	20
22	—	—	—	**TAFI 223416**	—	—	52	22
	—	—	—	**TAFI 223420**	—	—	67.5	22
	NA 49/22	—	—	—	—	—	87	22
	—	**NA 69/22**	—	—	—	—	152	22

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

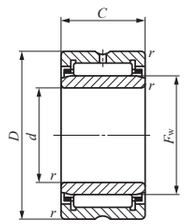
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. TAFI series with a bore diameter d of 22 mm or 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.

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

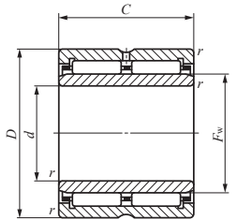
MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring

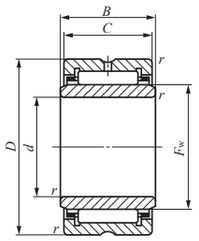




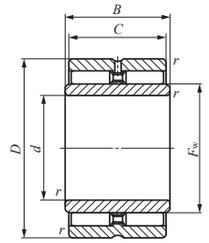
NA49 TAFI
NA69 ($d \leqq 30$)



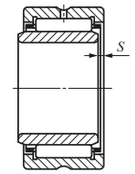
NA69

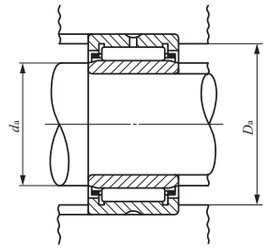


TRI



GTRI





Shaft dia. 25 — 32mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
25	—	—	—	**TAFI 253820**	—	—	82	25
	—	—	—	**TAFI 253830**	—	—	123	25
	NA 4905	—	—	—	—	—	92.5	25
	—	**NA 6905**	—	—	—	—	160	25
	—	—	—	—	**TRI 254425**	—	157	25
	—	—	—	—	—	**GTRI 254425**	175	25
28	—	—	—	**TAFI 284220**	—	—	96.5	28
	—	—	—	**TAFI 284230**	—	—	145	28
	NA 49/28	—	—	—	—	—	101	28
	—	**NA 69/28**	—	—	—	—	176	28
	—	—	—	—	—	**GTRI 284530**	196	28
30	—	—	—	**TAFI 304520**	—	—	112	30
	—	—	—	**TAFI 304530**	—	—	171	30
	NA 4906	—	—	—	—	—	106	30
	—	**NA 6906**	—	—	—	—	184	30
	—	—	—	—	**TRI 304830**	—	199	30
	—	—	—	—	—	**GTRI 304830**	225	30
32	—	—	—	**TAFI 324720**	—	—	121	32
	—	—	—	**TAFI 324730**	—	—	180	32
	NA 49/32	—	—	—	—	—	165	32
	—	—	—	—	**TRI 325230**	—	245	32
	—	**NA 69/32**	—	—	—	—	295	32
	—	—	—	—	—	**GTRI 325230**	270	32

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

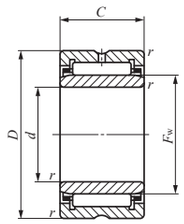
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

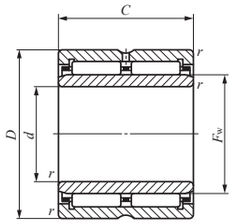
MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring

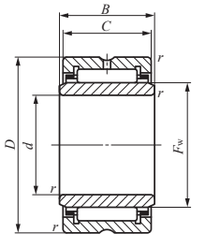




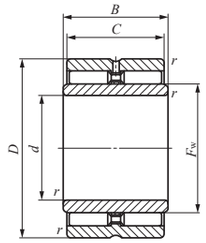
NA49 TAFI



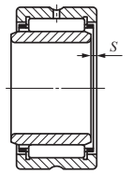
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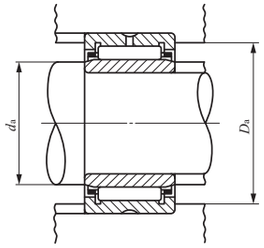


TRI



GTRI





Shaft dia. 35 — 45mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
35	—	—	—	**TAFI 355020**	—	—	129	35
	—	—	—	**TAFI 355030**	—	—	192	35
	NA 4907	—	—	—	—	—	178	35
	—	**NA 6907**	—	—	—	—	320	35
	—	—	—	—	**TRI 355630**	—	280	35
	—	—	—	—	—	**GTRI 355520**	191	35
	—	—	—	—	—	**GTRI 355630**	310	35
38	—	—	—	**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
	—	—	—	—	—	**GTRI 405930**	300	40
42	—	—	—	**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
	—	—	—	—	—	**GTRI 456430**	335	45

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

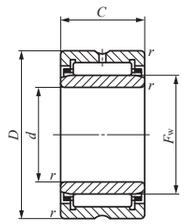
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

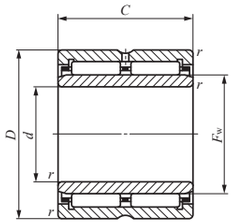
MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring

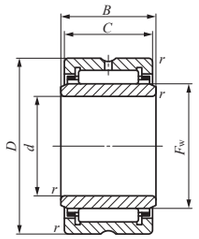




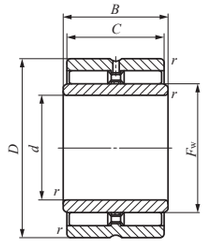
NA49 TAFI



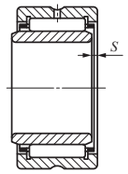
NA69

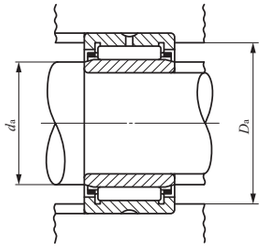


TRI



GTRI





Shaft dia. 50 — 70mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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
	—	**NA 6914**	—	—	—	—	1 400	70

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

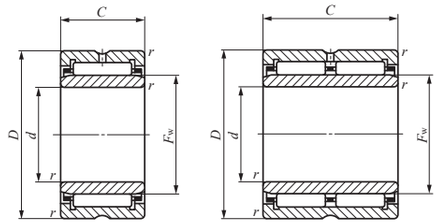
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

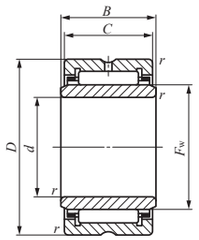
With Inner Ring



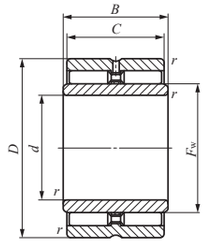


NA49 TAFI

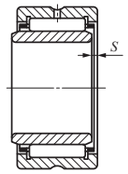
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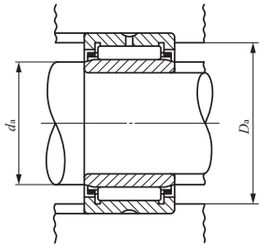


TRI



GTRI





Shaft dia. 75 — 90mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

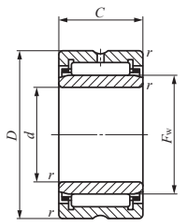
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

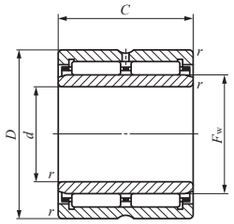
MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring

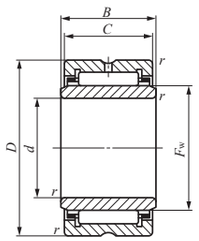




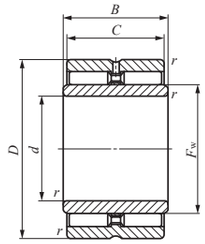
NA49 TAFI
NA48



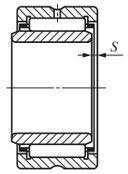
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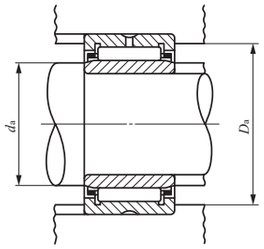


TRI



GTRI





Shaft dia. 95 — 150mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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
	—	—	—	—	**TRI 10013550**	—	2 040	100
	NA 4920	—	—	—	—	—	1 960	100
	—	—	—	—	—	**GTRI 10013550**	2 200	100
105	—	—	—	—	**TRI 10515350**	—	3 020	105
	—	—	—	—	—	**GTRI 10515350**	3 270	105
110	—	—	**NA 4822**	—	—	—	1 200	110
	NA 4922	—	—	—	—	—	2 120	110
120	—	—	**NA 4824**	—	—	—	1 300	120
	NA 4924	—	—	—	—	—	2 960	120
125	—	—	—	—	**TRI 12517860**	—	4 780	125
	—	—	—	—	—	**GTRI 12517860**	5 180	125
130	—	—	**NA 4826**	—	—	—	1 960	130
	NA 4926	—	—	—	—	—	4 030	130
135	—	—	—	—	**TRI 13518860**	—	5 100	135
	—	—	—	—	—	**GTRI 13518860**	5 530	135
140	—	—	**NA 4828**	—	—	—	2 100	140
	NA 4928	—	—	—	—	—	4 290	140
150	—	—	**NA 4830**	—	—	—	2 880	150
	NA 4930	—	—	—	—	—	6 380	150

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
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**

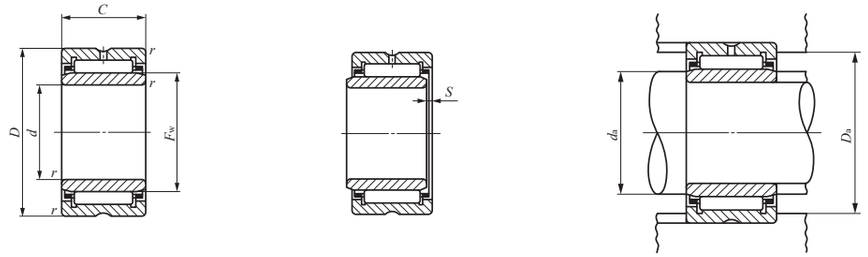
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring





NA49 NA48

Shaft dia. 160 — 340mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d	Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min⁻¹	Assembled inner ring
160	—	—	NA 4832	—	—	—	3 050	160	200	40	—	1.1	175	1.5	166.5	173	193.5	173 000	474 000	2 500	**LRT 16017540**
	NA 4932	—	—	—	—	—	6 750	160	220	60	—	2	180	3	169	178	211	337 000	761 000	1 900	**LRT 16018060**
170	—	—	NA 4834	—	—	—	4 120	170	215	45	—	1.1	185	1.5	176.5	183	208.5	211 000	567 000	1 900	**LRT 17018545**
	NA 4934	—	—	—	—	—	7 110	170	230	60	—	2	190	3	179	188	221	347 000	810 000	1 900	**LRT 17019060**
180	—	—	NA 4836	—	—	—	4 340	180	225	45	—	1.1	195	1.5	186.5	193	218.5	218 000	602 000	1 900	**LRT 18019545**
	NA 4936	—	—	—	—	—	10 200	180	250	69	—	2	205	3	189	203	241	434 000	989 000	1 900	**LRT 18020569**
190	—	—	NA 4838	—	—	—	5 760	190	240	50	—	1.5	210	1.5	198	208	232	249 000	726 000	1 800	**LRT 19021050**
	NA 4938	—	—	—	—	—	10 700	190	260	69	—	2	215	3	199	213	251	440 000	1 020 000	1 700	**LRT 19021569**
200	—	—	NA 4840	—	—	—	6 040	200	250	50	—	1.5	220	1.5	208	218	242	255 000	766 000	1 600	**LRT 20022050**
	NA 4940	—	—	—	—	—	15 400	200	280	80	—	2.1	225	4	211	223	269	518 000	1 120 000	1 600	**LRT 20022580**
220	—	—	NA 4844	—	—	—	6 570	220	270	50	—	1.5	240	1.5	228	238	262	266 000	833 000	1 500	**LRT 22024050**
	NA 4944	—	—	—	—	—	16 700	220	300	80	—	2.1	245	4	231	243	289	536 000	1 200 000	1 400	**LRT 22024580**
240	—	—	NA 4848	—	—	—	10 200	240	300	60	—	2	265	2	249	262	291	345 000	1 150 000	1 300	**LRT 24026560**
	NA 4948	—	—	—	—	—	18 000	240	320	80	—	2.1	265	4	251	262	309	565 000	1 320 000	1 300	**LRT 24026580**
260	—	—	NA 4852	—	—	—	11 000	260	320	60	—	2	285	2	269	282	311	354 000	1 220 000	1 100	**LRT 26028560**
	NA 4952	—	—	—	—	—	31 100	260	360	100	—	2.1	290	4	271	287	349	847 000	1 900 000	1 100	**LRT 260290100**
280	—	—	NA 4856	—	—	—	15 800	280	350	69	—	2	305	2.5	289	302	341	486 000	1 550 000	950	**LRT 28030569**
	NA 4956	—	—	—	—	—	33 100	280	380	100	—	2.1	310	4	291	307	369	877 000	2 040 000	950	**LRT 280310100**
300	—	—	NA 4860	—	—	—	22 300	300	380	80	—	2.1	330	2.5	311	327	369	610 000	1 900 000	900	**LRT 30033080**
	NA 4960	—	—	—	—	—	51 400	300	420	118	—	3	340	4	313	337	407	1 130 000	2 650 000	850	**LRT 300340118**
320	—	—	NA 4864	—	—	—	23 700	320	400	80	—	2.1	350	2.5	331	347	389	635 000	2 040 000	750	**LRT 32035080**
	NA 4964	—	—	—	—	—	54 400	320	440	118	—	3	360	4	333	357	427	1 170 000	2 830 000	750	**LRT 320360118**
340	—	—	NA 4868	—	—	—	25 000	340	420	80	—	2.1	370	2.5	351	367	409	651 000	2 140 000	700	**LRT 34037080**
	NA 4968	—	—	—	—	—	57 300	340	460	118	—	3	380	4	353	377	447	1 220 000	3 020 000	700	**LRT 340380118**

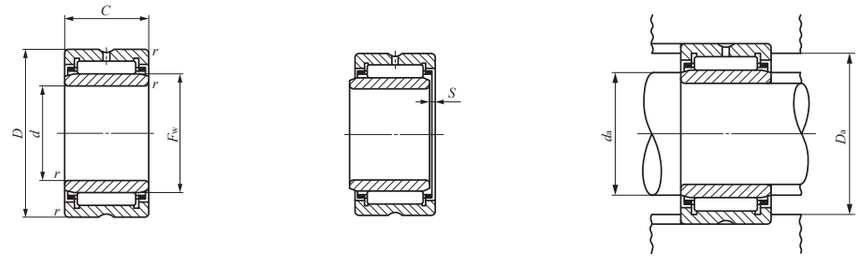
Notes(1) Minimum allowable value of chamfer dimension r
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring





NA49 NA48

Shaft dia. 360 — 440mm

Shaft dia. mm	Identification number NA 49	NA 69	NA 48	TAFI	TRI	GTRI	Mass (Ref.) g	d
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

Boundary dimensions mm D	C	B	$r_{s\,min}$ (1)	F_w	S (2)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min⁻¹	Assembled inner ring
440	80	—	2.1	390	2.5	371	387	429	680 000	2 320 000	650	**LRT 36039080**
480	118	—	3	400	4	373	397	467	1 260 000	3 200 000	600	**LRT 360400118**
480	100	—	2.1	415	3	391	412	469	951 000	2 860 000	600	**LRT 380415100**
520	140	—	4	430	5	396	427	504	1 540 000	4 030 000	500	**LRT 380430140**
540	140	—	4	450	5	416	447	524	1 590 000	4 270 000	500	**LRT 400450140**
560	140	—	4	470	5	436	467	544	1 640 000	4 510 000	500	**LRT 420470140**
600	160	—	4	490	5	456	487	584	1 910 000	5 140 000	400	**LRT 440490160**

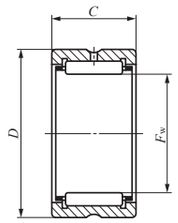
Notes(1) Minimum allowable value of chamfer dimension *r*
(2) Allowable axial shift amount of inner ring to outer ring
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil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

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

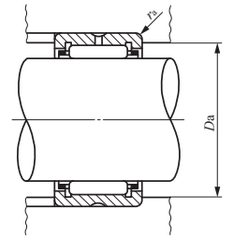
MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring, Inch Series





BR



Shaft dia. 15.875 — 47.625mm

Shaft dia. mm (inch)	Identification number	Mass (Ref.) g	Boundary dimensions mm(inch) F_w	D	C	Standard mounting dimensions mm D_a Max.	$r_{as\,max}$ (1)	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(2) min⁻¹
15.875 (5/8)	**BR 101812**	49	15.875 (5/8)	28.575 (1 1/8)	19.050 (3/4)	24.5	0.6	18 900	19 700	25 000
19.050 (3/4)	**BR 122012**	56	19.050 (3/4)	31.750 (1 1/4)	19.050 (3/4)	26.5	1	21 700	24 400	20 000
	BR 122016	75	19.050 (3/4)	31.750 (1 1/4)	25.400 (1)	26.5	1	27 600	33 100	20 000
22.225 (7/8)	**BR 142212**	63	22.225 (7/8)	34.925 (1 3/8)	19.050 (3/4)	29.7	1	23 000	27 100	18 000
	BR 142216	84.5	22.225 (7/8)	34.925 (1 3/8)	25.400 (1)	29.7	1	29 100	36 800	18 000
25.400 (1)	**BR 162412**	69	25.400 (1)	38.100 (1 1/2)	19.050 (3/4)	32.9	1	25 300	31 900	16 000
	BR 162416	92.5	25.400 (1)	38.100 (1 1/2)	25.400 (1)	32.9	1	32 100	43 300	16 000
28.575 (1 1/8)	**BR 182616**	102	28.575 (1 1/8)	41.275 (1 5/8)	25.400 (1)	36	1	34 900	49 900	14 000
	BR 182620	128	28.575 (1 1/8)	41.275 (1 5/8)	31.750 (1 1/4)	36	1	43 200	65 600	14 000
31.750 (1 1/4)	**BR 202816**	110	31.750 (1 1/4)	44.450 (1 3/4)	25.400 (1)	39.2	1	36 000	53 500	13 000
	BR 202820	138	31.750 (1 1/4)	44.450 (1 3/4)	31.750 (1 1/4)	39.2	1	44 600	70 300	13 000
34.925 (1 3/8)	**BR 223016**	119	34.925 (1 3/8)	47.625 (1 7/8)	25.400 (1)	42.4	1	38 500	60 000	11 000
	BR 223020	149	34.925 (1 3/8)	47.625 (1 7/8)	31.750 (1 1/4)	42.4	1	47 700	78 900	11 000
38.100 (1 1/2)	**BR 243316**	149	38.100 (1 1/2)	52.388 (2 1/16)	25.400 (1)	45.1	1.5	43 700	66 900	11 000
	BR 243320	187	38.100 (1 1/2)	52.388 (2 1/16)	31.750 (1 1/4)	45.1	1.5	54 200	88 200	11 000
41.275 (1 5/8)	**BR 263516**	158	41.275 (1 5/8)	55.562 (2 3/16)	25.400 (1)	48.3	1.5	44 800	70 900	9 500
	BR 263520	199	41.275 (1 5/8)	55.562 (2 3/16)	31.750 (1 1/4)	48.3	1.5	55 600	93 400	9 500
44.450 (1 3/4)	**BR 283716**	170	44.450 (1 3/4)	58.738 (2 5/16)	25.400 (1)	51.5	1.5	47 500	78 200	9 000
	BR 283720	215	44.450 (1 3/4)	58.738 (2 5/16)	31.750 (1 1/4)	51.5	1.5	58 900	103 000	9 000
	BR 283820	250	44.450 (1 3/4)	60.325 (2 3/8)	31.750 (1 1/4)	53.1	1.5	58 900	103 000	9 000
47.625 (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	60 100	108 000	8 500

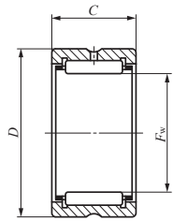
Notes(1) Maximum permissible corner radius of the housing
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The outer ring has an oil groove and an oil hole.
2. No grease is prepacked. Perform proper lubrication.

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

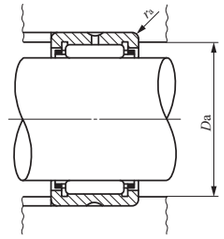
MACHINED TYPE NEEDLE ROLLER BEARINGS

Without Inner Ring, Inch Series





BR



Shaft dia. 50.800 — 101.600mm

Shaft dia. mm (inch)	Identification number	Mass (Ref.) g	Boundary dimensions mm(inch) F_w	D	C	Standard mounting dimensions mm D_a Max.	$r_{as\ max}$ (1)	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (2) min⁻¹
50.800 (2)	**BR 324116**	190	50.800 (2)	65.088 (2 9/16)	25.400 (1)	57.8	1.5	51 000	89 400	8 000
	BR 324120	240	50.800 (2)	65.088 (2 9/16)	31.750 (1 1/4)	57.8	1.5	63 200	118 000	8 000
57.150 (2 1/4)	**BR 364824**	435	57.150 (2 1/4)	76.200 (3)	38.100 (1 1/2)	69	1.5	90 300	158 000	7 000
	BR 364828	510	57.150 (2 1/4)	76.200 (3)	44.450 (1 3/4)	69	1.5	105 000	191 000	7 000
63.500 (2 1/2)	**BR 405224**	475	63.500 (2 1/2)	82.550 (3 1/4)	38.100 (1 1/2)	74.3	2	94 600	174 000	6 500
	BR 405228	555	63.500 (2 1/2)	82.550 (3 1/4)	44.450 (1 3/4)	74.3	2	110 000	210 000	6 500
69.850 (2 3/4)	**BR 445624**	510	69.850 (2 3/4)	88.900 (3 1/2)	38.100 (1 1/2)	80.7	2	98 700	189 000	5 500
	BR 445628	600	69.850 (2 3/4)	88.900 (3 1/2)	44.450 (1 3/4)	80.7	2	114 000	228 000	5 500
76.200 (3)	**BR 486024**	555	76.200 (3)	95.250 (3 3/4)	38.100 (1 1/2)	87	2	105 000	211 000	5 500
	BR 486028	650	76.200 (3)	95.250 (3 3/4)	44.450 (1 3/4)	87	2	122 000	255 000	5 500
82.550 (3 1/4)	**BR 526828**	990	82.550 (3 1/4)	107.950 (4 1/4)	44.450 (1 3/4)	99.7	2	141 000	259 000	5 000
	BR 526832	1 140	82.550 (3 1/4)	107.950 (4 1/4)	50.800 (2)	99.7	2	154 000	290 000	5 000
88.900 (3 1/2)	**BR 567232**	1 220	88.900 (3 1/2)	114.300 (4 1/2)	50.800 (2)	106.1	2	162 000	316 000	4 500
95.250 (3 3/4)	**BR 607632**	1 290	95.250 (3 3/4)	120.650 (4 3/4)	50.800 (2)	111.4	2.5	169 000	342 000	4 000
101.600 (4)	**BR 648032**	1 370	101.600 (4)	127.000 (5)	50.800 (2)	117.8	2.5	176 000	368 000	4 000

Notes(1) Maximum permissible corner radius of the housing
(2) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.

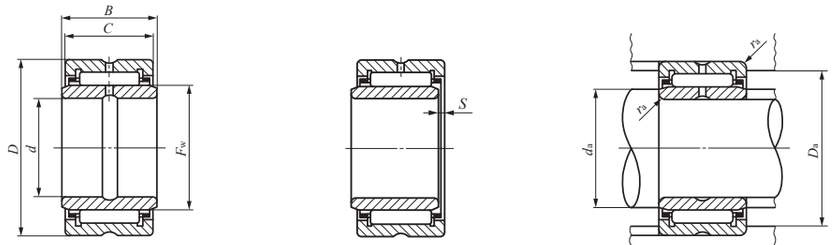
Remarks1. In bearings with a roller set bore diameter F_w of 69.850 mm or less, the outer ring has an oil groove and an oil hole. In others, the outer ring has an oil groove and two oil holes.
2. No grease is prepacked. Perform proper lubrication.

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring, Inch Series





BRI

Shaft dia. 9.525 — 41.275mm

Shaft dia. mm (inch)	Identification number	Mass (Ref.) g	Boundary dimensions mm(inch) d	D	C	B	F_w	S (1)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	$r_{as\,max}$ (2)	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed (3) min^{-1}	Assembled inner ring
9.525 (3/8)	**BRI 61812**	67.5	9.525 (3/8)	28.575 (1 1/8)	19.050 (3/4)	19.300	15.875 (5/8)	0.3	14	14.5	24.5	0.6	18 900	19 700	25 000	**LRB 61012**
12.700 (1/2)	**BRI 82012**	79.5	12.700 (1/2)	31.750 (1 1/4)	19.050 (3/4)	19.300	19.050 (3/4)	0.3	17.5	18	26.5	1	21 700	24 400	20 000	**LRB 81212**
	BRI 82016	106	12.700 (1/2)	31.750 (1 1/4)	25.400 (1)	25.650	19.050 (3/4)	0.5	17.5	18	26.5	1	27 600	33 100	20 000	**LRB 81216**
15.875 (5/8)	**BRI 102212**	91	15.875 (5/8)	34.925 (1 3/8)	19.050 (3/4)	19.300	22.225 (7/8)	0.3	21	21.2	29.7	1	23 000	27 100	18 000	**LRB 101412**
	BRI 102216	122	15.875 (5/8)	34.925 (1 3/8)	25.400 (1)	25.650	22.225 (7/8)	0.5	21	21.2	29.7	1	29 100	36 800	18 000	**LRB 101416**
19.050 (3/4)	**BRI 122412**	102	19.050 (3/4)	38.100 (1 1/2)	19.050 (3/4)	19.300	25.400 (1)	0.3	24	24.4	32.9	1	25 300	31 900	16 000	**LRB 121612**
	BRI 122416	136	19.050 (3/4)	38.100 (1 1/2)	25.400 (1)	25.650	25.400 (1)	0.5	24	24.4	32.9	1	32 100	43 300	16 000	**LRB 121616**
22.225 (7/8)	**BRI 142616**	152	22.225 (7/8)	41.275 (1 5/8)	25.400 (1)	25.650	28.575 (1 1/8)	0.5	27	27.5	36	1	34 900	49 900	14 000	**LRB 141816**
	BRI 142620	190	22.225 (7/8)	41.275 (1 5/8)	31.750 (1 1/4)	32.000	28.575 (1 1/8)	0.5	27	27.5	36	1	43 200	65 600	14 000	**LRB 141820**
25.400 (1)	**BRI 162816**	166	25.400 (1)	44.450 (1 3/4)	25.400 (1)	25.650	31.750 (1 1/4)	0.5	30.5	30.7	39.2	1	36 000	53 500	13 000	**LRB 162016**
	BRI 162820	210	25.400 (1)	44.450 (1 3/4)	31.750 (1 1/4)	32.000	31.750 (1 1/4)	0.5	30.5	30.7	39.2	1	44 600	70 300	13 000	**LRB 162020**
28.575 (1 1/8)	**BRI 183016**	182	28.575 (1 1/8)	47.625 (1 7/8)	25.400 (1)	25.650	34.925 (1 3/8)	0.5	33.5	33.9	42.4	1	38 500	60 000	11 000	**LRB 182216**
	BRI 183020	225	28.575 (1 1/8)	47.625 (1 7/8)	31.750 (1 1/4)	32.000	34.925 (1 3/8)	0.5	33.5	33.9	42.4	1	47 700	78 900	11 000	**LRB 182220**
31.750 (1 1/4)	**BRI 203316**	220	31.750 (1 1/4)	52.388 (2 1/16)	25.400 (1)	25.650	38.100 (1 1/2)	0.5	37	37.1	45.1	1.5	43 700	66 900	11 000	**LRB 202416**
	BRI 203320	275	31.750 (1 1/4)	52.388 (2 1/16)	31.750 (1 1/4)	32.000	38.100 (1 1/2)	0.5	37	37.1	45.1	1.5	54 200	88 200	11 000	**LRB 202420**
34.925 (1 3/8)	**BRI 223516**	235	34.925 (1 3/8)	55.562 (2 3/16)	25.400 (1)	25.650	41.275 (1 5/8)	0.5	40.2	40.2	48.3	1.5	44 800	70 900	9 500	**LRB 222616**
	BRI 223520	295	34.925 (1 3/8)	55.562 (2 3/16)	31.750 (1 1/4)	32.000	41.275 (1 5/8)	0.5	40.2	40.2	48.3	1.5	55 600	93 400	9 500	**LRB 222620**
38.100 (1 1/2)	**BRI 243716**	250	38.100 (1 1/2)	58.738 (2 5/16)	25.400 (1)	25.650	44.450 (1 3/4)	0.5	43.3	43.4	51.5	1.5	47 500	78 200	9 000	**LRB 242816**
	BRI 243720	315	38.100 (1 1/2)	58.738 (2 5/16)	31.750 (1 1/4)	32.000	44.450 (1 3/4)	0.5	43.3	43.4	51.5	1.5	58 900	103 000	9 000	**LRB 242820**
	BRI 243820	350	38.100 (1 1/2)	60.325 (2 3/8)	31.750 (1 1/4)	32.000	44.450 (1 3/4)	0.5	43.3	43.4	53.1	1.5	58 900	103 000	9 000	**LRB 242820**
	BRI 243920	380	38.100 (1 1/2)	61.912 (2 7/16)	31.750 (1 1/4)	32.000	47.625 (1 7/8)	0.5	43.3	43.4	54.7	1.5	60 100	108 000	8 500	**LRB 243020**
41.275 (1 5/8)	**BRI 264116**	325	41.275 (1 5/8)	65.088 (2 9/16)	25.400 (1)	25.650	50.800 (2)	0.5	48	49	57.8	1.5	51 000	89 400	8 000	**LRB 263216**
	BRI 264120	410	41.275 (1 5/8)	65.088 (2 9/16)	31.750 (1 1/4)	32.000	50.800 (2)	0.5	48	49	57.8	1.5	63 200	118 000	8 000	**LRB 263220**

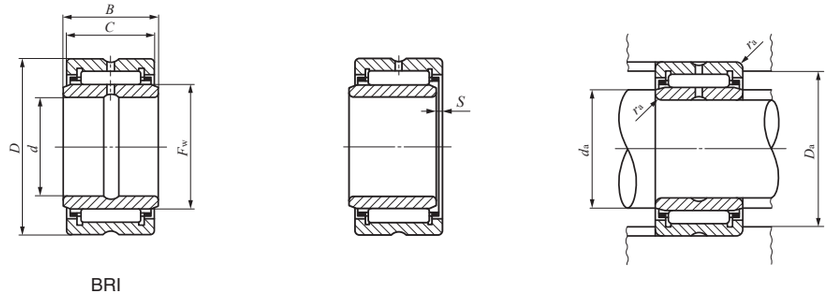
Notes(1) Allowable axial shift amount of inner ring to outer ring
(2) Maximum permissible corner radius of the shaft or housing
(3) Allowable rotational speed applies to oil lubrication. For grease lubrication, a maximum of 60% of this value is allowable.
Remarks1. The inner ring and the outer ring each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

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

MACHINED TYPE NEEDLE ROLLER BEARINGS

With Inner Ring, Inch Series





BRI

Shaft dia. 44.450 — 88.900mm

Shaft dia. mm (inch)	Identification number	Mass (Ref.) g	Boundary dimensions mm(inch) d	D	C	B	F_w	S(1)	Standard mounting dimensions mm d_a Min.	d_a Max.	D_a Max.	$r_{as\,max}$(2)	Basic dynamic load rating C N	Basic static load rating C_0 N	Allowable rotational speed(3) min^{-1}	Assembled inner ring
44.450 (1 3/4)	**BRI 284824**	735	44.450 (1 3/4)	76.200 (3)	38.100 (1 1/2)	38.350	57.150 (2 1/4)	1	52.5	55	69	1.5	90 300	158 000	7 000	**LRB 283624**
	BRI 284828	855	44.450 (1 3/4)	76.200 (3)	44.450 (1 3/4)	44.700	57.150 (2 1/4)	1	52.5	55	69	1.5	105 000	191 000	7 000	**LRB 283628**
50.800 (2)	**BRI 325224**	810	50.800 (2)	82.550 (3 1/4)	38.100 (1 1/2)	38.350	63.500 (2 1/2)	1	58	61	74.3	2	94 600	174 000	6 500	**LRB 324024**
	BRI 325228	945	50.800 (2)	82.550 (3 1/4)	44.450 (1 3/4)	44.700	63.500 (2 1/2)	1	58	61	74.3	2	110 000	210 000	6 500	**LRB 324028**
57.150 (2 1/4)	**BRI 365624**	885	57.150 (2 1/4)	88.900 (3 1/2)	38.100 (1 1/2)	38.350	69.850 (2 3/4)	1	65	67	80.7	2	98 700	189 000	5 500	**LRB 364424**
	BRI 365628	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	65	67	80.7	2	114 000	228 000	5 500	**LRB 364428**
63.500 (2 1/2)	**BRI 406024**	965	63.500 (2 1/2)	95.250 (3 3/4)	38.100 (1 1/2)	38.350	76.200 (3)	1	71	73	87	2	105 000	211 000	5 500	**LRB 404824**
	BRI 406028	1 130	63.500 (2 1/2)	95.250 (3 3/4)	44.450 (1 3/4)	44.700	76.200 (3)	1	71	73	87	2	122 000	255 000	5 500	**LRB 404828**
69.850 (2 3/4)	**BRI 446828**	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	77	79	99.7	2	141 000	259 000	5 000	**LRB 445228**
	BRI 446832	1 740	69.850 (2 3/4)	107.950 (4 1/4)	50.800 (2)	51.050	82.550 (3 1/4)	3	77	79	99.7	2	154 000	290 000	5 000	**LRB 445232**
76.200 (3)	**BRI 487232**	1 860	76.200 (3)	114.300 (4 1/2)	50.800 (2)	51.050	88.900 (3 1/2)	3	83.5	86	106.1	2	162 000	316 000	4 500	**LRB 485632**
82.550 (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	91	93	111.4	2.5	169 000	342 000	4 000	**LRB 526032**
88.900 (3 1/2)	**BRI 568032**	2 120	88.900 (3 1/2)	127.000 (5)	50.800 (2)	51.050	101.600 (4)	3	97	99	117.8	2.5	176 000	368 000	4 000	**LRB 566432**

Notes(1) Allowable axial shift amount of inner ring to outer ring
(2) Maximum permissible corner radius of the shaft or housing
(3) 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.

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