

Rolling Bearings



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Rolling Bearings

CAT. No. E1102m



Introduction to Revised **NSK** Rolling Bearing Catalog (CAT.No.E1102m)

We want to thank you for your interest in this edition of our Rolling Bearing Catalog. It has been revised with our customers in mind, and we hope it fills your needs.

Recently, technology has been advancing at a remarkable pace, and with it has come a host of new products in many fields including computers, office automation, audio-visual equipment, medical equipment, and many others. Accordingly, rolling bearings, which are highly important machine elements, must be designed to satisfy increasingly stringent requirements for higher speeds, greater precision, higher reliability, and other challenging demands.

We edited this Rolling Bearing Catalog to reflect the growing number of NSK products, new developments, and technical progress. In it, you will find a wide range of bearings that will satisfy almost any requirement.

This catalog was revised to reflect the growing number of NSK products and certain revisions in JIS and ISO and to better serve our customers. The first part contains general information about rolling bearings to facilitate selection of the most appropriate type. Next supplementary technical information is provided regarding bearing life, load ratings, limiting speeds, handling and mounting, lubrication, etc. Finally, the catalog presents extensive tables containing most bearing numbers and showing dimensions and pertinent design data listed in the order of increasing bore size. Data in the table are given in both the international Unit System (SI) and Engineering Unit System (Gravitational System of Units).

We hope this catalog will allow you to select the optimum bearing for your application. However, if assistance is required, please contact NSK, and the company's engineers and computer programs can quickly supply the information you need.



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1.TYPES AND FEATURES OF ROLLING BEARINGS

1.1 Design and Classification

Rolling bearings generally consist of two rings, rolling elements, and a cage, and they are classified into radial bearings or thrust bearings depending on the direction of the main load. In addition, depending on the type of rolling elements, they are classified into ball bearings or roller bearings, and they are further segregated by differences in their design or specific purpose.

The most common bearing types and nomenclature of bearing parts are shown in Fig.1.1, and a general classification of rolling bearings is shown in Fig. 1.2.

1.2 Characteristics of Rolling Bearings

Compared with plain bearings, rolling bearings have the following major advantages:

(1) Their starting torque or friction is low and the difference between the starting torque and running torque is small.

- (2) With the advancement of worldwide standardization, rolling bearings are internationally available and interchangeable.
- (3) Maintenance, replacement, and inspection are easy because the structure surrounding rolling bearings is simple.
- (4) Many rolling bearings are capable of taking both radial and axial loads simultaneously or independently.
- (5) Rolling bearings can be used under a wide range of temperatures.
- (6) Rolling bearings can be preloaded to produce a negative clearance and achieve greater rigidity.

Furthermore, different types of rolling bearings have their own individual advantages. The features of the most common rolling bearings are described on Pages A10 to A12 and in Table 1.1 (Pages A14 and A15).

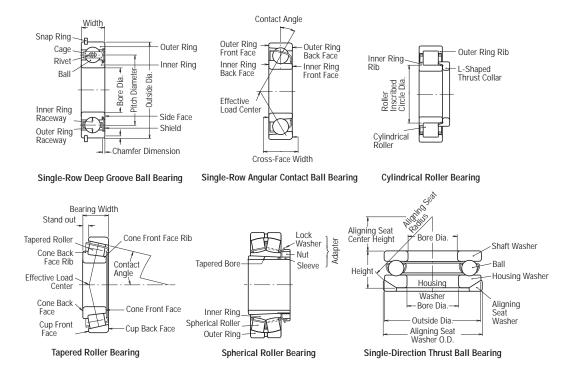
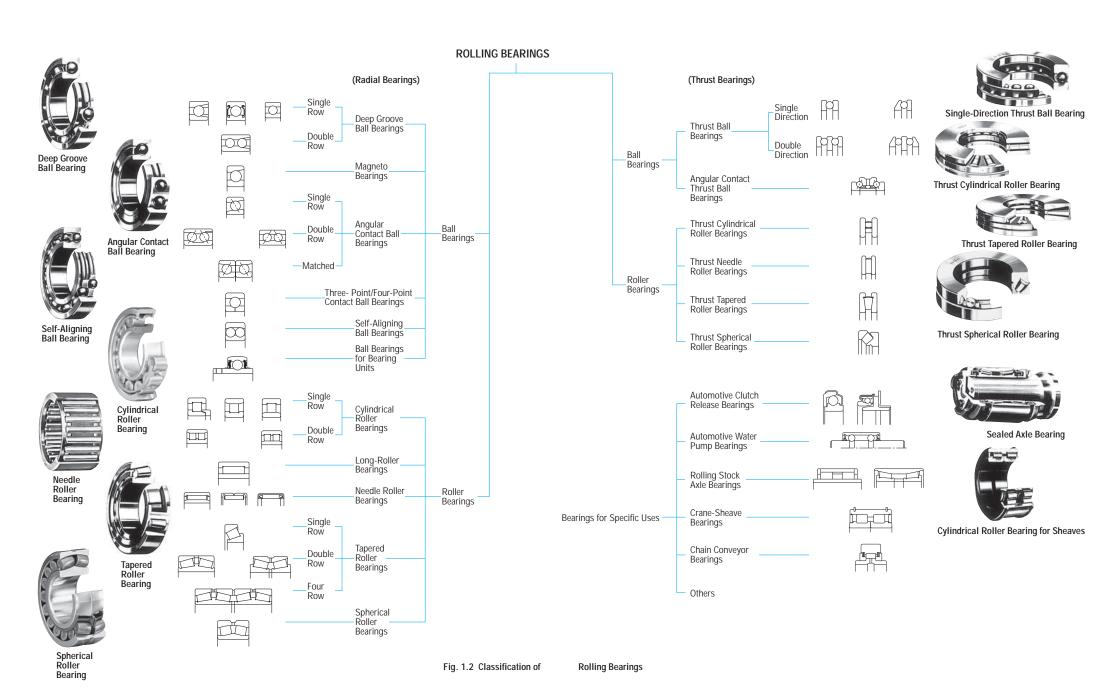


Fig. 1.1 Nomenclature for Bearing Parts

A 6 A 7







Single-Row Deep Groove Ball Bearings



Single-row deep groove ball bearings are the most common type of rolling bearings. Their use is very widespread. The raceway grooves on both the inner and outer rings have circular arcs of slightly larger radius than that of the balls. In addition to radial loads, axial loads can be imposed in either direction. Because of their low torque, they are highly suitable for applications where high speeds and low power loss are required.

In addition to open type bearings, these bearings often have steel shields or rubber seals installed on one or both sides and are prelubricated with grease. Also, snap rings are sometimes used on the periphery. As to cages, pressed steel ones are the most common.

Magneto Bearings



The inner groove of magneto bearings is a little shallower than that of deep groove bearings. Since the outer ring has a shoulder on only one side, the outer ring may be removed. This is often advantageous for mounting. In general, two such bearings are used in duplex pairs. Magneto bearings are small bearings with a bore diameter of 4 to 20 mm and are mainly used for small magnetos, gyroscopes, instruments, etc. Pressed brass cages are generally used.

Single-Row Angular Contact Ball Bearings



Individual bearings of this type are capable of taking radial loads and also axial loads in one direction. Four contact angles of 15°, 25°, 30°, and 40° are available. The larger the contact angle, the higher the axial load capacity. For high speed operation, however, the smaller contact angles are preferred. Usually, two bearings are used in duplex pairs, and the clearance between them must be adjusted properly.

Pressed-steel cages are commonly used, however, for high precision bearings with a contact angle less than 30°, polyamide resin cages are often used.



Duplex Bearings A combination of two radial bearings is called a duplex pair. Usually, they are formed using angular contact ball bearings or tapered roller bearings. Possible combinations include face-to-face, which have the outer ring faces together (type DF), back-to-back (type DB), or both front faces in the same direction (type DT). DF and DB duplex bearings are capable of taking radial loads and axial loads in either direction. Type DT is used when there is a strong axial load in one direction and it is necessary to impose the load equally on each bearing.

Double-Row **Angular Contact** Ball Bearings

Double-row angular contact ball bearings are basically two single-row angular contact ball bearings mounted back-to-back except that they have only one inner ring and one outer ring, each having raceways. They can take axial loads in either direction.



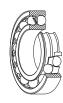
Four-Point Contact **Ball Bearings**



The inner and outer rings of four-point contact ball bearings are separable because the inner ring is split in a radial plane. They can take axial loads from either direction. The balls have a contact angle of 35° with each ring. Just one bearing of this type can replace a combination of face-to-face or back-to-back angular contact bearings.

Machined brass cages are generally used.

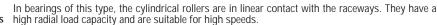
Self-Alianina Ball Bearings



The inner ring of this type of bearing has two raceways and the outer ring has a single spherical raceway with its center of curvature coincident with the bearing axis. Therefore, the axis of the inner ring, balls, and cage can deflect to some extent around the bearing center. Consequently, minor angular misalignment of the shaft and housing caused by machining or mounting error is automatically corrected.

This type of bearing often has a tapered bore for mounting using an adapter sleeve.

Cylindrical Roller Bearings



There are different types designated NU, NJ, NUP, N, NF for single-row bearings, and NNU, NN for double-row bearings depending on the design or absence of side ribs. The outer and inner rings of all types are separable.



Some cylindrical roller bearings have no ribs on either the inner or outer ring, so the rings can move axially relative to each other. These can be used as free-end bearings. Cylindrical roller bearings, in which either the inner or outer rings has two ribs and the other ring has one, are capable of taking some axial load in one direction. Double-row cylindrical roller bearings have high radial rigidity and are used primarily for precision machine tools.

Pressed steel or machined brass cages are generally used, but sometimes molded polyamide cages are also used.

A 11 A 10



Needle Roller Bearings

Needle roller bearings contain many slender rollers with a length 3 to 10 times their diameter. As a result, the ratio of the bearing outside diameter to the inscribed circle diameter is small, and they have a rather high radial load capacity.



There are numerous types available, and many have no inner rings. The drawn-cup type has a pressed steel outer ring and the solid type has a machined outer ring. There are also cage and roller assemblies without rings. Most bearings have pressed steel cages, but some are without cages.

Tapered Roller Bearings

Bearings of this type use conical rollers guided by a back-face rib on the cone. These bearings are capable of taking high radial loads and also axial loads in one direction. In the HR series, the rollers are increased in both size and number giving it an even higher load capacity.



They are generally mounted in pairs in a manner similar to single-row angular contact ball bearings. In this case, the proper internal clearance can be obtained by adjusting the axial distance between the cones or cups of the two opposed bearings. Since they are separable, the cone assemblies and cups can be mounted independently.

Depending upon the contact angle, tapered roller bearings are divided into three types called the normal angle, medium angle, and steep angle. Double-row and four-row tapered roller bearings are also available. Pressed steel cages are generally used.

Spherical Roller Bearings



These bearings have barrel-shaped rollers between the inner ring, which has two raceways, and the outer ring which has one spherical raceway. Since the center of curvature of the outer ring raceway surface coincides with the bearing axis, they are self-aligning in a manner similar to that of selfaligning ball bearings. Therefore, if there is deflection of the shaft or housing or misalignment of their axes, it is automatically corrected so excessive force is not applied to the bearings.

Spherical roller bearings can take, not only heavy radial loads, but also some axial loads in either direction. They have excellent radial load-carrying capacity and are suitable for use where there are heavy or impact loads.

Some bearings have tapered bores and may be mounted directly on tapered shafts or cylindrical shafts using adapters or withdrawal sleeves.

Pressed steel and machined brass cages are used.

Single-Direction Thrust Ball Bearings



Single-direction thrust ball bearings are composed of washer-like bearing rings with raceway grooves. The ring attached to the shaft is called the shaft washer (or inner ring) while that attached to the housing is called the housing washer (or outer ring).

In double-direction thrust ball bearings, there are three rings with the middle one (center ring) Double-Direction being fixed to the shaft.

Thrust Ball Bearings

There are also thrust ball bearings with an aligning seat washer beneath the housing washer in order to compensate for shaft misalignment or mounting error.

Pressed steel cages are usually used in the smaller bearings and machined cages in the larger



Spherical Thrust These bearings have a spherical raceway in the housing washer and barrel-shaped rollers obliquely Roller Bearings arranged around it. Since the raceway in the housing washer in spherical, these bearings are selfaligning. They have a very high axial load capacity and are capable of taking moderate radial loads when an axial load is applied.

Pressed steel cages or machined brass cages are usually used.



A 12 A 13



Table 1. 1 Types and Characteristics

_												
		Bearing Types	Deep Groove Ball Bearings	Magneto Bearings	Angular Contact Ball Bearings	Double-Row Angular Contact Ball Bearings	Duplex Angular Contact Ball Bearings	Four-Point Contact Ball Bearings	Self- Aligning Ball Bearings	Cylindrical Roller Bearings	Double-Row Cylindrical Roller Bearings	Cylindrical Roller Bearings with Single Rib
	Fe	atures				[DO]	Ø Ø	₩ P		囯		
	ity	Radial Loads	\bigcirc	0	0	0	0	0	\bigcirc	\odot	((o)
	Load Capacity	Axial Loads		0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\rightarrow	×	×	$\bigcup_{}$
	9	Combined Loads	\bigcirc	0	\odot	0	0	\bigcirc	0	×	×	\bigcirc
	ŀ	High Speeds	0	0	0	0	0	0	0	(\odot	0
	ŀ	High Accuracy			0		0	0		0	0	
		ow Noise and orque								0		
	F	Rigidity					0			0	0	0
	A	Angular Misalignment	0	0	0	0	0	0	0	\bigcirc	0	0
	(Self-Aligning Capability							☆			
	F	Ring Separability		☆				☆		☆	☆	☆
	F	ixed-End Bearing	☆			☆	☆	☆	☆			
	F	ree-End Bearing	*			*	*	*	*	☆	☆	
	1 i	Tapered Bore n Inner Ring							☆		☆	
	F	Remarks		Two bearings are usually mounted in opposition.	Contact angles of 15°, 25° 30°, and 40°. Two bearings are usually mounted in opposition. Clearance adjustment is necessary.		Combination of DF and DT pairs is possible, but use on free-end is not possible.	Contact angle of 35°		Including N type	Including NNU type	Including NF type
	F	Page No.	B5 B31	B5 B28	B47	B47 B70	B47	B47 B72	B77	B85	B85 B110	B85
Ī		Excellent	⊙ G	ood	O Fair	0	Poor ×	Impossible		ne direction nly	←→ Tw	o directions
		☆ Applicable	★ App	plicable, but	it is necessa	ry to allow s	haft contract	ion/elongatio	n at fitting s	urfaces of b	earings.	

of Rolling Bearings

Cylindrical Roller Bearings with Thrust Collars	Needle Roller Bearings	Tapered Roller Bearings	Double-and Multiple-Row Tapered Roller Bearings	Spherical Roller Bearings	Thrust Ball Bearings	Thrust Ball Bearings with Aligning Seat	Double- Direction Angular Contact Thrust Ball Bearings	Thrust Cylindrical Roller Bearings	Thrust Tapered Roller Bearings	Thrust Spherical Roller Bearings	Page No.
\bigcirc	0	\odot	0	0	×	×	×	×	×	0	
$\overline{\bigcirc}$	×	\bigcirc	$\bigcirc \downarrow$	$\bigcirc \mathfrak{l}$	\bigcirc	\bigcirc	\bigcirc	(i)	(i)		_
	×	0	0	0	×	×	×	×	×	0	_
\bigcirc	0	\bigcirc		\bigcirc	×	×	\bigcirc	0	0	0	A18 A37
		0			0		0				A19 A58 A81
											A19
\bigcirc	0	0	0				0	0	0		A19 A96
	0	\bigcirc	0	0	×	0	×	×	×	0	A18 Blue pages of each brg. type
				☆		☆				☆	A18
☆	☆	☆	☆		☆	☆	☆	☆	☆	☆	A19 A20
☆			☆	☆							A20 ~A21
	☆		*	*							A20 ~A27
				☆							A80 A118 A122
Including NUP type		Two bearings are usually mounted in opposition. Clearance adjustment is necessary.	KH, KV types are also available but use on free-end is impossible.					Including needle roller thrust bearings		To be used with oil lubrication	
B85		B115	B115 B176 B299	B183	B207	B207	B235	B207 B224		B207 B228	

A 14 A 15

[☆] Applicable ★ Applicable, but it is necessary to allow shaft contraction/elongation at fitting surfaces of bearings.



2. BEARING SELECTION PROCEDURE

The number of applications for rolling bearings is almost countless and the operating conditions and environments also vary greatly. In addition, the diversity of operating conditions and bearing requirements continue to grow with the rapid advancement of technology. Therefore, it is necessary to study bearings carefully from many angles to select the best one from the thousands of types and sizes available.

Usually, a bearing type is provisionally chosen considering the operating conditions, mounting arrangement, ease of mounting in the machine, allowable space, cost, availability, and other factors.

Then the size of the bearing is chosen to satisfy the desired life requirement. When doing this, in addition to fatigue life, it is necessary to consider grease life, noise and vibration, wear, and other factors.

There is no fixed procedure for selecting bearings. It is good to investigate experience with similar applications and studies relevant to any special requirements for your specific application. When selecting bearings for new machines, unusual operating conditions, or harsh environments, please consult with NSK.

The following diagram (Fig.2.1) shows an example of the bearing selection procedure.

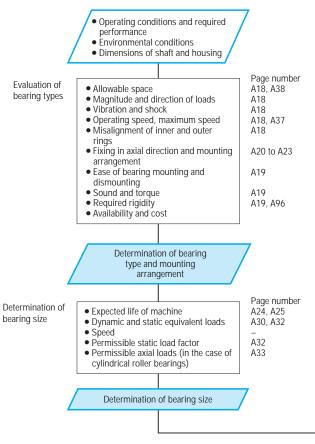
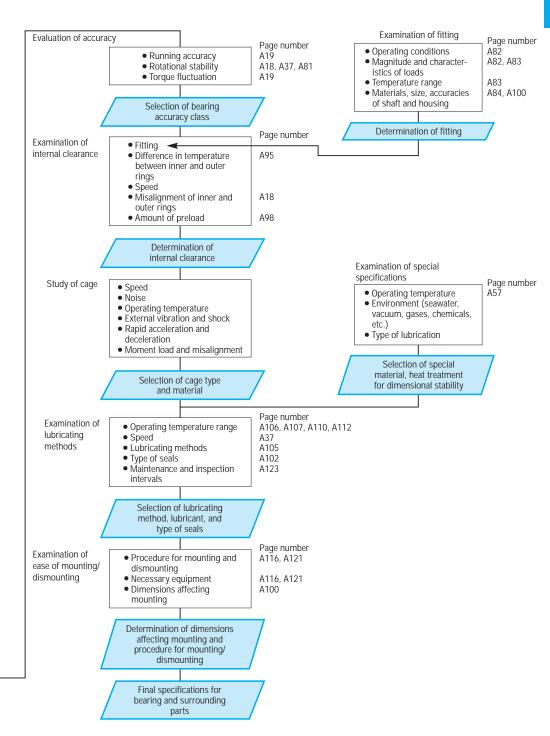


Fig. 2.1 Flow Chart for Selection of Rolling Bearings



3. SELECTION OF BEARING TYPES

3.1 Allowable Bearing Space

The allowable space for a rolling bearing and its adjacent parts is generally limited so the type and size of the bearing must be selected within such limits. In most cases, the shaft diameter is fixed first by the machine design; therefore, the bearing is often selected based on its bore size. For rolling bearings, there are numerous standardized dimension series and types, and the selection of the optimum bearing from among them is necessary. Fig. 3.1 shows the dimension series of radial bearings and corresponding bearing types.

3.2 Load Capacity and Bearing Types

The axial load carrying capacity of a bearing is closely related to the radial load capacity (see Page A24) in a manner that depends on the bearing design as shown in Fig. 3.2. This figure makes it clear that when bearings of the same dimension series are compared, roller bearings have a higher load capacity than ball bearings and are superior if shock loads exist.

3.3 Permissible Speed and Bearing Types

The maximum speed of rolling bearings varies depending, not only the type of bearing, but also its size, type of cage, loads, lubricating method, heat dissipation, etc. Assuming the common oil bath lubrication method, the bearing types are roughly ranked from higher speed to lower as shown in Fig. 3.3

3.4 Misalignment of Inner/Outer Rings and Bearing Types

Because of deflection of a shaft caused by applied loads, dimensional error of the shaft and housing, and mounting errors, the inner and outer rings are slightly misaligned. The permissible misalignment varies depending on the bearing type and operating conditions, but usually it is a small angle less than 0.0012 radian (4').

When a large misalignment is expected, bearings having a self-aligning capability, such as self-aligning ball bearings, spherical roller bearings, and certain bearing units should be selected (Figs. 3.4 and 3.5).

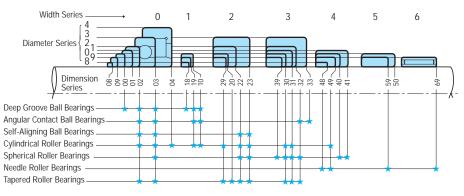


Fig. 3.1 Dimension Series of Radial Bearings

Bearing Types

Deep Groove

Ball Bearings

Ball Bearings

Needle Roller

Tapered Roller

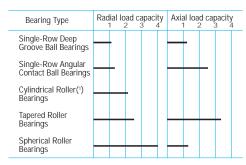
Bearings

Bearings

Bearings

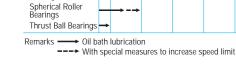
Angular Contact

Cylindrical Roller



Note(1) The bearings with ribs can take some axial loads.

Fig. 3.2 Relative Load Capacities of Various Bearing Types



Relative permissible speed

13

10

Fig. 3.3 Relative Permissible Speeds of Various Bearing Types

Permissible bearing misalignment is given at the beginning of the dimensional tables for each bearing type.

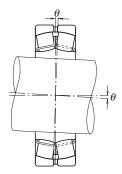


Fig. 3.4 Permissible Misalignment of Spherical Roller Bearings

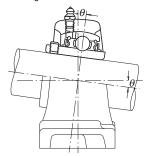


Fig. 3.5 Permissible Misalignment of Ball Bearing Units

Bearing Types	Highest accuracy specified	Tolerance comparison of inner ring radial runout 1 2 3 4 5
Deep Groove Ball Bearings	Class 2	-
Angular Contact Ball Bearings	Class 2	\rightarrow
Cylindrical Roller Bearings	Class 2	
Tapered Roller Bearings	Class 4	
Spherical Roller Bearings	Normal	

Fig. 3.6 Relative Inner Ring Radial Runout of Highest Accuracy Class for Various Bearing Types

3.5 Rigidity and Bearing Types

When loads are imposed on a rolling bearing, some elastic deformation occurs in the contact areas between the rolling elements and raceways. The rigidity of the bearing is determined by the ratio of bearing load to the amount of elastic deformation of the inner and outer rings and rolling elements. For the main spindles of machine tools, it is necessary to have high rigidity of the bearings together with the rest of the spindle. Consequently, since roller bearings are deformed less by load, they are more often selected than ball bearings. When extra high rigidity is required, bearings are given a preload, which means that they have a negative clearance. Angular contact ball bearings and tapered roller bearings are often preloaded.

3.6 Noise and Torque of Various Bearing Types

Since rolling bearings are manufactured with very high precision, noise and torque are minimal. For deep groove ball bearings and cylindrical roller bearings particularly, the noise level is sometimes specified depending on their purpose. For high precision miniature ball bearings, the starting torque is specified. Deep groove ball bearings are recommended for applications in which low noise and torque are required, such as motors and instruments.

3.7 Running Accuracy and Bearing Types

For the main spindles of machine tools that require high running accuracy or high speed applications like superchargers, high precision bearings of Class 5, 4 or 2 are usually used.

The running accuracy of rolling bearings is specified in various ways, and the specified accuracy classes vary depending on the bearing type. A comparison of the inner ring radial runout for the highest running accuracy specified for each bearing type is shown in Fig. 3.6.

For applications requiring high running accuracy, deep groove ball bearings, angular contact ball bearings, and cylindrical roller bearings are most suitable.

3.8 Mounting and Dismounting of Various Bearing Types

Separable types of bearings like cylindrical roller bearings, needle roller bearings and tapered roller bearings are convenient for mounting and dismounting. For machines in which bearings are mounted and dismounted rather often for periodic inspection, these types of bearings are recommended. Also, self-aligning ball bearings and spherical roller bearings (small ones) with tapered bores can be mounted and dismounted relatively easily using sleeves.



4. SELECTION OF BEARING ARRANGEMENT

In general, shafts are supported by only two bearings. When considering the bearing mounting arrangement, the following items must be investigated:

- Expansion and contraction of the shaft caused by temperature variations.
- (2) Ease of bearing mounting and dismounting.
- (3) Misalignment of the inner and outer rings caused by deflection of the shaft or mounting error.
- (4) Rigidity of the entire system including bearings and preloading method.
- (5) Capability to sustain the loads at their proper positions and to transmit them.

4.1 Fixed-End and Free-End Bearings

Fixed-end

Fixed-end

Among the bearings on a shaft, only one can be a "fixed-end" bearing that is used to fix the shaft axially. For this fixed-end bearing, a type which can carry both radial and axial loads must be selected.

Bearings other than the fixed-end one must be "freeend" bearings that carry only radial loads to relieve the shaft's thermal elongation and contraction.

No distinction between fixed-end and free-end

No distinction between fixed-end and free-end

Free-end (separable bearing)

Free-end (non-separable bearing)

If measures to relieve a shaft's thermal elongation and contraction are insufficient, abnormal axial loads are applied to the bearings, which can cause premature failure.

For free-end bearings, cylindrical roller bearings or needle roller bearings with separable inner and outer rings that are free to move axially (NU, N types, etc.) are recommended. When these types are used, mounting and dismounting are also easier.

When non-separable types are used as free-end bearings, usually the fit between the outer ring and housing is loose to allow axial movement of the running shaft together with the bearing. Sometimes, such elongation is relieved by a loose fitting between the inner ring and shaft.

When the distance between the bearings is short and the influence of the shaft elongation and contraction is negligible, two opposed angular contact ball bearings or tapered roller bearings are used. The axial clearance (possible axial movement) after the mounting is adjusted using nuts or shims.

BEARING B · Cylindrical I

Cylindrical Roller Bearing (NU, N types)
Needle Roller Bearing (NA type, etc.) Fig. 4.1.

BEARING C(1)

Deep Groove Ball Bearing
 Matched Angular Contact
Ball Bearing (back-to-back)
 Double Pow Angular

· Double-Row Angular Contact Ball Bearing

Self-Aligning Ball Bearing
 Double-Row Tapered
 Roller Bearing (KBE type)
 Spherical Roller Bearing

BEARING F

Deep Groove Ball Bearing Self-Aligning Ball Bearing Spherical Roller Bearing

BEARING D,E(²)

Angular Contact Ball
Bearing

Tapered Roller Bearing

Magneto Bearing

Cylindrical Roller Bearing

(NJ, NF types)

BEARING A

Ball Bearing

types)

· Deep Groove Ball Bearing · Matched Angular Contact

· Double-Row Angular

Contact Ball Bearing
Self-Aligning Ball Bearing
Cylindrical Roller Bearing

with Ribs (NH, NUP

· Double-Row Tapered

· Spherical Roller Bearing

Roller Bearing

Notes: (1) In the figure, shaft elongation and contraction are relieved at the outside surface of the outer ring, but sometimes it is done at the bore.

(2) For each type, two bearings are used in opposition.

The distinction between free-end and fixed-end bearings and some possible bearing mounting arrangements for various bearing types are shown in

4.2 Example of Bearing Arrangements

Some representative bearing mounting arrangements considering preload and rigidity of the entire assembly, shaft elongation and contraction, mounting error, etc. are shown in Table 4.1.

Table 4. 1 Representative Bearing Mounting Arrangements and Application Examples

Bearing Ar	rangements	- Remarks	Application Examples
Fixed-end	Free-end	IVCIII II IS	Aphiration Evamples
		 This is a common arrangement in which abnormal loads are not applied to bearings even if the shaft expands or contracts. If the mounting error is small, this is suitable for high speeds. 	Medium size electric motors, blowers
		OThis can withstand heavy loads and shock loads and can take some axial load. Every type of cylindrical roller bearing is separable. This is helpful when interference is necessary for both the inner and outer rings.	Traction motors for rolling stock
		 This is used when loads are relatively heavy. For maximum rigidity of the fixed-end bearing, it is a back-to-back type. Both the shaft and housing must have high accuracy and the mounting error must be small. 	Table rollers for steel mills, main spindles of lathes
		OThis is also suitable when interference is necessary for both the inner and outer rings. Heavy axial loads cannot be applied.	Calender rolls of paper making machines, axles of diesel locomotives
		 This is suitable for high speeds and heavy radial loads. Moderate axial loads can also be applied. It is necessary to provide some clearance between the outer ring of the deep groove ball bearing and the housing bore in order to avoid subjecting it to radial loads. 	Reduction gears in diesel locomotives



Continued on next page



Table 4. 1 Representative Bearing Mounting Arrangements and Application Examples (cont'd)

Bearing Arrangements Fixed-end Free-end	Remarks	Application Examples
The cha	○This is the most common arrangement. ○It can sustain not only radial loads, but moderate axial loads also.	Double suction volute pumps, automotive transmissions
	 This is the most suitable arrangement when there is mounting error or shaft deflection. It is often used for general and industrial applications in which heavy loads are applied. 	Speed reducers, table rollers of steel mills, wheels for overhead travelling cranes
	 This is suitable when there are rather heavy axial loads in both directions. Double row angular contact bearings may be used instead of a arrangement of two angular contact ball bearings. 	Worm gear reducers
When there is no distinction between fixed-end and free-end	Remarks	Application Examples
Back-to-back mounting Face-to-face mounting	 This arrangement is widely used since it can withstand heavy loads and shock loads. The back-to-back arrangement is especially good when the distance between bearings is short and moment loads are applied. Face-to-face mounting makes mounting easier when interference is necessary for the inner ring. In general, this arrangement is good when there is mounting error. To use this arrangement with a preload, affection must be paid to the amount of preload and clearance adjustment. 	Pinion shafts of automotive differential gears, automotive front and rear axles, worm gear reducers
Back-to-back mounting	 This is used at high speeds when radial loads are not so heavy and axial loads are relatively heavy. It provides good rigidity of the shaft by preloading. For moment loads, back-to-back mounting is better than face-to-face mounting. 	Grinding wheel shafts

When there is no distinction between fixed-end and free-end	Remarks	Application Examples
NJ + NJ mounting	 ○This can withstand heavy loads and shock loads. ○It can be used if interference is necessary for both the inner and outer rings. ○Care must be taken so the axial clearance doesn't become too small during running. ○NF type + NF type mounting is also possible. 	Final reduction gears of construction machines
	Osometimes a spring is used at the side of the outer ring of one bearing.	Small electric motors, small speed reducers, small pumps
Vertical arrangements	Remarks	Application Examples
	Matched angular contact ball bearings are on the fixed end.Cylindrical roller bearing is on the free end.	Vertical electric motors
	 The spherical center of the self-aligning seat must coincide with that of the self-aligning ball bearing. The upper bearing is on the free end. 	Vertical openers (spinning and weaving machines)

Continued on next page



5. SELECTION OF BEARING SIZE

5.1 Bearing Life

The various functions required of rolling bearings vary according to the bearing application. These functions must be performed for a prolonged period. Even if bearings are properly mounted and correctly operated, they will eventually fail to perform satisfactorily due to an increase in noise and vibration, loss of running accuracy, deterioration of grease, or fatigue flaking of the rolling surfaces.

Bearing life, in the broad sense of the term, is the period during which bearings continue to operate and to satisfy their required functions. This bearing life may be defined as noise life, abrasion life, grease life, or rolling fatigue life, depending on which one causes loss of bearing service.

Aside from the failure of bearings to function due to natural deterioration, bearings may fail when conditions such as heat-seizure, fracture, scoring of the rings, damage of the seals or the cage, or other damage occurs.

Conditions such as these should not be interpreted as normal bearing failure since they often occur as a result of errors in bearing selection, improper design or manufacture of the bearing surroundings, incorrect mounting, or insufficient maintenance.

5.1.1 Rolling Fatigue Life and Basic Rating Life

When rolling bearings are operated under load, the raceways of their inner and outer rings and rolling elements are subjected to repeated cyclic stress. Because of metal fatigue of the rolling contact surfaces of the raceways and rolling elements, scaly particles may separate from the bearing material (Fig. 5.1). This phenomenon is called "flaking". Rolling fatigue life is represented by the total number of revolutions at which time the bearing surface will start flaking due to stress. This is called fatigue life. As shown in Fig. 5.2, even for seemingly identical bearings, which are of the same type, size, and material and receive the same heat treatment and other processing, the rolling fatigue life varies greatly even under identical operating conditions. This is because the flaking of materials due to fatigue is subject to many other variables. Consequently, "basic rating life", in which rolling fatigue life is treated as a statistical phenomenon, is used in preference to actual rolling fatigue life.

Suppose a number of bearings of the same type are operated individually under the same conditions. After a certain period of time, 10 % of them fail as a result of flaking caused by rolling fatigue. The total number of revolutions at this point is defined as the basic rating life or, if the speed is constant, the basic rating life is often expressed by the total number of operating hours completed when 10 % of the bearings become inoperable due to flaking.

In determining bearing life, basic rating life is often the only factor considered. However, other factors must also be taken into account. For example, the grease life

of grease-prelubricated bearings (refer to Section 12, Lubrication, Page A107) can be estimated. Since noise life and abrasion life are judged according to individual standards for different applications, specific values for noise or abrasion life must be determined empirically.

5.2 Basic Load Rating and Fatigue Life5.2.1 Basic Load Rating

The basic load rating is defined as the constant load applied on bearings with stationary outer rings that the inner rings can endure for a rating life of one million revolutions ($10^6~{\rm rev}$). The basic load rating of radial bearings is defined as a central radial load of constant direction and magnitude, while the basic load rating of thrust bearings is defined as an axial load of constant magnitude in the same direction as the central axis. The load ratings are listed under $C_{\rm r}$ for radial bearings and $C_{\rm a}$ for thrust bearings in the dimension tables.

5.2.2 Machinery in which Bearings are Used and Projected Life

It is not advisable to select bearings with unnecessarily high load ratings, for such bearings may be too large and uneconomical. In addition, the bearing life alone should not be the deciding factor in the selection of bearings. The strength, rigidity, and design of the shaft



Fig. 5.1 Example of Flaking

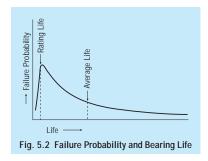


Table 5. 1 Fatigue Life Factor f_h for Various Bearing Applications

Operating Deriods			Fatigue Life Factor $f_{ m f}$	ı	
Operating Periods	~3	2~4	3~5	4~7	6~
Infrequently used or only for short periods	· Small motors for home appliances like vacuum cleaners and washing machines · Hand power tools	· Agricultural equipment			
Used only occasionally but reliability is impor- tant		· Motors for home heaters and air conditioners · Construction equipment	· Conveyors · Elevator cable sheaves		
Used intermittently for relatively long periods	· Rolling mill roll necks	Small motors Deck cranes General cargo cranes Pinion stands Passenger cars	Factory motors Machine tools Transmissions Vibrating screens Crushers	Crane sheaves Compressors Specialized transmissions	
Used intermittently for more than eight hours daily		·Escalators	Centrifugal separators Air conditioning equipment Blowers Woodworking machines Large motors Axle boxes on railway rolling stock	Mine hoists Press flywheels Railway traction motors Locomotive axle boxes	Paper making machines
Used continuously and high reliability is impor- tant					Waterworks pumps Electric power stations Mine draining pumps

on which the bearings are to be mounted should also be considered. Bearings are used in a wide range of applications and the design life varies with specific applications and operating conditions. Table 5.1 gives an empirical fatigue life factor derived from customary operating experience for various machines. Also refer to Table 5.2.

5.2.3 Selection of Bearing Size Based on Basic Load Rating

The following relation exists between bearing load and basic rating life:

For ball bearings
$$L = \left(\frac{C}{P}\right)^3$$
.....(5.1)
For roller bearings $L = \left(\frac{C}{P}\right)^{\frac{10}{3}}$(5.2)

where L: Basic rating life (10⁶ rev)

P: Bearing load (equivalent load) (N), {kgf}(Refer to Page A30)

C: Basic load rating (N), {kgf} For radial bearings, C is written C_r For thrust bearings, C is written C_a

In the case of bearings that run at a constant speed, it is convenient to express the fatigue life in terms of hours. In general, the fatigue life of bearings used in automobiles and other vehicles is given in terms of mileage.

By designating the basic rating life as L_h (h), bearing speed as n (min⁻¹), fatigue life factor as f_h , and speed factor as f_n , the relations shown in Table 5.2 are obtained:

Table 5. 2 Basic Rating Life, Fatigue Life Factor and Speed Factor

	. aoto: ana opo	ou : uoto.
Life Parameters	Ball Bearings	Roller Bearings
Basic Rating Life	$L_{\rm h} = \frac{10^6}{60 n} \left(\frac{C}{P}\right)^3 = 500 f_{\rm h}^3$	$L_{\rm h} = \frac{10^6}{60n} \left(\frac{C}{P}\right)^{\frac{10}{3}} = 500 f_{\rm h}^{\frac{10}{3}}$
Fatigue Life Factor	$f_{\rm h} = f_{ m h} \frac{C}{P}$	$f_{\rm h} = f_{ m n} \frac{C}{P}$
Speed Factor	$f_{n} = \left(\frac{10^{6}}{500 \times 60 n}\right)^{\frac{1}{3}}$ $= (0.03 n)^{-\frac{1}{3}}$	$f_{n} = \left(\frac{10^{6}}{500 \times 60 n}\right)^{\frac{3}{10}}$ $= (0.03 n)^{-\frac{3}{10}}$

n, f_nFig. 5.3 (See Page A26), Appendix Table 12 (See Page C24)

 $L_{\rm h},~f_{\rm h}$...Fig. 5.4 (See Page A26), Appendix Table 13 (See Page C25)



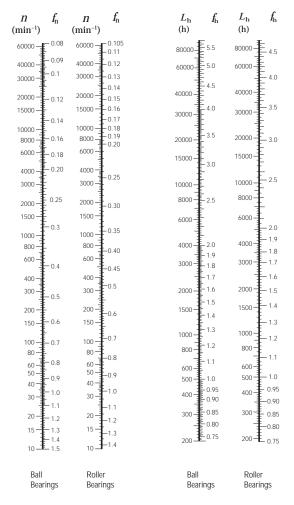


Fig. 5.3 Bearing Speed and Speed Factor

Fig. 5.4 Fatigue Life Factor and Fatigue Life

If the bearing load P and speed n are known, determine a fatigue life factor f_h appropriate for the projected life of the machine and then calculate the basic load rating C by means of the following equation.

$$C = \frac{f_{\rm h} \cdot P}{f_{\rm n}} \dots (5.3)$$

A bearing which satisfies this value of C should then be selected from the bearing

5.2.4 Temperature Adjustment for Basic Load Rating

If rolling bearings are used at high temperature, the hardness of the bearing steel decreases. Consequently, the basic load rating, which depends on the physical properties of the material, also decreases. Therefore, the basic load rating should be adjusted for the higher temperature using the following equation:

$$C_t = f_t \cdot C \quad \dots \quad (5.4)$$

where C_t : Basic load rating after temperature correction (N), {kgf}

> $f_{\rm t}$: Temperature factor (See Table 5.3.)

C: Basic load rating before temperature adjustment $(N), \{kgf\}$

If large bearings are used at higher than 120°C, they must be given special dimensional stability heat treatment to prevent excessive dimensional changes. The basic load rating of bearings given such special dimensional stability heat treatment may become lower than the basic load rating listed in the bearing tables.

Table 5.3 Temperature Factor $f_{\rm t}$

		•			
Bearing Temperature °C	125	150	175	200	250
Temperature Factor $ extbf{\emph{f}}_{ ext{t}}$	1.00	1.00	0.95	0.90	0.75

5.2.5 Correction of Basic Rating Life

As described previously, the basic equations for calculating the basic rating life are as follows:

For ball bearings
$$L_{10} = \left(\frac{C}{P}\right)^3$$
(5.5)

For roller bearings
$$L_{10} = \left(\frac{C}{P}\right)^{\frac{10}{3}}$$
(5.6)

The L_{10} life is defined as the basic rating life with a statistical reliability of 90%. Depending on the machines in which the bearings are used, sometimes a reliability higher than 90% may be required. However, recent improvements in bearing material have greatly extended the fatigue life. In addition, the developent of the Elasto-Hydrodynamic Theory of Lubrication proves that the thickness of the lubricating film in the contact zone between rings and rolling elements greatly influences bearing life. To reflect such improvements in the calculation of fatique life, the basic rating life is adjusted using the following adjustment factors:

$$L_{\text{na}} = \partial_1 \, \partial_2 \, \partial_3 \, L_{10} \, \dots (5.7)$$

where L_{na} : Adjusted rating life in which reliability, material improvements, lubricating conditions, etc. are considered

 L_{10} : Basic rating life with a reliability of 90%

a₁: Life adjustment factor for reliability

a2: Life adjustment factor for special bearing properties

a₃: Life adjustment factor for operating conditions

The life adjustment factor for reliability, a_1 , is listed in Table 5.4 for reliabilities higher than 90%.

The life adjustment factor for special bearing properties, a_2 , is used to reflect improvements in bearing steel.

NSK now uses vacuum degassed bearing steel, and the results of tests by NSK show that life is greatly improved when compared with earlier materials. The basic load ratings C_r and C_a listed in the bearing tables were calculated considering the extended life achieved by improvements in materials and manufacturing techniques. Consequently, when estimating life using Equation (5.7), it is sufficient to assume that is greater than one.

Table 5.4 Reliability Factor a_1

Reliability (%)	90	95	96	97	98	99
∂_1	1.00	0.62	0.53	0.44	0.33	0.21

The life adjustment factor for operating conditions a_3 is used to adjust for various factors, particularly lubrication. If there is no misalignment between the inner and outer rings and the thickness of the lubricating film in the contact zones of the bearing is sufficient, it is possible for a_3 to be greater than one; however, a_3 is less than one in the following cases:

- ·When the viscosity of the lubricant in the contact zones between the raceways and rolling elements is low.
- ·When the circumferential speed of the rolling elements is very slow.
- · When the bearing temperature is high.
- · When the lubricant is contaminated by water or foreign matter.
- · When misalignment of the inner and outer rings is excessive.

It is difficult to determine the proper value for a_3 for specific operating conditions because there are still many unknowns. Since the special bearing property factor a_2 is also influenced by the operating conditions, there is a proposal to combine a_2 and a_3 into one quantity($a_2 \times a_3$), and not consider them independently. In this case, under normal lubricating and operating conditions, the product $(a_2 \times a_3)$ should be assumed equal to one. However, if the viscosity of the lubricant is too low, the value drops to as low as 0.2.

If there is no misalignment and a lubricant with high viscosity is used so sufficient fluid-film thickness is secured, the product of $(a_2 \times a_3)$ may be about two.

When selecting a bearing based on the basic load rating, it is best to choose an a_1 reliability factor appropriate for the projected use and an empirically determined C/P or f_b value derived from past results for lubrication, temperature, mounting conditions, etc. in similar machines.

The basic rating life equations (5.1), (5.2), (5.5), and (5.6) give satisfactory results for a broad range of bearing loads. However, extra heavy loads may cause detrimental plastic deformation at ball/raceway contact points. When $P_{\rm r}$ exceeds $C_{\rm or}$ (Basic static load rating) or 0.5 $C_{\rm r}$, whichever is smaller, for radial bearings or P_a exceeds 0.5 C_a for thrust bearings, please consult NSK to establish the applicability of the rating fatigue life equations.



5.3 Calculation of Bearing Loads

The loads applied on bearings generally include the weight of the body to be supported by the bearings, the weight of the revolving elements themselves, the transmission power of gears and belting, the load produced by the operation of the machine in which the bearings are used, etc. These loads can be theoretically calculated, but some of them are difficult to estimate. Therefore, it becomes necessary to correct the estimated using empirically derived data.

5.3.1 Load Factor

When a radial or axial load has been mathematically calculated, the actual load on the bearing may be greater than the calculated load because of vibration and shock present during operation of the machine. The actual load may be calculated using the following equation:

where F_r , F_a : Loads applied on bearing (N), {kgf}

 $\begin{array}{c} F_{rc},\,F_{ac}: \text{Theoretically calculated load (N),} \\ \{kgf\} \end{array}$

 f_{w} : Load factor

The values given in Table 5.5 are usually used for the load factor $f_{\rm w}$.

5.3.2 Bearing Loads in Belt or Chain Transmission Applications

The force acting on the pulley or sprocket wheel when power is transmitted by a belt or chain is calculated using the following equations.

$$M = 9 550 000H/n...(N \cdot mm)$$

= 974 000 $H/n....(kgf \cdot mm)$ }.....(5.9)

$$P_{\rm k} = M / r$$
(5.10)

where M: Torque acting on pulley or sprocket wheel $(N \cdot mm)$, $\{kgf \cdot mm\}$

 P_{k} : Effective force transmitted by belt or chain (N), {kgf}

H: Power transmitted(kW)

n: Speed (min⁻¹)

r: Effective radius of pulley or sprocket wheel (mm)

When calculating the load on a pulley shaft, the belt tension must be included. Thus, to calculate the actual load $K_{\rm b}$ in the case of a belt transmission, the effective transmitting power is multiplied by the belt factor $f_{\rm b}$, which represents the belt tension. The values of the belt factor $f_{\rm b}$ for different types of belts are shown in Table 5.6.

$$K_{\rm b} = f_{\rm b} \cdot P_{\rm k}$$
(5.11)

In the case of a chain transmission, the values corresponding to f_b should be 1.25 to 1.5.

Table 5. 5 Values of Load Factor f_{vv}

Operating Conditions	Typical Applications	$f_{\rm w}$
Smooth operation free from shocks	Electric motors, Machine tools, Air conditioners	1 to 1.2
Normal operation	Air blowers, Compressors, Elevators, Cranes, Paper making machines	1.2 to 1.5
Operation accompanied by shock and vibration	Construction equipment, Crushers, Vibrating screens, Rolling mills	1.5 to 3

Table 5. 6 Belt Factor $f_{\rm b}$

$f_{ m b}$
1.3 to 2
2 to 2.5
2.5 to 3
4 to 5

5.3.3 Bearing Loads in Gear Transmission Applications

The loads imposed on gears in gear transmissions vary according to the type of gears used. In the simplest case of spur gears, the load is calculated as follows:

$$M = 9 550 000H / n(N \cdot mm)$$

$$= 974 000H / n\{kgf \cdot mm\}\}......(5.12)$$

$$P_k = M / r(5.13)$$

$$S_k = P_k \tan \theta(5.14)$$

$$K_c = \sqrt{P_k^2 + S_k^2} = P_k \sec \theta(5.15)$$

where M: Torque applied to gear $(N \cdot mm)$, $\{kgf \cdot mm\}$

 P_k : Tangential force on gear (N), {kgf}

 S_k : Radial force on gear (N), $\{kgf\}$

 K_c : Combined force imposed on gear (N), {kgf}

H: Power transmitted (kW)

n: Speed (min⁻¹)

r: Pitch circle radius of drive gear (mm)

 θ : Pressure angle

In addition to the theoretical load calculated above, vibration and shock (which depend on how accurately the gear is finished) should be included using the gear factor $f_{\rm g}$ by multiplying the theoretically calculated load by this factor.

The values of $f_{\rm g}$ should generally be those in Table 5.7. When vibration from other sources accompanies gear operation, the actual load is obtained by multiplying the load factor by this gear factor.

Table 5. 7 Values of Gear Factor f_{σ}

Gear Finish Accuracy	$f_{ m g}$
Precision ground gears	1 ~1.1
Ordinary machined gears	1.1~1.3

5.3.4 Load Distribution on Bearings

In the simple examples shown in Figs. 5.5 and 5.6. The radial loads on bearings I and II can be calculated using the following equations:

$$F_{\rm CI} = \frac{b}{c} K$$
....(5.16)

$$F_{\text{CII}} = \frac{a}{C}K \dots (5.17)$$

where F_{CI} : Radial load applied on bearing I (N), {kgf}

 F_{CII} : Radial load applied on bearing II (N), {kgf}

K: Shaft load (N), {kgf}

When these loads are applied simultaneously, first the radial load for each should be obtained, and then, the sum of the vectors may be calculated according to the load direction.

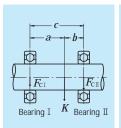


Fig. 5.5 Radial Load Distribution (1)

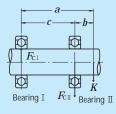


Fig. 5.6 Radial Load Distribution (2)

5.3.5 Average of Fluctuating Load

When the load applied on bearings fluctuates, an average load which will yield the same bearing life as the fluctuating load should be calculated.

(1) When the relation between load and rotating speed is divided into the following steps (Fig. 5.7)

 $\begin{array}{c} \mathsf{Load} \ F_1 : \mathsf{Speed} \ \textit{\textbf{n}}_1 \ ; \ \mathsf{Operating} \ \mathsf{time} \ \textit{\textbf{t}}_1 \\ \mathsf{Load} \ F_2 : \ \mathsf{Speed} \ \textit{\textbf{n}}_2 \ ; \ \mathsf{Operating} \ \mathsf{time} \ \textit{\textbf{t}}_2 \\ \vdots \\ \vdots \\ \vdots \\ \end{array}$

Load $F_{
m n}$: Speed $n_{
m n}$; Operating time $t_{
m n}$

Then, the average load $F_{\rm m}$ may be calculated using the following equation:

$$F_{\rm m} = {}^{\rm p} \sqrt{\frac{F_1{}^{\rm p} n_1 t_1 + F_2{}^{\rm p} n_2 t_2 + \dots + F_n{}^{\rm p} n_n t_n}{n_1 t_1 + n_2 t_2 + \dots + n_n t_n}}$$
.....(5.18)

where F_m : Average fluctuating load (N), {kgf}

p = 3 for ball bearings

p = 10/3 for roller bearings

NSK

The average speed $n_{\rm m}$ may be calculated as follows:

$$n_{\rm m} = \frac{n_1 t_1 + n_2 t_2 + \dots + n_{\rm n} t_{\rm n}}{t_1 + t_2 + \dots + t_{\rm n}} \dots (5.19)$$

(2) When the load fluctuates almost linearly (Fig. 5.8), the average load may be calculated as follows:

$$F_{\rm m} = \frac{1}{3} (F_{\rm min} + 2F_{\rm max}) \dots (5.20)$$

 F_{\min} : Minimum value of fluctuating load (N), {kgf}

 F_{\max} : Maximum value of fluctuating load (N), {kgf}

(3) When the load fluctuation is similar to a sine wave (Fig. 5.9), an approximate value for the average load $F_{\rm m}$ may be calculated from the following

In the case of Fig. 5.9 (a)

$$F_{\rm m} \stackrel{..}{=} 0.65 \; F_{\rm max}$$
(5.21)

In the case of Fig. 5.9 (b)

(4) When both a rotating load and a stationary load are applied (Fig. 5.10).

 $F_{\mathbb{R}}$: Rotating load (N), {kgf}

 F_s : Stationary load (N), {kgf}

An approximate value for the average load F_m may be calculated as follows:

a) Where
$$F_{\rm R} \ge F_{\rm S}$$

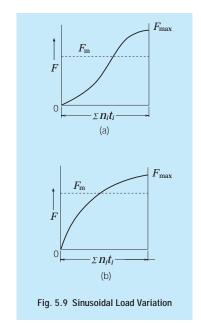
$$F_{\rm m} = F_{\rm R} + 0.3F_{\rm S} + 0.2 \frac{{F_{\rm S}}^2}{F_{\rm R}}.....(5.23)$$

b) Where
$$F_{\rm R} < F_{\rm S}$$

$$F_{\rm m} = F_{\rm S} + 0.3 F_{\rm R} + 0.2 \frac{F_{\rm R}^2}{F_{\rm c}}......(5.24)$$

5.4 Equivalent Load

In some cases, the loads applied on bearings are purely radial or axial loads; however, in most cases, the loads are a combination of both. In addition, such loads usually fluctuate in both magnitude and direction. In such cases, the loads actually applied on bearings cannot be used for bearing life calculations; therefore, a hypothetical load that has a constant magnitude and passes through the center of the bearing, and will give the same bearing life that the bearing would attain under actual conditions of load and rotation should be estimated. Such a hypothetical load is called the equivalent load.



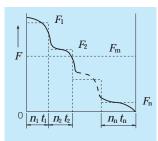


Fig. 5.7 Incremental Load Variation

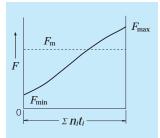
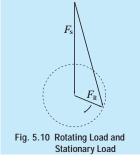


Fig. 5.8 Simple Load Fluctuation



5.4.1 Calculation of Equivalent Loads

The equivalent load on radial bearings may be calculated using the following equation:

$$P = XF_{r} + YF_{a}$$
(5.25)

P: Equivalent Load (N), {kgf}

 $F_{\rm r}$: Radial load (N), {kgf}

 F_a : Axial load (N), {kgf}

X: Radial load factor

Y: Axial load factor

The values of X and Y are listed in the bearing tables. The equivalent radial load for radial roller bearings with $\alpha = 0^{\circ}$ is

$$P = F_r$$

In general, thrust ball bearings cannot take radial loads, but spherical thrust roller bearings can take some radial loads. In this case, the equivalent load may be calculated using the following equation:

$$P = F_{\rm a} + 1.2 F_{\rm r} \eqno(5.26)$$
 where
$$\frac{F_{\rm r}}{F_{\rm c}} \le 0.55$$

5.4.2 Axial Load Components in Angular Contact Ball Bearings and Tapered Roller Bearings

The effective load center of both angular contact ball bearings and tapered roller bearings is at the point of intersection of the shaft center line and a line representing the load applied on the rolling element by the outer ring as shown in Fig. 5.11. This effective load

center for each bearing is listed in the bearing tables. When radial loads are applied to these types of bearings, a component of load is produced in the axial direction. In order to balance this component load bearings of the same type are used in pairs, placed face to face or back to back. These axial loads can be calculated using the following equation:

$$F_{ai} = \frac{0.6}{V} F_{r}$$
(5.27)

where F_{ai} : Component load in the axial direction

(N), {kgf}

 F_r : Radial load (N), {kgf}

Y: Axial load factor

Assume that radial loads F_{r1} and F_{rII} are applied on bearings I and II (Fig. 5.12) respectively, and an external axial load $F_{\rm ae}$ is applied as shown. If the axial load factors are $Y_{\rm I}$, $Y_{\rm II}$ and the radial load factor is X, then the equivalent loads $P_{\scriptscriptstyle \rm T}$, $P_{\scriptscriptstyle \rm T}$ may be calculated as

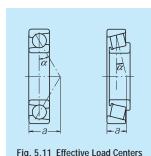
where
$$F_{ae} + \frac{0.6}{Y_{\parallel}} F_{r_{\parallel}} \ge \frac{0.6}{Y_{\parallel}} F_{r_{\parallel}}$$

 $P_{\parallel} = XF_{r_{\parallel}} + Y_{\parallel} \left(F_{ae} + \frac{0.6}{Y_{\parallel}} F_{r_{\parallel}} \right)$ (5.28)
 $P_{\parallel} = F_{r_{\parallel}}$

where
$$F_{\mathrm{ae}} + \frac{0.6}{Y_{\mathrm{II}}} F_{\mathrm{r}\,\mathrm{II}} < \frac{0.6}{Y_{\mathrm{I}}} F_{\mathrm{r}\,\mathrm{I}}$$

$$P_{\text{I}} = F_{\text{r}_{\text{I}}}$$

 $P_{\text{II}} = XF_{\text{r}_{\text{II}}} + Y_{\text{II}} \left(\frac{0.6}{Y_{\text{I}}} F_{\text{r}_{\text{I}}} - F_{\text{ae}} \right)$ (5.29)



Bearing I Bearing II Bearing II F_{ae} $F_{
m rI}$ (b) (a)

Fig. 5.12 Loads in Opposed Duplex Arrangement



5.5 Static Load Ratings and Static Equivalent Loads

5.5.1 Static Load Ratings

When subjected to an excessive load or a strong shock load, rolling bearings may incur a local permanent deformation of the rolling elements and permanent deformation of the rolling elements and raceway surface if the elastic limit is exceeded. The nonelastic deformation increases in area and depth as the load increases, and when the load exceeds a certain limit, the smooth running of the bearing is impeded.

The basic static load rating is defined as that static load which produces the following calculated contact stress at the center of the contact area between the rolling element subjected to the maximum stress and the raceway surface.

In this most heavily stressed contact area, the sum of the permanent deformation of the rolling element and that of the raceway is nearly 0.0001 times the rolling element's diameter. The basic static load rating $C_{\rm o}$ is written $C_{\rm or}$ for radial bearings and $C_{\rm oa}$ for thrust bearings in the bearing tables.

In addition, following the modification of the criteria for basic static load rating by ISO, the new $C_{\rm o}$ values for NSK's ball bearings became about 0.8 to 1.3 times the past values and those for roller bearings about 1.5 to 1.9 times. Consequently, the values of permissible static load factor $f_{\rm s}$ have also changed, so please pay attention to this.

5.5.2 Static Equivalent Loads

The static equivalent load is a hypothetical load that produces a contact stress equal to the above maximum stress under actual conditions, while the bearing is stationary (including very slow rotation or oscillation), in the area of contact between the most heavily stressed rolling element and bearing raceway. The static radial load passing through the bearing center is taken as the static equivalent load for radial bearings, while the static avail load in the direction coinciding with the central axis is taken as the static equivalent load for thrust bearings.

(a) Static equivalent load on radial bearings

The greater of the two values calculated from the following equations should be adopted as the static equivalent load on radial bearings.

$$P_{\rm o} = X_{\rm o} F_{\rm r} + Y_{\rm o} F_{\rm a}$$
 (5.30)
 $P_{\rm o} = F_{\rm r}$ (5.31)

where P_0 : Static equivalent load (N), {kgf}

 $F_{\rm r}$: Radial load (N), {kgf} $F_{\rm a}$: Axial load (N), {kgf}

 X_0 : Static radial load factor

 Y_0 : Static axial load factor

(b)Static equivalent load on thrust bearings

$$P_0 = X_0 F_r + F_a$$
 $\alpha \neq 90^{\circ}$ (5.32)

where P_0 : Static equivalent load (N), {kgf}

 α : Contact angle

When $F_{\rm a}{<}X_{\rm o}F_{\rm r}$, this equation becomes less accurate. The values of $X_{\rm o}$ and $Y_{\rm o}$ for Equations (5.30) and (5.32) are listed in the bearing tables.

The static equivalent load for thrust roller bearings with

$$\alpha = 90^{\circ}$$
 is $P_0 = F_3$

5.5.3 Permissible Static Load Factor

The permissible static equivalent load on bearings varies depending on the basic static load rating and also their application and operating conditions.

The permissible static load factor f_s is a safety factor that is applied to the basic static load rating, and it is defined by the ratio in Equation (5.33). The generally recommended values of f_s are listed in Table 5.8. Conforming to the modification of the static load rating, the values of f_s were revised, especially for bearings for which the values of C_o were increased, please keep this in mind when selecting bearings.

$$f_{\rm S} = \frac{C_0}{P_0}$$
....(5.33)

where C_0 : Basic static load rating (N), {kgf}

 P_{o} : Static equivalent load (N), {kgf}

For spherical thrust roller bearings, the values of f_s should be greater than 4.

Table 5. 8 Values of Permissible Static Load Factor f_s

Operating Conditions		Lower Limit of $\emph{\textbf{f}}_{\!s}$ Ball Bearings Roller Bearings	
Low-noise applications	2	3	
Bearings subjected to vibration and shock loads	1.5	2	
Standard operating conditions	1	1.5	

5.6 Maximum Permissible Axial Loads for Cylindrical Roller Bearings

Cylindrical roller bearings having inner and outer rings with ribs, loose ribs or thrust collars are capable of sustaining radial loads and limited axial loads simultaneously. The maximum permissible axial load is limited by an abnormal temperature rise or heat seizure due to sliding friction between the end faces of rollers and the rib face, or the rib strength.

The maximum permissible axial load (the load considered the heat generation between the end face of rollers and the rib face) for bearings of diameter series 3 that are continuously loaded and lubricated with grease or oil is shown in Fig. 5.13.

Grease lubrication (Empirical equation)

$$C_{\Lambda} = 9.8f \left\{ \frac{900 (k \cdot d)^{2}}{n+1500} - 0.023 \times (k \cdot d)^{2.5} \right\} ...(N)$$

$$= f \left\{ \frac{900 (k \cdot d)^{2}}{n+1500} - 0.023 \times (k \cdot d)^{2.5} \right\} \{ kgf \}$$

Oil lubrication (Empirical equation)

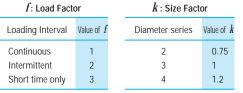
$$C_{A} = 9.8f \left\{ \frac{490 (k d)^{2}}{n+1000} - 0.000135 \times (k d)^{3.4} \right\}...(N)$$

$$= f \left\{ \frac{490 (k d)^{2}}{n+1000} - 0.000135 \times (k d)^{3.4} \right\}....\{kgf\}$$

where C_{Δ} : Permissible axial load (N), {kgf}

d: Bearing bore diameter (mm)

n : Speed (min⁻¹)



In the equations (5.34) and (5.35), the examination for the rib strength is excluded. Concerning the rib strength, please consult with NSK.

In addition, for cylindrical roller bearings to have a stable axial-load carrying capacity, the following precautions are required for the bearings and their surroundings:

- Radial load must be applied and the magnitude of radial load should be larger than that of axial load by 2.5 times or more.
- · Sufficient lubricant must exist between the roller end faces and ribs.
- · Superior extreme-pressure grease must be used.
- · Sufficient running-in should be done.
- ·The mounting accuracy must be good
- The radial clearance should not be more than necessary.

In cases where the bearing speed is extremely slow, the speed exceeds the limiting speed by more than 50%, or the bore diameter is more than 200mm, careful study is necessary for each case regarding lubrication, cooling, etc. In such a case, please consult with NSK.

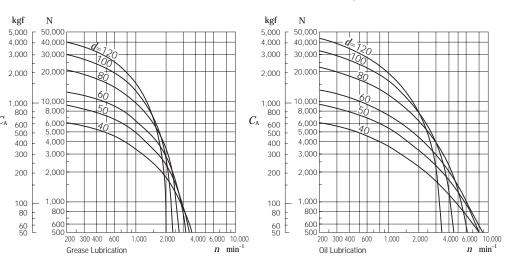


Fig. 5.13 Permissible Axial Load for Cylindrical Roller Bearings

For Diameter Series 3 bearings (k=1.0) operating under a continuous load and lubricated with grease or oil.



5.7 Examples of Bearing Calculations

(Example1)

Obtain the fatigue life factor $f_{\rm h}$ of single-row deep groove ball bearing 6208 when it is used under a radial load $F_{\rm r}$ =2 500 N, (255kgf) and speed n =900 min⁻¹.

The basic load rating $C_{\rm r}$ of **6208** is 29 100N, (2 970kgf) (Bearing Table, Page B10). Since only a radial load is applied, the equivalent load P may be obtained as follows:

$$P = F_{\rm r} = 2500$$
N, {255kgf}

Since the speed is $n = 900 \text{ min}^{-1}$, the speed factor f_n can be obtained from the equation in Table 5.2 (Page A25) or Fig. 5.3(Page A26).

$$f_{\rm n} = 0.333$$

The fatigue life factor $f_{\!\scriptscriptstyle h}$, under these conditions, can be calculated as follows:

$$f_{\rm h} = f_{\rm h} \frac{C_{\rm r}}{P} = 0.333 \times \frac{29100}{2500} = 3.88$$

This value is suitable for industrial applications, air conditioners being regularly used, etc., and according to the equation in Table 5.2 or Fig. 5.4 (Page A26), it corresponds approximately to 29 000 hours of service life.

(Example 2)

Select a single-row deep groove ball bearing with a bore diameter of 50 mm and outside diameter under 100 mm that satisfies the following conditions:

Radial load $F_r = 3000N$, (306kgf)

Speed $n = 1900 \text{ min}^{-1}$

Basic rating life $L_h \ge 10~000h$

The fatigue life factor f_h of ball bearings with a rating fatigue life longer than 10 000 hours is $f_h \ge 2.72$. Because $f_n = 0.26$, $P = F_r = 3 000$ N. (306kgf)

$$f_{\rm h} = f_{\rm h} \frac{C_{\rm r}}{P} = 0.26 \times \frac{C_{\rm r}}{3.000} \ge 2.72$$

therefore,
$$C_r \ge 2.72 \times \frac{3000}{0.26} = 31380N$$
, (3 200kgf)

Among the data listed in the bearing table on Page B12, **6210** should be selected as one that satisfies the above conditions.

(Example3

Obtain C_r/P or fatigue life factor f_h when an axial load F_a =1 000N, (102kgf) is added to the conditions of (Example 1)

When the radial load F_r and axial load F_a are applied on single-row deep groove ball bearing **6208**, the dynamic equivalent load P should be calculated in accordance with the following procedure.

Obtain the radial load factor X, axial load factor Y and constant e obtainable, depending on the magnitude of f_0F_a/C_{or} , from the table above the single-row deep groove ball bearing table.

The basic static load rating C_{or} of ball bearing **6208** is 17 900N, (1 820kgf) (Page B10)

$$f_{\rm o}F_{\rm a}/C_{\rm or} = 14.0 \times 1\ 000/17\ 900 = 0.782$$

 $e \doteq 0.26$

and
$$F_a$$
 / F_r = 1 000/2 500 = 0.4 > e

$$X = 0.56$$

Y=1.67 (the value of Y is obtained by linear interpolation)

Therefore, the dynamic equivalent load *P* is

$$P = XF_r + YF_a$$

$$= 0.56 \times 2500 + 1.67 \times 1000$$

$$= 3070N$$
, {313kgf}

$$\frac{C_{\rm r}}{P} = \frac{29\ 100}{3\ 070} = 9.48$$

$$f_{\rm h} = f_{\rm h} \frac{C_{\rm r}}{P} = 0.333 \times \frac{29 \ 100}{3 \ 070} = 3.16$$

This value of $f_{\rm h}$ corresponds approximately to 15 800 hours for ball bearings.

(Example 4)

Select a spherical roller bearing of series 231 satisfying the following conditions:

Radial load $F_{\rm r} = 45\,000{\rm N}$, {4 950kgf}

Axial load $F_a = 8000 \text{N}$, (816kgf)

Speed $n = 500 \text{min}^{-1}$

Basic rating life $L_h \ge 30~000h$

The value of the fatigue life factor f_h which makes $L_h \ge 30~000h$ is bigger than 3.45 from Fig. 5.4 (Page A26).

The dynamic equivalent load P of spherical roller bearings is given by:

when
$$F_a / F_r \leq e$$

$$P = XF_r + YX_a = F_r + Y_3 F_a$$

when
$$F_a / F_r > e$$

$$P = XF_r + YF_a = 0.67 F_r + Y_2 F_a$$

 $F_a / F_r = 8000/45000 = 0.18$

We can see in the bearing table that the value of e is about 0.3 and that of Y_3 is about 2.2 for bearings of series 231:

Therefore,
$$P = XF_r + YF_a = F_r + Y_3F_a$$

= 45 000 + 2.2 × 8 000
= 62 600N, (6 380kgf)

From the fatigue life factor f_n , the basic load rating can be obtained as follows:

$$f_{\rm h} = f_{\rm n} \frac{C_{\rm r}}{P} = 0.444 \times \frac{C_{\rm r}}{62\,600} \ge 3.45$$

consequently, $C_r \ge 490\,000N$, $_{50\,000kgf}$ Among spherical roller bearings of series 231 satisfying this value of C_r , the smallest is **23126CE4** $(C_r = 505\,000N$, $_{51\,500keff})$

Once the bearing is determined, substitude the value of Y_2 in the equation and obtain the value of P_2 .

$$P = F_r + Y_3 F_a = 45\ 000 + 2.4 \times 8\ 000$$

= 64 200N, {6 550kgf}

$$L_{h} = 500 \left(f_{h} \frac{C_{r}}{P} \right)^{\frac{10}{3}}$$

$$= 500 \left(0.444 \times \frac{505\ 000}{64\ 200} \right)^{\frac{10}{3}}$$

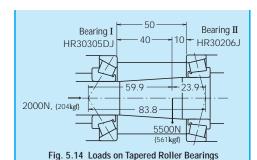
$$= 500 \times 3.49^{\frac{10}{3}} \stackrel{3}{=} 32\ 000\ h$$

(Example 5)

Assume that tapered roller bearings HR30305DJ and HR30206J are used in a back-to-back arrangement as shown in Fig. 5.14, and the distance between the cup back faces is 50 mm.

Calculate the basic rating life of each bearing when beside the radial load $F_r = 5\,500N$, (561kgf),

axial load $F_{\rm ae}$ =2 000N,(204kgf) are applied to HR30305DJ as shown in Fig. 5.14. The speed is 600 min⁻¹.



To distribute the radial load $F_{\rm r}$ on bearings I and II, the effective load centers must be located for tapered roller bearings. Obtain the effective load center a for bearings I and II from the bearing table, then obtain the relative position of the radial load $F_{\rm r}$ and effective load centers. The result will be as shown in Fig. 5.14. Consequently, the radial load applied on bearings I (HR30305DJ) and II (HR30206J) can be obtained from the following equations:

$$F_{\rm rI} = 5\,500 \times \frac{23.9}{83.8} = 1\,569$$
N, {160kgf}

$$F_{\text{rII}} = 5\,500 \times \frac{59.9}{83.8} = 3\,931\text{N}$$
, (401kgf)

From the data in the bearing table, the following values are obtained;

Bearings	Basic dynamic load rating $C_{ m r}$ (N) {kgf}		load rating $C_{ m r}$		load rating $C_{ m r}$		Axial load factor Y_1	Constant e
Bearing I (HR30305DJ)	38 000	{3 900}	$Y_{\rm I} = 0.73$	0.83				
Bearing II (HR30206J)	43 000	{4 400}	$Y_{II} = 1.6$	0.38				

When radial loads are applied on tapered roller bearings, an axial load component is produced, which must be considered to obtain the dynamic equivalent radial load (Refer to Paragraph 5.4.2, Page A31).



$$F_{\text{ae}} + \frac{0.6}{Y_{\text{II}}} F_{\text{r II}} = 2\,000 + \frac{0.6}{1.6} \times 3\,931$$

= 3 474N, (354kgf)

$$\frac{0.6}{Y_{\rm I}} F_{\rm rI} = \frac{0.6}{0.73} \times 1569 = 1290 \text{N}, \{132 \text{kgf}\}$$

Therefore, with this bearing arrangement, the axial load $F_{ae}+\frac{0.6}{Y_{I\!I}}$ $F_{r\,I\!I}$ is applied on bearing I but not on bearing II . For bearing I

$$F_{\rm r\,I}=1$$
 569N, {160kgf}

$$F_{aI} = 3 474 \text{N}, \text{ (354kgf)}$$

since
$$F_{\rm a\,I} / F_{\rm r\,I} = 2.2 > e = 0.83$$

the dynamic equivalent load $P_{
m I} = X F_{
m r\,I} + Y_{
m I} \, F_{
m a\,I}$

$$= 0.4 \times 1569 + 0.73 \times 3474$$

= 3164N, {323kgf}

The fatigue life factor
$$f_h = f_n \frac{C_r}{P_r}$$

$$=\frac{0.42\times38\ 000}{3\ 164}=5.04$$

and the rating fatigue life $L_{\rm h} = 500 \times 5.04^{\frac{10}{3}} = 109$ 750h

For bearing II

since $F_{\text{rII}} = 3 \ 931 \text{N}$, {401kgf}, $F_{\text{aII}} = 0$

the dynamic equivalent load

$$P_{\Pi} = F_{r \Pi} = 3.931 \text{N}$$
, (401kgf)

the fatigue life factor

$$f_{\rm h} = f_{\rm h} \frac{C_{\rm r}}{P_{\rm T}} = \frac{0.42 \times 43\,000}{3\,931} = 4.59$$

and the rating fatigue life $L_h = 500 \times 4.59^{\frac{10}{3}} = 80 \ 400 h$ are obtained

Remarks For face-to-face arrangements (DF type), please contact NSK.

(Example 6)

Select a bearing for a speed reducer under the following conditions:

Operating conditions

Radial load $F_{\rm r} = 245~000{\rm N}$, {25 000kgf}

Axial load $F_a = 49\ 000\text{N}$, (5 000kgf)

Speed Size limitation

 $n = 500 \text{min}^{-1}$

Shaft diameter: 300mm

Bore of housing: Less than 500mm

In this application, heavy loads, shocks, and shaft deflection are expected; therefore, spherical roller bearings are appropriate.

The following spherical roller bearings satisfy the above size limitation (refer to Page B196)

d	D	В	Bearing No.	Basic dyl load ra $C_{ m r}$ (N)		Constant $oldsymbol{e}$	Factor Y_3
300	420	90	23960 CAE4	1 230 000	125 000	0.19	3.5
	460	118	23060 CAE4	1 920 000	196 000	0.24	2.8
	460	160	24060 CAE4	2 310 000	235 000	0.32	2.1
	500	160	23160 CAE4	2 670 000	273 000	0.31	2.2
	500	200	24160 CAE4	3 100 000	315 000	0.38	1.8

since $F_a / F_r = 0.20 < e$ the dynamic equivalent load P is

$$P = F_r + Y_3 F_a$$

Judging from the fatigue life factor f_h in Table 5.1 and examples of applications (refer to Page A25), a value of f_h between 3 and 5 seems appropriate.

$$f_{\rm h} = f_{\rm n} \frac{C_{\rm r}}{P} = \frac{0.444 \ C_{\rm r}}{F_{\rm r} + Y_3 F_{\rm a}} = 3 \text{ to } 5$$

Assuming that $Y_3 = 2.1$, then the necessary basic load rating C_r can be obtained

$$C_{\rm r} = \frac{(F_{\rm r} + Y_3 F_{\rm a}) \times (3 \text{ to } 5)}{0.444}$$

$$=\frac{(245\ 000+2.1\times49\ 000)\times(3\ to\ 5)}{0.444}$$

= 2 350 000 to 3 900 000 N, $\{240 000 \text{ to } 400 000 \text{ kgf}\}$

The bearings which satisfy this range are 23160CAE4, and 24160CAE4.

6. LIMITING SPEED

The speed of rolling bearings is subject to certain limits. When bearings are operating, the higher the speed, the higher the bearing temperature due to friction. The limiting speed is the empirically obtained value for the maximum speed at which bearings can be continuously operated without failing from seizure or generation of excessive heat. Consequently, the limiting speed of bearings varies depending on such factors as bearing type and size, cage form and material, load, lubricating method, and heat dissipating method including the design of the bearing's surroundings.

The limiting speeds for bearings lubricated by grease and oil are listed in the bearing tables. The limiting speeds in the tables are applicable to bearings of standard design and subjected to normal loads, i.e.

standard design and subjected to normal loads, i. e. $C/P \ge 12$ and $F_a/F_r \le 0.2$ approximately. The limiting speeds for oil lubrication listed in the bearing tables are for conventional oil bath lubrication.

Some types of lubricants are not suitable for high speed, even though they may be markedly superior in other respects. When speeds are more than 70 percent of the listed limiting speed, it is necessary to select an oil or grease which has good high speed characteristics.

(Refer to)

Table 12.2 Grease Properties (Pages A110 and 111)

Table 12.5 Example of Selection of Lubricant for Bearing Operating Conditions (Page A113)

Table 15.8 Brands and Properties of Lubricating Grease (Pages A138 to A141)

6.1 Correction of Limiting Speed

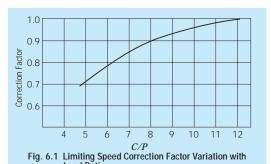
When the bearing load P exceeds 8 % of the basic load rating C, or when the axial load F_a exceeds 20 % of the radial load F_r , the limiting speed must be corrected by multiplying the limiting speed found in the bearing tables by the correction factor shown in Figs. 6.1 and 6.2.

When the required speed exceeds the limiting speed of the desired bearing; then the accuracy grade, internal clearance, cage type and material, lubrication, etc., must be carefully studied in order to select a bearing capable of the required speed. In such a case, forcedcirculation oil lubrication, jet lubrication, oil mist lubrication, or oil-air lubrication must be used.

If all these conditions are considered. The maximum permissible speed may be corrected by multiplying the limiting speed found in the bearing tables by the correction factor shown in Table 6.1. It is recommended that NSK be consulted regarding high speed applications.

6.2 Limiting Speed for Rubber Contact Seals for Ball Bearings

The maximum permissible speed for contact rubber sealed bearings (DDU type) is determined mainly by the sliding surface speed of the inner circumference of the seal. Values for the limiting speed are listed in the bearing tables.



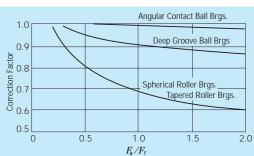


Fig. 6.2 Limiting Speed Correction Factor for Combined Radial and Axial Loads

Table 6.1 Limiting Speed Correction Factor for High-Speed Applications

riigii-Speca Applications						
Bearing Types	Correction Factor					
Cylindrical Roller Brgs.(single row)	2					
Needle Roller Brgs.(except broad width)	2					
Tapered Roller Brgs.	2					
Spherical Roller Brgs.	1.5					
Deep Grooove Ball Brgs.	2.5					
Angular Contact Ball Brgs.(except matched bearings)	1.5					



7. BOUNDARY DIMENSIONS AND IDENTIFYING NUMBERS FOR BEARINGS

7.1 Boundary Dimensions and Dimensions of Snap Ring Grooves

7.1.1 Boundary Dimensions

The boundary dimensions of rolling bearings, which are shown in Figs.7.1 through 7.5, are the dimensions that define their external geometry. They include bore diameter d, outside diameter D, width B, bearing width(or height) T, chamfer dimension r, etc. It is necessary to know all of these dimensions when mounting a bearing on a shaft and in a housing. These boundary dimensions have been internationally standardized (ISO15) and adopted by JIS B 1512 (Boundary Dimensions of Rolling Bearings).

The boundary dimensions and dimension series of radial bearings, tapered roller bearings, and thrust bearings are listed in Table 7.1 to 7.3 (Pages A40 to A49).

In these boundary dimension tables, for each bore number, which prescribes the bore diameter, other boundary dimensions are listed for each diameter series and dimension series. A very large number of series are possible; however, not all of them are commercially available so more can be added in the future. Across the top of each bearing table (7.1 to 7.3), representative bearing types and series symbols are shown (refer to Table 7.5, Bearing Series Symbols, Page A55).

The relative cross-sectional dimensions of radial bearings (except tapered roller bearings) and thrust bearings for the various series classifications are shown in Figs. 7.6 and 7.7 respectively.

7.1.2 Dimensions of Snap Ring Grooves and Locating Snap Rings

The dimensions of Snap ring grooves in the outer surfaces of bearings are specified by ISO 464. Also, the dimensions and accuracy of the locating snap rings themselves are specified by ISO 464. The dimensions of snap ring grooves and locating snap ring for bearings of diameter series 8, 9, 0, 2, 3, and 4, are shown in Table 7.4 (Pages A50 to A53).

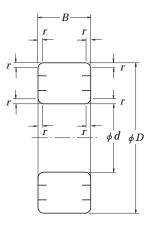


Fig. 7.1 Boundary Dimensions of Radial Ball and Roller Bearings

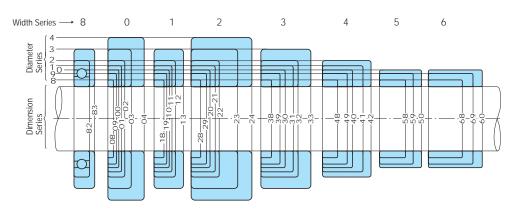


Fig. 7.6 Comparison of Cross Sections of Radial Bearings (except Tapered Roller Bearings) for various Dimensional Series

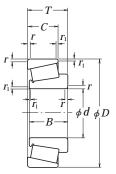


Fig. 7.2 Tapered Roller Bearings

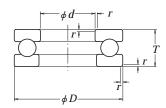


Fig. 7.3 Single-Direction Thrust Ball Bearings

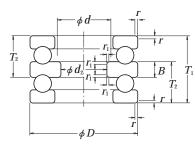


Fig. 7.4 Double-Direction Thrust Ball Bearings

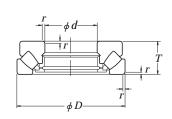


Fig. 7.5 Spherical Thrust Roller Bearings

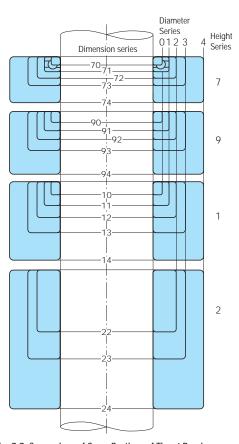


Fig. 7.7 Comparison of Cross Sections of Thrust Bearings (except Diameter Series 5) for Various Dimension Series

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					Dimension Series	10~60	r (min.)	0.15	0.15 0.15 0.15	0.2	0.3	0.3	0.3	0.6			====	====	7.1.5
					Dim	8	r(1.1.1	111	111	111	0.3	0.3	0.3	0.3	0.6	0.6	0.6	
						09		1.1.1	111	111	25	3333	2844	43	44 50 50	54 63	63 71	188	88
				s 0		20		1.1.1	111	111	19 20	21 21 23	30 30 30	32 33 34 34	38	40 46 46	46 54 54	54 60 60	67
	NN40		240	Serie	Series	40		111	1.1.1	111	144	16 17	18 22 22	22 24 25	26 27 28	32 30	35 40	45 45	20
	NN30		230	Diameter Series	Dimension Series	98	В	ო	3.5	976	111	13 13	4 9 9 9	19 19 19	20 21	23 26 26	30 28	34 34 34	37
	N20			Ä	Dime	20		111	1.1.1	111	860	199	14 4	15 5	9 1 2 8	13	222	27 72	88
92	N10					10		2.5	3.88	4 5 9	9~~	∞ ∞ o-	12 12	13 12 13	14 13	9 9 9	20 18	222	24
160						8		111	1.1.1	\perp	1.1.1	1 ~ ∞	∞ ∞ ∞	∞∞0	666	551	====	£ 4 4	16
						Q		%	7 8 9	12 14 17	19 22 24	26 32 32	35 44	47 52 55	58 62 68	27 80 90	95 110 110	115 125 130	140
					series	49~64		1.1.1	111	0.15 0.15	0.15 0.2 0.3	0.3	0.3	0.3	0.6 0.6 0.6	0.6			===
					Dimension Series	19~39 49~69	(min.)	0.1	0.15 0.15 0.15	0.15 0.2 0.2	0.3	0.3	0.3	0.3	0.6 0.6 0.6	0.6			<u>::::</u>
					Dimen	60	r	111	1.1.1	111	1.1.1	1.1.1	0.3	0.3	0.3	0.3	0.3	0.6 0.6 0.6	9.0
		NA69				69		111	111	111	111	3222	30.33	888	38 40	40 42 45	45 54	54 63	63
		NA59		ries 9		26		111	1.1.1	111	1.1.1	222	18 23 23	23	27 27 30	34 30 30	34 40	40 40 40 40	46
	NN49	NA49		Diameter Series	eries	49		111	111	166	222	555	113	1111	22 22	22 22 25	25 30	3293	35
	NN39		239	Diame	Dimension Series	39	В	2.3	3.5	7	L 6 6	999	13 10	2 2 2	15 9	16 19	19 19 23	23 23 26	26 26
	N29			_	Dimen	29		111	1.1.1	111	1.1.1	∞ ∞ ∞ ъ.	11.5	===	21 2 4	4 4 4 9	16	19	22
9£	N19					19		2 2	2.3	4 4 6	0.00	991	L 6 6	000	299	13 12 12	13 13	222	20 20
						60		111	111	111	111	111		~~~	~ ~ 0	∞ ∞ ૦-	9 01	555	==
						Д	,	4 2	9 7 8	± 55 £	11 20 20	22 24 28	30 37 39	42 45	52 55 62	68 72 80	85 100 100	105 110	125
					imension Series	18~68	(min.)	0.05	0.08 0.08 0.1	0.1 0.15 0.15	0.15 0.2 0.2	0.3	0.3	0.3	0.3	0.3	0.3 0.6 0.6	0.6	
					Dimer Seri	8	r (m	111	111	111	111	111	0.3	0.3	0.3	0.3	0.3	0.3	0.3
						89		111	111	111	111	111	122	222	222	873	888	884	45
				80		28		111	111	111	111	111	16 16	91 99	9199	18 23	24	27	34
	NN48	NA48		Diameter Series	eries	84		111	111	111	1 ∞ ∞	000	17 1	12 12	122	17	20 28	2222	25
	NN38			neter	sion S	88	В	2 1.5	2.3	4 10 9	999	~~~	701	222	222	127	15	15 2 2	19
	N28			Diar	Dimension Series	28		111	111	3.5	വവവ	999	9 ® I	∞ ∞	∞ ∞	1108	13	133	16
89					_	8		2	2 1.5	3.5	3.5	വവവ	7 7 2	~~~	~~~	L L 6	222	1300	213
						80		111	111	111	111	111	4 4	444	444	4 5 7	~ ~ 8	000°	66
						Д	,	2.5 3	5 4	13 13	14 16 17	19 21 24	26 32 34	37 40 42	44 47 52	58 65 72	78 85 90	95 100 110	115
					SS	17~37	(min.)	0.05	0.05	0.08	0.1	0.7	0.2	0.2	111	111	111	111	1.1
				ies 7	Dimension Series	37 1		1 %:	3.3	3333	3.55		1 22			111	111	111	1.1
				Diameter Series	ensio	27	В	111	2.5	3.5	_m	111	111		111	111	111	111	1.1
				Jiamet	- Ei	17		0.8	1.5	2.5	3.55	W 4 4	44	4 4	111	111	111	111	11
>	Ball Ball	e.	ler	٦		Ω		2.5	409	7 8 10	124		23		111	111	111	111	1.1
Single-Row Ball Brgs.	Double-Row Ball Brgs. Cylindrical Roller Brgs.	Ile Roll 3rgs.	Spherical Roller Brgs.			p		0.6	2.5	4 5 9	7 8 6	1219	17 20 22	25 28 30	32 35 40	45 50 55	65 65 70	75 80 85	92
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	26 130 28 140 30 150														1600 1600 1700 1700 1800 1800	
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111	111	111	111	111	111		111	111	111	111	111	111	111	111	111	1.1
111	111	111	111	111	111	1.1.1	111	111	111	1.1.1	111	111	111	111	111	1.1
111	111	111	111	111	111	111	111	111	111	111	111	111	111	111		
130 150	165 175 190	200 215 225	240 250 270	300 320 350	380 400 420	440 480 500	520 540 580	620 650 650	680 730 780	820 870 920	980 1030 1090	1150 1220 1280	1360 1420 1500	1600 1700 1820	1950 2060 2180	2300
600	===	£ 4 4	222	23 13	2222	3325	3333	37	8 4 3	882	6 21 21	63	888	1 588	111	1 1
16 13	2888	222	24 7	33 888	8888	38 46 46	46 46 56	26 56 56	90 69	69 74 78	82 1 85 1	888	12 11	22 32 1 40	155 2 2 2 2 2 2 3	175 2
	222			4288	888	888	982	222	88 22	888	288	288	888	22.22	200 206 218 218	230 33
23 73	228	848	37	244	888	888			288	895	888	888	888	206 224 243	265 272 290	300
30 30	35	45	2022	09 69	888	888	199	929	118	1202	988	200 218 218	243 243 250	280 300 315	345 355 375	425
¥84	8 8 2	2,88	19	888	966	13%	128	888	255	230	243	30023	325 2335 2	1 400	111	11
54.24	63	1288	888	109	145	180	180	218 218 218	218 236 272	272	325 325 345	355 400 400	438 438 450	1 545	111	1.1
0.3	0.6	0.6			61.5	2 2 2 2	22 22 23 23	2.1	33.7	440	446	222	666	9	111	
	222	222	5 1 5 5	222	2.1	22.1	3.1.1	000	εε 4 1.00	2.0.5	211	6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	90 90 90 90 90 90 90 90 90 90 90 90 90 9	6 7.5 7.5	7.5 27 9.5 23	9.5 24
145 150 165	180 190 210	220 230 250	260 280 300	320 360 380	420 440 460	480 520 540	560 600 620	650 670 710	750 800 850	900	1060 1120 1180	1250 1320 1400	1460 1540 1630	1720 1820 1950	2060 2180 2300	2430
554	999	23 13	222	3332	33	£ 4 4	488	22 22	388		8888	103	109	128	7 7 7	
288	24 28 28	33888	3333	38 46 46	26	92 92	74 74	82 88 88 11 11	888	12603	118 112 1	2843	282	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	200 212 218 218	230
27 74 75	888	4288	488	888	222	882	888	888	128	868	150 1	175 185 2 195 2	195 206 218 218	230 243 358 3	265 280 390 390	308
30 34	37	45 52	2999	60 75 75	988	90	106	128 128 136	140 150 2 165 2	170 2 180 2 185 2	195 200 206 206	224 236 3 250 3	250 272 280 3	300 4 315 4 335 4	345 4 355 4 375 5	1 400
40 45	9222	09069	888	888	1188	844	140 160 2 160 2	222	190 200 218 3	230 243 350 350	258 272 280 3	300 4 315 4 335 4	335 355 4 375 5	400 425 450	462 475 500	230
54 60	67 67 80	95	95	36 1 36 1 1	999	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	190 218 218 218	230 230 243 3	258 272 300 4	308 325 4 335 4	355 4 365 4 375 5	400 438 5 462 6	462 488 515 6	545 7	111	1.1
771	066	125	125 145 145	145 180 180	218 218 218	218 250 250	250 290 290	308 308 325	345 355 400	412 438 450	462 488 500	545 580 615	615 650 690	110	111	1.1
0.6			1.5.5	2 2 2 2	2.1.2	3 3.7	644	444	222	000	999	6 7.5	7.5	7.5	111	1 1 2
===	1.5	222	22.1.2	22.1	enen enen	844	444	222	623	999	999	7.5 7	7.5 7	7.5 7 9.5 9	9.5 9.5 9.5	
222		222		22.1	000		444		0 co co	999	999	7.5 12	7.5	מטטט	സസ	2
09120	200 210 225	240 260 280	290 310 340	360 400 420	460 480 520	540	620 650 680	720	820 870 920	980 1030 1090 10	1150 1220 1280	1360 1 1420 1 1500 1	1580 14 1660 15 1750 -	1850 1950 2120	2240 2360 2500	11
9 6 6	252	228 23 31 7	37	444	50 22		63 67 10	71 10 71 10 80 11	82 11 92 12	0000	112 118 122 17	132 136 140 140	145 20	77.5	338	11
888	3333	45 46 66 66	55 6	565 8	74 74 82 10	288	04 8 22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0001	115 15 118 15 128 17	86 68 88 88 88 88 88 88 88 88 88 88 88 8	155 27 27 27 27 27 27 27 27 27 27 27 27 27	9888	200 212 212 218 23	230 30 243 31 272 35	280 290 37 308 40	11
33	422	54 60 7	960	82 10	95 11 106 11	106	118 122 18 16 16 16	128 128 145 185	150 155 27 27 27	282 28	200 25 212 218 28 28	236 243 36 250 33	265 272 290 33	300 40 315 41 355 46	365 375 50 50 50	11
445	552 6	60 8 67 74 10	75 10 82 10 90 11	92 104 17 106 17	118 16 121 16 133 18	134 135 148 20	150 20 157 21 163 21	165 21 167 21 185 25	195 25 200 27 212 29	230 236 33 250 33	258 34 272 36 280 33	300 41 308 41 325 45	345 46 355 47 375 50	400 412 54 462 61	475 630 500 650 530 690	11
929	69	888	118	118	8,000	180 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	200 212 218 218	218 218 3 250 3	258 3 272 3 290 3	308 315 4 335 4	345 4 365 5 375 5	412 412 5 438 6	462 475 500	530 545 615		1.1
75 80 10 80 11 80	95 12 00 12 12	09 22 36 11 36	36 50 20 20 20 20 20 20 20 20 20 20 20 20 20	2222	218 29 218 29 243 33	243 33, 243 33, 272 33,	272 280 33 300 40	300 335 44	355 46 365 46 388 5	425 438 58 462 6,	475 66 500 67 515 66	560 560 75 600 80	615 82	111	111	11
0660	125 1 1 36 1 1	100	180 200 218 218	218 2.7 250 3 250 3	290 290 4 4 325	325 4 325 4 355 5	355 375 5 400 5	400 400 450 6	462 6 488 6 515 6	560 6 580 6 615 7	.7 069 .7 069 .7 .7	730 7 750 7 800 9	825 9 875 9	111	111	11
	===	2 2 2		_						6 7.5	വവവ	تاتاتات	9.5	111	111	1.1
222	22.1	22.1	3.71	844	440	വവവ	999	999	6	7.5	7.5	7.5 7.5 9.5	9.5	222	122	11

The chamfer dimensions listed in this table do not necessarily apply to the following chamfers: (a) Chamfers of the grooves in outer rings that have snap ring grooves. (b) For thin section cylindrical roller bearings, the chamfers on side without rib and bearing bore (in case of an inner ring) or outer surface (in case of an outer ring). (c) For angular contact ball bearings, the chamfers between the front face and bore (in case of an inner ring) or outer surface (in case of an outer ring). (d) Chamfers on inner rings of bearings with tapered bores. Remarks

7 Table 7. 1 Boundary Dimensions of Radial Bearings (except Tapered Roller Bearings)

			ּוֹם,		_). -	140		יטו טו	LIVIII	11110	INOIN	IDLI	3101	\ DLA	IVIIVO	3			
					4	Dimension Series	04~24	r (min.)	111	111	111	0.6	0.6	221	1.5	1.5	2.1	2.1	∞∞4	444
					Series	Dimension Series	24	В	111	1 1 1	111	1 4 5	16 19 24	29	36	43	50 53 57	64 74	77 80 86	82 80
74	104	N 4			Diameter Series 4	Dime	04	Щ	111	111	111	191	13 12	119	21		33	35	45 48 52	222
					Ω		D		111	1.1.1	1.1.1	30	37 42 52	62 72 —	80 06	100	120 130 140	150 160 180	190 200 210	225
						nsion	03~33	in.)	111	0.2	0.3	0.3	1 1 0.6	-55	222	1.5.1	1.5	2:1	2.1	m m i
						Dimension Series	83	r (min.)	111	111	111	111	0.3	9.0	0.6 0.6 0.6	0.6		1.1.1.	1.5	222
633	32	N 33					33		111	~	9 2 13	15 16	19	22.2 22.2 25	25.4 30.2 30.2	32 34.9 36.5	39.7 44.4 49.2	54 58.7 63.5	68.3 68.3 73	73
623	23	N 23		223	Diameter Series 3	eries	23		111	111	=	13.3	11	21 21	2242	33 33	44 63	94 51 51	98.89	64
					ameter	Dimension Series	13	В	111	111	1.1.1	111	111	111	111	111	111	1.1.1	111	5
23	13	N 3		213	□	Dime	03		111	115	7 0 2	6 6 0	12 13	15 16	18 19	23 23	27.22	3333	33	45
							83		111	111	111	111	666	199	1337	4 4 1 9	17	22 24 25	27 28 30	33
							Ω	'	111	1 1	16 22	26 28 30	35 37 42	47 52 56	62 68 72	75 80 90	120	130 150	160 170 180	200
						nsion	02~42	in.)	111	0.15	0.3	0.3	0.6 0.6 0.6	1 1 1 1 1		-55	1111	2; T 2; T 3; T	1.5 2	2.1
						Dimension Series	82	r (min.)	111	1.0	0.15 0.15 0.2	0.3	0.3	0.3	0.3	9.0	9.0			==:
							42		111	1.1.1	1.1.1	111	70	22 27 27	27 30 32	33 37 40	40 45	220	2999	69
632	222	N 32		232	ies 2	0	32		111	112	7 8 10	13 13	14.3 15.9 15.9	17.5 20.6 20.6	20.6 23 23.8	25 27 30.2	30.2 30.2 33.3	36.5 38.1 39.7	41.3 44.4 49.2	52.4
622	42	N 22		222	Diameter Series 2	Dimension Series	22	В	111	111	111	111	4 4 4	9 8 8	8198	2323	2233	338	3833	43.6
					Diam	imensic	12	Щ	111	111	111	111	111	111	111	111	111	1.1.1	111	11
25	12	N 2					02		111	4	O CO CO	<u>~</u> ∞ ∞	1109	244	16	17 18	19 20 21	23 24	25 26 28	32
							82		111	2.5	3.5	6 5 5	r r 8	00 O	555	121	25.54	222	18 19 21	242
							D		111	1 ا و	19 13	22 24 26	30 32 35	40 47 50	52 58 62	65 72 80	85 100	110 120 125	130 140 150	160
						Dimension Series	11~41	(min.)	111	1 1 1	111	111	111	111	111	111	111	1.1.1	111	222
						Dime	10	r (n	111	1 1 1	111	111	111	111	111	111	111	1.1.1	111	113
				241	-		41		111	1 1 1	111	15	2000	848	25 27 28	3333	35 40	45.4	2623	999
		NN 31		231	Series '	Series	31		111	1 1 1	7 01	12	<u> </u>	1986	28 21	25 22 26 26	888	888	37 37 41	42
					Diameter	Dimension S	21	В	111	1 1 1	∞	600	12 12	13	16	19 21 22	22 22 24	24 27 27	30 31	33
					Ω	Dime	11		111	111	111	111	111	111	111	111	111	1.1.1	111	118
							10		111	1 1 1	111	111	111	111	111	111	111	1.1.1	111	1 13
< .	w	- ú	er	ller			О		111	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	1.1.1	150
ingle-Rov 3all Brgs.	Double-Row Ball Brgs.	ylindrica oller Brgs	edle Roll Brgs.	erical Ro Brgs.		,	p		0.6	2.5	409	7 8 6	12 10	17 20 22	25 28 30	32 35 40	45 50 55	65 70	75 80 85	929
S. S.	200	O.5	Ne	Sph	ı	əqwr	re Nu	og		3 2	4 5 9	7 8 9	010	03 04 22	05 28 06	/32 07 08	110	132	15 16 17	2 1 2

440	വവവ	O CO CO	999	7.5	7.5 9.5 9.5	9.5 9.5	12 12	15 15	15 15	15	111	111	1.1.1	1.1
100 108 118	128 132 138	142 145 150	155 160 180	190 206 224	236 250 265	280 300 315	325 335 345	365 375 400	412 438 450	475	111	111	111	1.1
60 65 72	78 82 85	92 88	98 102 115	122 132 140	150 155 165	180 190 200	206 212 218	230 236 250	258 272 280	290	111	111	111	11
260 280 310	340 360 380	400 420 440	460 480 540	580 620 670	710 750 800	850 900 950	980 1030 1060	1120 1150 1220	1280 1360 1420	1500	111	111	111	1.1
നനന	444	444	വവവ	665	7.5 7.5 7.5	7.5 7.5 7.5	9.5 9.5 9.5	9.5 12 12	12 12	512	119	19	111	
33.7	κ4	111	111	111	111	111	111	111	111	111	111	111	111	11
87.3 92.1 106	112 118 128	128	155 186 186	195 206 224	236 258 272	300 308 308	315 345 365	375 388 412	438 462 488	515 530 560	630 630 650	670 710 —	111	11
1288	201 108 108	178	132 138 145	155 165 175	185 200 212	224 230 243	250 265 280	290 300 325	335 355 375	400 412 438	462 488 500	515 545 —	111	11
53 62	66 70 75	79 88 88	92 97 106	114 123 132	140 155 165	170 175 185	190 200 212	218 230 243	258 272 280	300 308 325	355 375 388	400	111	11
8888	8279	3728	888	8201	112	138 138 138	138	858	200 200 200 90	218 224 236	258 272 280	300	111	11
37 44	48 50 —	111	111	111	111	111	111	111	111	111	111	111	111	11
225 240 260	280 300 320	340 360 380	400 420 460	500 540 580	620 670 710	750 780 820	850 900 950	980 1030 1090	1150 1220 1280	1360 1420 1500	1600 1700 1780	1850 1950 —	111	11
2:1	നനന	844	444	400	6 C) S	999	7.5	7.5 7.5 9.5	9.5 9.5	122	555	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	111	11
1.5	111	111	111	111	111	111	111	111	111	111	111	111	111	11
888	100 109 118	178 140 140	86,000	200 218 218	243 258 280	290 300 315	335 345 365	388 412 450	475 488 515	545 560 615	615 650 670	710	111	11
65.1 69.8 76	88 88 96	104 110 112	120 128 144	160 174 176	192 208 224	232 240 256	272 280 296	310 336 355	365 388 412	438 450 475	488 515 515	530	111	
2222	64 68 73	888	92 108	2200	140 150 165	170 175 185	195 200 212	224 243 258	272 280 300	315 325 345	355 375 388	412 425 —	111	
42	46 50 54	58 62 62	65 70 78	90 82	98 105 118	122 132 140	150 155 165	170 185 200	206 212 230	243 250 265	272 280 300	315 330	111	
36 38 40	40 45	48 52 52	55 58 65	72 80 80	85 92 92	95 95 103	109 112 118	125 136 145	150 155 165	175 180 195	200 206 218	230 243	111	
27 28	111	111	111	1.1.1	111	1.1.1	1.1.1	111	111	111	111	111	111	
190 200 215	230 250 270	290 310 320	340 360 400	440 480 500	540 580 620	650 680 720	760 790 830	870 920 980	1030 1090 1150	1220 1280 1360	1420 1500 1580	1660 1750 —	111	11
222	2.1 2.1	2.1	c.c.4	440	വവവ	6 5 5	6 6 7.5	7.5 7.5 7.5	7.5 7.5 7.5	7.5 9.5 9.5	9.5 12 12	12 15	15	19
1111	1.5	2 2.1	m m m	444	വവവ	6 5 5	9 9 9	6 7.5 7.5	7.5	7.5 9.5 9.5	9.5 12 12	272	111	
6668	880	109	178 140 120	928	200 218 243	243 243 250	280 280 300	308 325 335	355 375 400	412 438 475	475 500 515	545 580 600	630 670 710	750
62 55	88 64	888	104	128 144 146	160 176 198	192 194 200	224 226 240	248 264 272	280 300 315	336 345 365	375 400 412	438 462 475	475 500 530	280
448	48 50 60	66 66 72	78 88 88	36 90 108	118 128 140	140 145	165 165 175	855	206 218 230	243 250 272	272 290 300	315 335 345	365 388 400	450
3333	38 40 46	55	69 69	74 82 82	865	106	122	136 145 150	160 170 175	185 195 206	212 224 230	243 258 265	280 290 308	325
22 25 25	25 27 31	34 37	44 48 48	50 57 57	63	78 78 80	9888	001	115 122 128	136	155 165 165	175	111	11
													1750 1850 1950	
													1120 1180 1250	
21 22 24	26 28 30	32 34 36	38 40 44	48 52 56	64 68	72 76 80	88 92	96 /500 /530	/260	/670 /710 /750	/820 /820	/1000/1060	/1120 /1180 /1250	/1320

Remarks

Table 7. 2 Boundary Dimensions of

Tapi Ro Bri	ller					329						32	0 X				330					3:	31		
					Diam	eter Se	ries 9							Diam	eter Se	eries 0					Di	iametei	Serie	s 1	
nber				Din	nensio	n Serie:	s 29		Cha Dime	mfer nsion		Dime	nsion S	Series	Dime	nsion S	Series	Cha Dime	mfer nsion		Dime	nsion S	Series	Cha Dime	mfer nsion
Bore Number	d			Ι			II		Cone				20			30	ı	Cone	Cup			31	I	Cone	Cup
Bor		D	В	С	T	В	С	Т	r (1	min.)	D	В	С	Т	В	С	Т	r (r	min.)	D	В	С	Т	r (1	min.)
00 01 02	10 12 15	_ _ _	=	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	28 32	 11 12	_ _ _	 11 12	13 14	_ _ _	13 14	0.3 0.3	0.3 0.3	_ _ _	=	_	_ _ _	_ _ _	_ _ _
03 04 /22	17 20 22	— 37 40	11 —	_ _ _	11.6 —	12 12	- 9 9	— 12 12	 0.3 0.3	0.3 0.3	35 42 44	13 15 15	12 11.5	13 15 15	15 17 —	_ _ _	15 17 —	0.3 0.6 0.6	0.3 0.6 0.6	_ _ _	=	_ _ _	_ _ _	_ _ _	_
05 /28 06	25 28 30	42 45 47	11 — 11	_ _ _	11.6 — 11.6	12 12 12	9 9 9	12 12 12	0.3 0.3 0.3	0.3 0.3 0.3	47 52 55	15 16 17	11.5 12 13	15 16 17	17 — 20	14 — 16	17 — 20	0.6 1 1	0.6 1 1	_ _ _	=	_ _ _	_ _ _	_ _ _	_ -
/32 07 08	32 35 40	52 55 62	 13 14	_ _ _	 14 15	15 14 15	10 11.5 12	14 14 15	0.6 0.6 0.6	0.6 0.6 0.6	58 62 68	17 18 19	13 14 14.5	17 18 19	 21 22	 17 18	21 22	1 1 1	1 1 1	_ _ 75	_ _ 26	_ _ _ 20.5	_ _ _ 26	_ _ 1.5	_ _ 1.5
09 10 11	45 50 55	68 72 80	14 14 16	_ _ _	15 15 17	15 15 17	12 12 14	15 15 17	0.6 0.6 1	0.6 0.6 1	75 80 90	20 20 23	15.5 15.5 17.5	20 20 23	24 24 27	19 19 21	24 24 27	1 1 1.5	1 1 1.5	80 85 95	26 26 30	20.5 20 23	26 26 30	1.5 1.5 1.5	1.5 1.5 1.5
12 13 14	60 65 70	85 90 100	16 16 19	_ _ _	17 17 20	17 17 20	14 14 16	17 17 20	1 1 1	1 1 1	95 100 110	23 23 25	17.5 17.5 19	23 23 25	27 27 31	21 21 25.5	27 27 31	1.5 1.5 1.5	1.5 1.5 1.5	100 110 120	30 34 37	23 26.5 29	30 34 37	1.5 1.5 2	1.5 1.5 1.5
15 16 17	75 80 85	105 110 120	19 19 22	_ _ _	20 20 23	20 20 23	16 16 18	20 20 23	1 1 1.5	1 1 1.5	115 125 130	25 29 29	19 22 22	25 29 29	31 36 36	25.5 29.5 29.5	31 36 36	1.5 1.5 1.5	1.5 1.5 1.5	125 130 140	37 37 41	29 29 32	37 37 41	2 2 2.5	1.5 1.5 2
18 19 20	90 95 100	125 130 140	22 22 24	_ _ _	23 23 25	23 23 25	18 18 20	23 23 25	1.5 1.5 1.5	1.5 1.5 1.5	140 145 150	32 32 32	24 24 24	32 32 32	39 39 39	32.5 32.5 32.5	39 39 39	2 2 2	1.5 1.5 1.5	150 160 165	45 49 52	35 38 40	45 49 52	2.5 2.5 2.5	2 2 2
21 22 24	105 110 120	145 150 165	24 24 27	_ _ _	25 25 29	25 25 29	20 20 23	25 25 29	1.5 1.5 1.5	1.5 1.5 1.5	160 170 180	35 38 38	26 29 29	35 38 38	43 47 48	34 37 38	43 47 48	2.5 2.5 2.5	2 2 2	175 180 200	56 56 62	44 43 48	56 56 62	2.5 2.5 2.5	2 2 2
26 28 30	130 140 150	180 190 210	30 30 36	_ _ _	32 32 38	32 32 38	25 25 30	32 32 38	2 2 2.5	1.5 1.5 2	200 210 225	45 45 48	34 34 36	45 45 48	55 56 59	43 44 46	55 56 59	2.5 2.5 3	2 2 2.5	_ _ _	=	=	_ _ _	_ _ _	=
32 34 36	160 170 180	220 230 250	36 36 42	_ _ _	38 38 45	38 38 45	30 30 34	38 38 45	2.5 2.5 2.5	2 2 2	240 260 280	51 57 64	38 43 48	51 57 64	_ _ _	_ _ _	_ _ _	3 3 3	2.5 2.5 2.5	_ _ _	=	_ _ _	_ _ _	_ _ _	_
38 40 44	190 200 220	260 280 300	42 48 48	_ _ _	45 51 51	45 51 51	34 39 39	45 51 51	2.5 3 3	2 2.5 2.5	290 310 340	64 70 76	48 53 57	64 70 76	_ _ _	_ _ _	_ _ _	3 3 4	2.5 2.5 3	_ _ _	=	_ _ _	_ _ _		_ _ _
48 52 56	240 260 280	320 360 380	48 — —	_ _ _	51 —	51 63.5 63.5	39 48 48	51 63.5 63.5	3 3 3	2.5 2.5 2.5	360 400 420	76 87 87	57 65 65	76 87 87	_ _ _	_ _ _	=	4 5 5	3 4 4	_ _ _	Ξ	_ _ _	_ _ _	_ _ _	=
60 64	300 320	420 440	_	_	_	76 76	57 57	76 76	4	3	460 480	100	74 74	100	_	_	_	5	4	_	_	_	_	_	_

Remarks

1. Other series not conforming to this table are also specified by ISO.

2. In the Dimension Series of Diameter Series 9, Classification I is those specified by the old standard, Classification II is those specified by the ISO.

2. Dimension Series not classified conform to dimensions (D, B, C, T) specified by ISO.

3. The chamfer dimensions listed are the minimum permissible dimensions specified by ISO. They do not apply to

chamfers on the front face.

Tapered Roller Bearings

																								Units:	mm	
	31	02			322				332				303	3 or 30)3D			313				323			Tape Ro Bre	ller
				Di	amete	r Series	s 2										Diam	eter Se	eries 3							
	Di	imensi	ion	Di	imensi	on	Di	imensi	on	Cha	mfer nsion		Di	mensi	on Ser	ies	Di	mensi	on	Di	imensi	on	Cha	mfer		per
	S	ieries (12	S	eries 2	2	S	eries 3	2	Cone				C	3		S	eries 1	3	S	eries 2	23	Cone		d	Bore Number
D												D													-	ore
	В	С	T	В	С	Т	В	С	Т	<i>r</i> (1	min.)	D	В	С	C (1)	Т	В	С	Т	В	С	T	r (1	min.)		<u> </u>
30 32 35	9 10 11	9 10	9.7 10.75 11.75	14 14 14	_ _ _	14.7 14.75 14.75	_ _ _		1 1 1	0.6 0.6 0.6	0.6 0.6 0.6	35 37 42	11 12 13	_ _ 11	 	11.9 12.9 14.25		_ _ _	_	17 17 17	_ _ 14	17.9 17.9 18.25	0.6 1 1	0.6 1 1	10 12 15	00 01 02
40 47 50	12 14 14	11 12 12	13.25 15.25 15.25	16 18 18	14 15 15	17.25 19.25 19.25	_ _ _	_ _ _	_ _ _	1 1 1	1 1 1	47 52 56	14 15 16	12 13 14	_ _ _	15.25 16.25 17.25	_ _ _	_ _ _	_	19 21 21	16 18 18	20.25 22.25 22.25	1 1.5 1.5	1 1.5 1.5	17 20 22	03 04 /22
52 58 62	15 16 16	13 14 14	16.25 17.25 17.25	18 19 20	15 16 17	19.25 20.25 21.25	22 24 25	18 19 19.5	22 24 25	1 1 1	1 1 1	62 68 72	17 18 19	15 15 16	13 14 14	18.25 19.75 20.75	=	 - -	_ _ _	24 24 27	20 20 23	25.25 25.75 28.75		1.5 1.5 1.5	25 28 30	05 /28 06
65 72 80	17 17 18	15 15 16	18.25 18.25 19.75	21 23 23	18 19 19	22.25 24.25 24.75	26 28 32	20.5 22 25	26 28 32	1 1.5 1.5	1 1.5 1.5	75 80 90	20 21 23	17 18 20	15 15 17	21.75 22.75 25.25	=	_ 	_	28 31 33	24 25 27	29.75 32.75 35.25	1.5 2 2	1.5 1.5 1.5	32 35 40	/32 07 08
85 90 100	19 20 21	16 17 18	20.75 21.75 22.75	23 23 25	19 19 21	24.75 24.75 26.75	32 32 35	25 24.5 27	32 32 35	1.5 1.5 2	1.5 1.5 1.5	100 110 120	25 27 29	22 23 25	18 19 21	27.25 29.25 31.5	_ _ _	_ _ _	_	36 40 43	30 33 35	38.25 42.25 45.5	2 2.5 2.5	1.5 2 2	45 50 55	09 10 11
110 120 125	22 23 24	19 20 21	23.75 24.75 26.25	28 31 31	24 27 27	29.75 32.75 33.25	38 41 41	29 32 32	38 41 41	2 2 2	1.5 1.5 1.5	130 140 150	31 33 35	26 28 30	22 23 25	33.5 36 38	_ _ _	_ _ _	_	46 48 51	37 39 42	48.5 51 54	3 3 3	2.5 2.5 2.5	60 65 70	12 13 14
130 140 150	25 26 28	22 22 24	27.25 28.25 30.5	31 33 36	27 28 30	33.25 35.25 38.5	41 46 49	31 35 37	41 46 49	2 2.5 2.5	1.5 2 2	160 170 180	37 39 41	31 33 34	26 27 28	40 42.5 44.5	_	_ _ _		55 58 60	45 48 49	58 61.5 63.5	3 3 4	2.5 2.5 3	75 80 85	15 16 17
160 170 180	30 32 34	26 27 29	32.5 34.5 37	40 43 46	34 37 39	42.5 45.5 49	55 58 63	42 44 48	55 58 63	2.5 3 3	2 2.5 2.5	190 200 215	43 45 47	36 38 39	30 32 —	46.5 49.5 51.5	_ 51	_ _ 35	_ _ 56.5	64 67 73	53 55 60	67.5 71.5 77.5	4 4 4	3 3 3	90 95 100	18 19 20
190 200 215	36 38 40	30 32 34	39 41 43.5	50 53 58	43 46 50	53 56 61.5	68 — —	52 —	68 —	3 3 3	2.5 2.5 2.5	225 240 260	49 50 55	41 42 46	_	53.5 54.5 59.5	53 57 62	36 38 42	58 63 68	77 80 86	63 65 69	81.5 84.5 90.5	4 4 4	3 3 3	105 110 120	21 22 24
230 250 270	40 42 45	34 36 38	43.75 45.75 49	64 68 73	54 58 60	67.75 71.75 77	_ _ _	_ _ _	_ _ _	4 4 4	3 3 3	280 300 320	58 62 65	49 53 55	_ _ _	63.75 67.75 72	66 70 75	44 47 50	72 77 82	93 102 108	78 85 90	98.75 107.75 114	5 5 5	4 4 4	130 140 150	26 28 30
290 310 320	48 52 52	40 43 43	52 57 57	80 86 86	67 71 71	84 91 91	_ _ _	_ _ _	_ _ _	4 5 5	3 4 4	340 360 380	68 72 75	58 62 64	_ _ _	75 80 83	79 84 88	_ _ _	87 92 97	114 120 126	95 100 106	121 127 134	5 5 5	4 4 4	160 170 180	32 34 36
340 360 400	55 58 65	46 48 54	60 64 72	92 98 108	75 82 90	97 104 114	_ _ _	_ _ _	_ _ _	5 5 5	4 4 4	400 420 460	78 80 88	65 67 73	_ _ _	86 89 97	92 97 106	_ _ _	101 107 117	132 138 145	109 115 122	140 146 154	6 6 6	5 5 5	190 200 220	38 40 44
440 480 500	72 80 80	60 67 67	79 89 89	120 130 130	100 106 106	127 137 137	_ _ _	_ _ _	_ _ _	5 6 6	4 5 5	500 540 580	95 102 108	80 85 90	_ _ _	105 113 119	114 123 132	_ _ _	125 135 145	155 165 175	132 136 145	165 176 187	6 6 6	5 6 6	240 260 280	48 52 56
540 580 —	85 92 —	71 75 —	96 104 —	140 150 —	115 125 —	149 159 —	_ _ _	_ _ _	- - -	6 6 —	5 5 —	_ _ _ _	_ _ _	=	_ _ _	_ _ _ _	_ _ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	300 320 340 360	60 64 68 72

Note (1) Regarding steep-slope bearing 303D, in DIN, the one corresponding to 303D of JIS is numbered 313. For bearings with bore diameters larger than 100 mm, those of dimension series 13 are numbered 313.



Table 7. 3 Boundary Dimensions of

Thrust B	Ball Brgs.									511					512		522			
Spherica Roller	al Thrust Brgs.													292						
			Diam	neter Se	ries 0			Diam	neter Se	ries 1					Dian	neter Sei	ries 2			
per			Dime	ension S	Series			Dime	ension S	Series				[Dimensi	on Serie	S			
Bore Number	d	ъ.	70	90	10		D	71	91	11		D	72	92	12	22	2	2		
Bori		D		Т		$m{r}$ (min.)	D		Т		$m{r}$ (min.)	D			Т		Central	Washer	I (min.)	r_1 (min.)
				1					1						1		d_2	В		
4 6 8	4 6 8	12 16 18	4 5 5	_ _ _	6 7 7	0.3 0.3 0.3	=	_ _ _	_ _ _	_ _ _	=	16 20 22	6 6 6	_ _ _	8 9 9	_ _ _	_	_ _ _	0.3 0.3 0.3	_ _ _
00 01 02	10 12 15	20 22 26	5 5 5	_ _ _	7 7 7	0.3 0.3 0.3	24 26 28	6 6 6	_ _ _	9 9 9	0.3 0.3 0.3	26 28 32	7 7 8	_ _ _	11 11 12	_ 22	_ 10	_ _ 5	0.6 0.6 0.6	 0.3
03 04 05	17 20 25	28 32 37	5 6 6	_ _ _	7 8 8	0.3 0.3 0.3	30 35 42	6 7 8	_ _ _	9 10 11	0.3 0.3 0.6	35 40 47	8 9 10		12 14 15	26 28	15 20	- 6 7	0.6 0.6 0.6	 0.3 0.3
06 07 08	30 35 40	42 47 52	6 6 6	_ _ _	8 8 9	0.3 0.3 0.3	47 52 60	8 8 9	_ _ _	11 12 13	0.6 0.6 0.6	52 62 68	10 12 13		16 18 19	29 34 36	25 30 30	7 8 9	0.6 1 1	0.3 0.3 0.6
09 10 11	45 50 55	60 65 70	7 7 7	_ _ _	10 10 10	0.3 0.3 0.3	65 70 78	9 9 10	_ _ _	14 14 16	0.6 0.6 0.6	73 78 90	13 13 16	_ 21	20 22 25	37 39 45	35 40 45	9 9 10	1 1 1	0.6 0.6 0.6
12 13 14	60 65 70	75 80 85	7 7 7	_ _ _	10 10 10	0.3 0.3 0.3	85 90 95	11 11 11	_ _ _	17 18 18	1 1 1	95 100 105	16 16 16	21 21 21	26 27 27	46 47 47	50 55 55	10 10 10	1 1 1	0.6 0.6 1
15 16 17	75 80 85	90 95 100	7 7 7	_ _ _	10 10 10	0.3 0.3 0.3	100 105 110	11 11 11	_ _ _	19 19 19	1 1 1	110 115 125	16 16 18	21 21 24	27 28 31	47 48 55	60 65 70	10 10 12	1 1 1	1 1 1
18 20 22	90 100 110	105 120 130	7 9 9	_ _ _	10 14 14	0.3 0.6 0.6	120 135 145	14 16 16		22 25 25	1 1 1	135 150 160	20 23 23	27 30 30	35 38 38	62 67 67	75 85 95	14 15 15	1.1 1.1 1.1	1 1 1
24 26 28	120 130 140	140 150 160	9 9 9	_ _ _	14 14 14	0.6 0.6 0.6	155 170 180	16 18 18	21 24 24	25 30 31	1 1 1	170 190 200	23 27 27	30 36 36	39 45 46	68 80 81	100 110 120	15 18 18	1.1 1.5 1.5	1.1 1.1 1.1
30 32 34	150 160 170	170 180 190	9 9 9	_ _ _	14 14 14	0.6 0.6 0.6	190 200 215	18 18 20	24 24 27	31 31 34	1 1 1.1	215 225 240	29 29 32	39 39 42	50 51 55	89 90 97	130 140 150	20 20 21	1.5 1.5 1.5	1.1 1.1 1.1
36 38 40	180 190 200	200 215 225	9 11 11	_ _ _	14 17 17	0.6 1 1	225 240 250	20 23 23	27 30 30	34 37 37	1.1 1.1 1.1	250 270 280	32 36 36	42 48 48	56 62 62	98 109 109	150 160 170	21 24 24	1.5 2 2	2 2 2
44 48 52	220 240 260	250 270 290	14 14 14	_ _ _	22 22 22	1 1 1	270 300 320	23 27 27	30 36 36	37 45 45	1.1 1.5 1.5	300 340 360	36 45 45	48 60 60	63 78 79	110 —	190 — —	24 —	2 2.1 2.1	2
56 60 64	280 300 320	310 340 360	14 18 18	 24 24	22 30 30	1 1 1	350 380 400	32 36 36	42 48 48	53 62 63	1.5 2 2	380 420 440	45 54 54	60 73 73	80 95 95	_ _ _	_ _ _	_ _ _	2.1 3 3	_ _ _

Remarks
1. Dimension Series 22, 23, and 24 are double direction bearings.
2. The maximum permissible outside diameter of shaft and central washers and minimum permissible bore diameter of housing washers are omitted here. (Refer to the bearing tables for Thrust Bearings).

Thrust Bearings (Flat Seats) — 1 —

																					Un	its: mm	
				513		523							514		524							Thrus Bro	
			293									294										Spherica Roller	l Thrust Brgs.
				Diam	eter Se	ries 3							Diam	eter Se	ries 4				Diam	neter Se	ries 5		
			D)imensi	on Serie	es						D	imensi	on Serie	es					Dimensior Series			Je C
		73	93	13	23	2	3				74	94	14	24	2	4				95			Bore Number
	D			1		Central	Washer	$m{r}$ (min.)	$m{r}_1$ (min.)	D		1			Central	Washer	<i>I</i> * (min.)	$m{r}_1$ (min.)	D		I (min.)	d	Bore
				T		d_2	В						Γ		d_2	В				Т			
-		_				u _L									u _L								
	20 24	7	_	11 12	_	_	_	0.6 0.6	_	_	_	_	_	_	_	_	_	_	_	=	_	4 6	6
	26	8	_	12	_	_	_	0.6	_	_	_	_	_	_	_	_	_	_	_	_	_	8	8
	30 32	9	_	14 14	_	_	_	0.6 0.6	_	_	_	_	_	_	_	_	_	_	_	_	_	10 12	00 01
	37	10	_	15	_	_	_	0.6	_	_	_	_	_	_	_	_	_	_	_	-	_	15	02
	40 47	10 12	_	16 18	_	-	_	0.6 1	_	=	=	_	_	=	_	=	_	_	52 60	21 24	1	17 20	03 04
	52	12	_	18	34	20	8	1	0.3	60	16	21	24	45	15	11	1	0.6	73	29	1.1	25	05
	60 68	14 15	_	21 24	38 44	25 30	9 10	1	0.3 0.3	70 80	18 20	24 27	28 32	52 59	20 25	12 14	1 1.1	0.6	85 100	34 39	1.1 1.1	30 35	06 07
	78	17	22	26	49	30	12	i	0.6	90	23	30	36	65	30	15	1.1	0.6	110	42	1.5	40	08
	85	18	24	28	52	35	12	1	0.6	100	25	34	39	72	35	17	1.1	0.6	120	45	2	45	09
	95 105	20 23	27 30	31 35	58 64	40 45	14 15	1.1 1.1	0.6 0.6	110 120	27 29	36 39	43 48	78 87	40 45	18 20	1.5 1.5	0.6	135 150	51 58	2 2.1	50 55	10 11
	110	23	30	35	64	50	15	1.1	0.6	130	32	42	51	93	50	21	1.5	0.6	160	60	2.1	60	12
	115 125	23 25	30 34	36 40	65 72	55 55	15 16	1.1 1.1	0.6 1	140 150	34 36	45 48	56 60	101 107	50 55	23 24	2 2	1	170 180	63 67	2.1 3	65 70	13 14
	135	27	36	44	79	60	18	1.5	1	160	38	51	65	115	60	26	2	1	190	69	3	75	15
	140 150	27 29	36 39	44 49	79 87	65 70	18 19	1.5 1.5	1 1	170 180	41 42	54 58	68 72	120 128	65 65	27 29	2.1 2.1	1 1.1	200 215	73 78	3 4	80 85	16 17
	155	29	39	50	88	75	19	1.5	1	190	45	60	77	135	70	30	2.1	11	225	82	4	90	18
	170 190	32 36	42 48	55 63	97 110	85 95	21 24	1.5	1 1	210 230	50 54	67 73	85 95	150 166	80 90	33 37	3	1.1	250 270	90 95	4 5	100 110	20 22
	210 225 240	41 42 45	54 58 60	70 75 80	123 130 140	100 110 120	27 30 31	2.1 2.1 2.1	1.1 1.1 1.1	250 270 280	58 63 63	78 85 85	102 110 112	177 192 196	95 100 110	40 42 44	4 4 4	1.5 2 2	300 320 340	109 115 122	5 5 5	120 130 140	24 26 28
	250 270	45 50	60 67	80 87	140 153	130 140	31 33	2.1	1.1	300 320	67 73	90 95	120 130	209 226	120 130	46 50	5	2 2	360 380	125 132	6	150 160	30 32
	280	50	67	87	153	150	33	3	1.1	340	78	103	135	236	135	50	5	2.1	400	140	6	170	34
	300 320	54 58	73 78	95 105	165 183	150 160	37 40	3	2	360 380	82 85	109 115	140 150	245 —	140	52 —	5	3	420 440	145 150	6	180 190	36 38
	340	63	85	110	192	170	42	4	2	400	90	122	155	_	-	_	5	_	460	155	7.5	200	40
	360 380	63 63	85 85	112 112	_	=	_	4 4	_	420 440	90 90	122 122	160 160	=	_	=	6	_	500 540	170 180	7.5 7.5	220 240	44 48
	420	73	95	130	-	-	-	5	-	480	100	132	175	-	-	_	6	_	580	190	9.5	260	52
	440 480	73 82	95 109	130 140	_	_	_	5 5	_	520 540	109 109	145 145	190 190	_	_	_	6	_	620 670	206 224	9.5 9.5	280 300	56 60
	500	82	109	140	_	_	_	5	_	580	118	155	205	_	_	_	7.5	_	710	236	9.5	320	64

A 46 A 47



Table 7. 3 Boundary Dimensions of

Thrust B	Ball Brgs.									511					512		522			
Spherica Roller	al Thrust Brgs.													292						
			Dian	neter Se	ries 0			Diam	neter Se	ries 1					Dian	neter Sei	ries 2			
per			Dime	ension S	Series			Dime	ension S	Series				ı	Dimensi	on Serie	s			
Bore Number	d	ъ.	70	90	10		D	71	91	11		D	72	92	12	22	2	2		
Bori		D		T		$m{r}$ (min.)	D		T		$m{r}$ (min.)	D			Т		Central	Washer	I (min.)	r_1 (min.)
				1					1						1		d_2	В		
68 72 76	340 360 380	380 400 420	18 18 18	24 24 24	30 30 30	1 1 1	420 440 460	36 36 36	48 48 48	64 65 65	2 2 2	460 500 520	54 63 63	73 85 85	96 110 112	_ _ _	_ _ _	=	3 4 4	_ _ _
80 84 88	400 420 440	440 460 480	18 18 18	24 24 24	30 30 30	1 1 1	480 500 540	36 36 45	48 48 60	65 65 80	2 2 2.1	540 580 600	63 73 73	85 95 95	112 130 130	_ _ _	_ _ _	_ _ _	4 5 5	_ _ _
92 96 /500	460 480 500	500 520 540	18 18 18	24 24 24	30 30 30	1 1 1	560 580 600	45 45 45	60 60 60	80 80 80	2.1 2.1 2.1	620 650 670	73 78 78	95 103 103	130 135 135	_ _ _	_ _ _	_ _ _	5 5 5	
/530 /560 /600	530 560 600	580 610 650	23 23 23	30 30 30	38 38 38	1.1 1.1 1.1	640 670 710	50 50 50	67 67 67	85 85 85	3 3 3	710 750 800	82 85 90	109 115 122	140 150 160	_ _ _	_ _ _	_ _ _	5 5 5	_ _ _
/630 /670 /710	630 670 710	680 730 780	23 27 32	30 36 42	38 45 53	1.1 1.5 1.5	750 800 850	54 58 63	73 78 85	95 105 112	3 4 4	850 900 950	100 103 109	132 140 145	175 180 190	_ _ _	_ _ _	_ _ _	6 6 6	_ _ _
/750 /800 /850	750 800 850	820 870 920	32 32 32	42 42 42	53 53 53	1.5 1.5 1.5	900 950 1000	67 67 67	90 90 90	120 120 120	4 4 4	1000 1060 1120	112 118 122	150 155 160	195 205 212	_ _ _	_ _ _	_ _ _	6 7.5 7.5	
/900 /950 /1000	900 950 1000	980 1030 1090	36 36 41	48 48 54	63 63 70	2 2 2.1	1060 1120 1180	73 78 82	95 103 109	130 135 140	5 5 5	1180 1250 1320	125 136 145	170 180 190	220 236 250	_ _ _	_ _ _	_ _ _	7.5 7.5 9.5	
/1060 /1120 /1180	1060 1120 1180	1150 1220 1280	41 45 45	54 60 60	70 80 80	2.1 2.1 2.1	1250 1320 1400	85 90 100	115 122 132	150 160 175	5 5 6	1400 1460 1520	155 — —	206 206 206	265 —	_ _ _	_ _ _	_ _ _	9.5 9.5 9.5	
/1250 /1320 /1400	1250 1320 1400	1360 1440 1520	50 —	67 —	85 95 95	3 3 3	1460 1540 1630	_ _ _	_ _ _	175 175 180	6 6 6	1610 1700 1790	_ _ _	216 228 234	_ _ _	_ _ _	_ _ _	_ _ _	9.5 9.5 12	_ _ _
/1500 /1600 /1700	1500 1600 1700	1630 1730 1840	_ _ _	_ _ _	105 105 112	4 4 4	1750 1850 1970	_ _ _	_ _ _	195 195 212	6 6 7.5	1920 2040 2160	_ _ _	252 264 276	_ _ _	_ _ _	_ _ _	_ _ _	12 15 15	_ _ _
/1800 /1900 /2000	1800 1900 2000	1950 2060 2160	_ _ _	_ _ _	120 130 130	4 5 5	2080 2180 2300	_ _ _	_ _ _	220 220 236	7.5 7.5 7.5	2280 — —	_ _ _	288 — —	_ _ _	_ _ _	_ _ _	_ _ _	15 — —	_ _ _
/2120 /2240 /2360 /2500	2120 2240 2360 2500	2300 2430 2550 2700	_ _ _ _	_ _ _ _	140 150 150 160	5 5 5 5	2430 2570 2700 2850		_ _ _ _	243 258 265 272	7.5 9.5 9.5 9.5	_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _			_ _ _ _	_ _ _ _	_ _ _ _

- Remarks
 Dimension Series 22, 23, and 24 are double direction bearings.
 The maximum permissible outside diameter of shaft and central washers and minimum permissible bore diameter of housing washers are omitted here. (Refer to the bearings tables for Thrust Bearings).

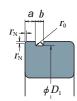
Thrust Bearings (Flat Seats) — 2 —

		ŭ	Ť		•															Un	its: mm	1
			513		523							514		524							Thrus Br	st Ball gs.
		293									294										Spheric	al Thrust Brgs.
			Diam	eter Se	ries 3							Diam	eter Se	ries 4				Diam	neter Se	ries 5		
		D	imensi	on Serie	es						0	imensi	on Serie	es					Dimension Series			Jer.
	73	93	13	23	2	3				74	94	14	24	2	4				95		d	Bore Number
D					Central	Washer	I (min.)	$m{r}_1$ (min.)	D					Central	Washer	I (min.)	$m{r}_1$ (min.)	D		$m{r}$ (min.)	_	Bore
			T		d_2	В						T		d_2	В				Т			
540	90	122	160	_	_	_	5	_	620	125	170	220	_	_	_	7.5	_	750	243	12	340	68
560 600	90 100	122	160 175	_	=	=	5	_	640 670	125 132	170 175	220 224	_	_	_	7.5 7.5	_	780 820	250 265	12	360 380	72 76
620	100	132	175				ļ ,		710	140	185	243				7.5		850	272	12	400	80
650 680	100 103 109	140 145	180 190	_		=	6 6	_	730 780	140 140 155	185 185 206	243 243 265		_	=	7.5 7.5 9.5	=	900 950	290 308	15 15	420 440	84 88
							-										_					
710 730	112 112	150 150	195 195	_	_	_	6	_	800 850	155 165	206 224	265 290	_	_	_	9.5 9.5	_	980 1000	315 315	15 15	460 480	92 96
750	112	150	195	_	_	_	6	-	870	165	224	290	_	_	_	9.5	_	1060	335	15	500	/500
800 850	122 132	160 175	212 224	_	_	_	7.5 7.5	_	920 980	175 190	236 250	308 335	_	_	_	9.5 12	_	1090 1150	335 355	15 15	530 560	/530 /560
900	136	180	236	_	_	_	7.5	-	1030	195	258	335	_	_	_	12	_	1220	375	15	600	/600
950 1000	145 150	190 200	250 258	_	_	_	9.5 9.5	_	1090 1150	206 218	280 290	365 375	_	_	_	12 15	_	1280 1320	388 388	15 15	630 670	/630 /670
1060	160	212	272	_	-	-	9.5	-	1220	230	308	400	_	_	_	15	_	1400	412	15	710	/710
1120	165	224	290	_	_	_	9.5	_	1280	236	315	412	_	_	_	15	_	=	_	_	750	/750
1180 1250	170 180	230 243	300 315	_	_	=	9.5 12	_	1360 1440	250 —	335 354	438	_	_	_	15 15	_	_	=	_	800 850	/800 /850
1320	190	250	335	_	_	_	12	_	1520	_	372	_	_	_	_	15	_	_	_	_	900	/900
1400 1460	200	272 276	355	_	_	_	12 12	_	1600 1670	_	390 402	_	_	_	_	15 15	_	_	=	_	950 1000	/950 /1000
1540	_	288	_	_	_	_	15	_	1770	_	426	_	_	_	_	15	_	_	_	_	1060	/1060
1630 1710	_	306 318	_	_	_	_	15 15	_	1860 1950	_	444 462	_	_	_	_	15 19	_	_	=	_	1120 1180	/1120 /1180
1800		330					19		2050		480					19					1250	/1250
1900 1900 2000	_	348 360	_	_		=	19 19 19	_	2160 2280	Ξ	505 530	_		_	=	19 19 19	=	=	Ξ	_	1320 1400	/1320 /1400
									2200		330					'						
2140 2270	_	384 402	_	_	_	_	19 19	_	_	=	_	_	_	_	_	_	_	_	=	_	1500 1600	/1500 /1600
_	_	_	_	_	-	_	-	_	_	-	_	_	_	_	_	_	_	_	_	_	1700	/1700
_	_	_	_	_	=	_	_	_	_	=	_	_	_	_	_	_	_	_	_	_	1800 1900	/1800 /1900
_	_	_	_	_	_	-	-	_	_	-	_	_	_	_	_	_	_	_	-	-	2000	/2000
Ξ	=	_	_	_	_	=	_	_	_	=	_	_	_	_	=	_	_	=	=	_	2120 2240	/2120 /2240
_	_	_	_	_	_	_	_	_	_	=	_	_	_	_	_	_	_	Ξ	Ξ	=	2360 2500	/2360 /2500

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Table 7. 4 Dimensions of Snap Ring Grooves and Locating Snap Rings — (1) Bearings of Dimension Series 18 and 19

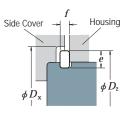


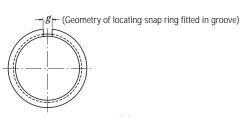
Арр	licable Bear	ings				Snap F	Ring Groove				
	d			ig Groove neter			a			g Groove dth	Radius of Bottom
		D		D ₁		Bearing Dim				b	Corners
Dimension	on Series		1	21		18	1	19			r_0
18	19		max.	min.	max.	min.	max.	min.	max.	min.	max.
_	10 12 15	22 24 28	20.8 22.8 26.7	20.5 22.5 26.4	_	_	1.05 1.05 1.3	0.9 0.9 1.15	1.05 1.05 1.2	0.8 0.8 0.95	0.2 0.2 0.25
	17 —	30 32 34	28.7 30.7 32.7	28.4 30.4 32.4	1.3 1.3	— 1.15 1.15	1.3 — —	1.15 — —	1.2 1.2 1.2	0.95 0.95 0.95	0.25 0.25 0.25
25 — 28	20 22 —	37 39 40	35.7 37.7 38.7	35.4 37.4 38.4	1.3 — 1.3	1.15 — 1.15	1.7 1.7 —	1.55 1.55 —	1.2 1.2 1.2	0.95 0.95 0.95	0.25 0.25 0.25
30 32 —	25 — 28	42 44 45	40.7 42.7 43.7	40.4 42.4 43.4	1.3 1.3 —	1.15 1.15 —	1.7 — 1.7	1.55 — 1.55	1.2 1.2 1.2	0.95 0.95 0.95	0.25 0.25 0.25
35 40 —	30 32 35	47 52 55	45.7 50.7 53.7	45.4 50.4 53.4	1.3 1.3 —	1.15 1.15 —	1.7 1.7 1.7	1.55 1.55 1.55	1.2 1.2 1.2	0.95 0.95 0.95	0.25 0.25 0.25
45 — 50	40 —	58 62 65	56.7 60.7 63.7	56.4 60.3 63.3	1.3 — 1.3	1.15 — 1.15	1.7 —	 1.55 	1.2 1.2 1.2	0.95 0.95 0.95	0.25 0.25 0.25
 55 60	45 50 —	68 72 78	66.7 70.7 76.2	66.3 70.3 75.8	— 1.7 1.7	— 1.55 1.55	1.7 1.7 —	1.55 1.55 —	1.2 1.2 1.6	0.95 0.95 1.3	0.25 0.25 0.4
65 70	55 60 65	80 85 90	77.9 82.9 87.9	77.5 82.5 87.5	1.7 1.7	— 1.55 1.55	2.1 2.1 2.1	1.9 1.9 1.9	1.6 1.6 1.6	1.3 1.3 1.3	0.4 0.4 0.4
75 80 —	70 75	95 100 105	92.9 97.9 102.6	92.5 97.5 102.1	1.7 1.7 —	1.55 1.55 —	2.5 2.5	 2.3 2.3	1.6 1.6 1.6	1.3 1.3 1.3	0.4 0.4 0.4
85 90 95	80 — 85	110 115 120	107.6 112.6 117.6	107.1 112.1 117.1	2.1 2.1 2.1	1.9 1.9 1.9	2.5 — 3.3	2.3 — 3.1	1.6 1.6 1.6	1.3 1.3 1.3	0.4 0.4 0.4
100 105 110	90 95 100	125 130 140	122.6 127.6 137.6	122.1 127.1 137.1	2.1 2.1 2.5	1.9 1.9 2.3	3.3 3.3 3.3	3.1 3.1 3.1	1.6 1.6 2.2	1.3 1.3 1.9	0.4 0.4 0.6
120 130	105 110 120	145 150 165	142.6 147.6 161.8	142.1 147.1 161.3	2.5 3.3		3.3 3.3 3.7	3.1 3.1 3.5	2.2 2.2 2.2	1.9 1.9 1.9	0.6 0.6 0.6
140 — 150 160	130 140 —	175 180 190 200	171.8 176.8 186.8 196.8	171.3 176.3 186.3 196.3	3.3 — 3.3 3.3	3.1 3.1 3.1	3.7 3.7 —	3.5 3.5 —	2.2 2.2 2.2 2.2	1.9 1.9 1.9 1.9	0.6 0.6 0.6 0.6

Remarks The minimum permissible chamfer dimensions $r_{\rm N}$ on the snap-ring-groove side of the outer rings are as follows: Dimension series 18: For outside diameters of 78mm and less, use 0.3mm chamfer. For all others exceeding 78mm, use 0.5mm chamfer. Dimension series 19: For outside diameters of 24mm and less, use 0.2mm chamfer.

For 47mm and less, use 0.3mm chamfer.

For all others exceeding 47mm, use 0.5mm chamfer (However, for an outside diameter of 68 mm, use a 0.3 mm chamfer, which is not compliant with ISO 15).



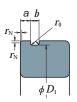


Units: mm

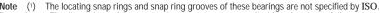
		Locati	ng Snap Rir	ng			Side Cover
Locating Snap Ring Number	He	Sectional ight	Thic	kness f	fitted	ry of snap ring d in groove eference) Snap Ring Outside Diameter D ₂	Stepped Bore Diameter (Reference)
	max.	min.	max.	min.	approx.	max.	min.
NR 1022	2.0	1.85	0.7	0.6	2	24.8	25.5
NR 1024	2.0	1.85	0.7	0.6	2	26.8	27.5
NR 1028	2.05	1.9	0.85	0.75	3	30.8	31.5
NR 1030	2.05	1.9	0.85	0.75	3	32.8	33.5
NR 1032	2.05	1.9	0.85	0.75	3	34.8	35.5
NR 1034	2.05	1.9	0.85	0.75	3	36.8	37.5
NR 1037	2.05	1.9	0.85	0.75	3	39.8	40.5
NR 1039	2.05	1.9	0.85	0.75	3	41.8	42.5
NR 1040	2.05	1.9	0.85	0.75	3	42.8	43.5
NR 1042	2.05	1.9	0.85	0.75	3	44.8	45.5
NR 1044	2.05	1.9	0.85	0.75	4	46.8	47.5
NR 1045	2.05	1.9	0.85	0.75	4	47.8	48.5
NR 1047	2.05	1.9	0.85	0.75	4	49.8	50.5
NR 1052	2.05	1.9	0.85	0.75	4	54.8	55.5
NR 1055	2.05	1.9	0.85	0.75	4	57.8	58.5
NR 1058	2.05	1.9	0.85	0.75	4	60.8	61.5
NR 1062	2.05	1.9	0.85	0.75	4	64.8	65.5
NR 1065	2.05	1.9	0.85	0.75	4	67.8	68.5
NR 1068	2.05	1.9	0.85	0.75	5	70.8	72
NR 1072	2.05	1.9	0.85	0.75	5	74.8	76
NR 1078	3.25	3.1	1.12	1.02	5	82.7	84
NR 1080	3.25	3.1	1.12	1.02	5	84.4	86
NR 1085	3.25	3.1	1.12	1.02	5	89.4	91
NR 1090	3.25	3.1	1.12	1.02	5	94.4	96
NR 1095	3.25	3.1	1.12	1.02	5	99.4	101
NR 1100	3.25	3.1	1.12	1.02	5	104.4	106
NR 1105	4.04	3.89	1.12	1.02	5	110.7	112
NR 1110	4.04	3.89	1.12	1.02	5	115.7	117
NR 1115	4.04	3.89	1.12	1.02	5	120.7	122
NR 1120	4.04	3.89	1.12	1.02	7	125.7	127
NR 1125	4.04	3.89	1.12	1.02	7	130.7	132
NR 1130	4.04	3.89	1.12	1.02	7	135.7	137
NR 1140	4.04	3.89	1.7	1.6	7	145.7	147
NR 1145	4.04	3.89	1.7	1.6	7	150.7	152
NR 1150	4.04	3.89	1.7	1.6	7	155.7	157
NR 1165	4.85	4.7	1.7	1.6	7	171.5	173
NR 1175	4.85	4.7	1.7	1.6	10	181.5	183
NR 1180	4.85	4.7	1.7	1.6	10	186.5	188
NR 1190	4.85	4.7	1.7	1.6	10	196.5	198
NR 1200	4.85	4.7	1.7	1.6	10	206.5	208

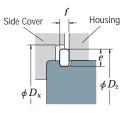


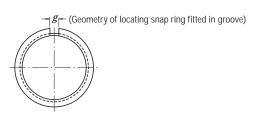
Table 7. 4 Dimensions of Snap Ring Grooves and Locating Snap Rings — (2) Bearing of Diameter Series 0, 2, 3, and 4



	Appli	cable Bea	rings					Snap Ri	ng Groove				
	(d				ng Groove meter			oove Positi 2 meter Serie			g Groove dth	Radius of Bottom
	Diamete	er Series		D	i	D_1)	2, 3		1 .	b	Corners r_0
0	2	3	4		max.	min.	max.	min.	max.	min.	max.	min.	max.
10 12	_	_	_	26 28	24.5 26.5	24.25 26.25	1.35 1.35	1.19 1.19	_	_	1.17 1.17	0.87 0.87	0.2 0.2
 15 17	10 12 15	9 — 10	8 9 —	30 32 35	28.17 30.15 33.17	27.91 29.9 32.92	2.06 2.06	1.9 1.9	2.06 2.06 2.06	1.9 1.9 1.9	1.65 1.65 1.65	1.35 1.35 1.35	0.4 0.4 0.4
 20	17 —	12 — 15	10 — 12	37 40 42	34.77 38.1 39.75	34.52 37.85 39.5	 2.06	 1.9	2.06 2.06 2.06	1.9 1.9 1.9	1.65 1.65 1.65	1.35 1.35 1.35	0.4 0.4 0.4
22 25 —		17		44 47 50	41.75 44.6 47.6	41.5 44.35 47.35	2.06	1.9 1.9	2.46 2.46	2.31 2.31	1.65 1.65 1.65	1.35 1.35 1.35	0.4 0.4 0.4
28 30	25 —	20 — 22	15 —	52 55 56	49.73 52.6 53.6	49.48 52.35 53.35	2.06 2.08	1.9 1.88	2.46 — 2.46	2.31	1.65 1.65 1.65	1.35 1.35 1.35	0.4 0.4 0.4
32 35 —	28 30 32	25 —		58 62 65	55.6 59.61 62.6	55.35 59.11 62.1	2.08 2.08	1.88 1.88	2.46 3.28 3.28	2.31 3.07 3.07	1.65 2.2 2.2	1.35 1.9 1.9	0.4 0.6 0.6
40 — 45	35 —	28 30 32	20 —	68 72 75	64.82 68.81 71.83	64.31 68.3 71.32	2.49 — 2.49	2.29 — 2.29	3.28 3.28 3.28	3.07 3.07 3.07	2.2 2.2 2.2	1.9 1.9 1.9	0.6 0.6 0.6
50 — 55	40 45 50	35 — 40	25 — 30	80 85 90	76.81 81.81 86.79	76.3 81.31 86.28	2.49 — 2.87	2.29 — 2.67	3.28 3.28 3.28	3.07 3.07 3.07	2.2 2.2 3	1.9 1.9 2.7	0.6 0.6 0.6
60 65 70	55 60	— 45 50	— 35 40	95 100 110	91.82 96.8 106.81	91.31 96.29 106.3	2.87 2.87 2.87	2.67 2.67 2.67	3.28 3.28	3.07 3.07	3 3 3	2.7 2.7 2.7	0.6 0.6 0.6
75 — 80	65 70	 55 	45 —	115 120 125	111.81 115.21 120.22	111.3 114.71 119.71	2.87 — 2.87	2.67 — 2.67	4.06 4.06	3.86 3.86	3 3.4 3.4	2.7 3.1 3.1	0.6 0.6 0.6
85 90 95	75 80 —	60 65 —	50 55 —	130 140 145	125.22 135.23 140.23	124.71 134.72 139.73	2.87 3.71 3.71	2.67 3.45 3.45	4.06 4.9 —	3.86 4.65 —	3.4 3.4 3.4	3.1 3.1 3.1	0.6 0.6 0.6
100 105 110	85 90 95	70 75 80	60 65 —	150 160 170	145.24 155.22 163.65	144.73 154.71 163.14	3.71 3.71 3.71	3.45 3.45 3.45	4.9 4.9 5.69	4.65 4.65 5.44	3.4 3.4 3.8	3.1 3.1 3.5	0.6 0.6 0.6
120 — 130	100 105 110	85 90 95	70 75 80	180 190 200	173.66 183.64 193.65	173.15 183.13 193.14	3.71 — 5.69	3.45 — 5.44	5.69 5.69 5.69	5.44 5.44 5.44	3.8 3.8 3.8	3.5 3.5 3.5	0.6 0.6 0.6







Units: mm

		Locat	ing Snap I	Ring			Side Cover
Locating Snap Ring Number		Sectional eight	Thic	ckness	fittee	ry of snap ring d in groove eference) Snap Ring Outside	Stepped Bore Diameter (Reference)
				•	g	Diameter D_2	$D_{\rm X}$
	max.	min.	max.	min.	approx.	max.	min.
NR 26 (1) NR 28 (1)	2.06 2.06	1.91 1.91	0.84 0.84	0.74 0.74	3	28.7 30.7	29.4 31.4
NR 30 NR 32	3.25 3.25	3.1 3.1	1.12 1.12	1.02 1.02	3	34.7 36.7	35.5 37.5
NR 35	3.25	3.1	1.12	1.02	3	39.7	40.5
NR 37 NR 40	3.25 3.25	3.1 3.1	1.12 1.12	1.02 1.02	3	41.3 44.6	42 45.5
NR 42	3.25	3.1	1.12	1.02	3	46.3	47
NR 44 NR 47	3.25 4.04	3.1 3.89	1.12 1.12	1.02 1.02	3 4	48.3 52.7	49 53.5
NR 50	4.04	3.89	1.12	1.02	4	55.7	56.5
NR 52 NR 55	4.04 4.04	3.89 3.89	1.12 1.12	1.02 1.02	4	57.9 60.7	58.5 61.5
NR 56 NR 58	4.04 4.04	3.89 3.89	1.12	1.02 1.02	4 4	61.7 63.7	62.5 64.5
NR 62 NR 65	4.04 4.04 4.04	3.89 3.89	1.7	1.6 1.6	4 4	67.7 70.7	68.5 71.5
NR 68 NR 72	4.85 4.85	4.7 4.7	1.7 1.7	1.6 1.6	5 5	74.6 78.6	76 80
NR 75	4.85	4.7	1.7	1.6	5	81.6	83
NR 80 NR 85	4.85 4.85	4.7 4.7	1.7 1.7	1.6 1.6	5 5	86.6 91.6	88 93
NR 90	4.85	4.7	2.46	2.36	5	96.5	98
NR 95 NR 100 NR 110	4.85 4.85 4.85	4.7 4.7 4.7	2.46 2.46 2.46	2.36 2.36 2.36	5 5 5	101.6 106.5 116.6	103 108 118
NR 115	4.85	4.7	2.46	2.36	5	121.6	123
NR 120 NR 125	7.21 7.21	7.06 7.06	2.82 2.82	2.72 2.72	7 7	129.7 134.7	131.5 136.5
NR 130	7.21	7.06	2.82	2.72	7	139.7	141.5
NR 140 NR 145	7.21 7.21	7.06 7.06	2.82 2.82	2.72 2.72	7 7	149.7 154.7	152 157
NR 150	7.21	7.06	2.82	2.72	7	159.7	162
NR 160 NR 170	7.21 9.6	7.06 9.45	2.82 3.1	2.72 3	7 10	169.7 182.9	172 185
NR 180 NR 190	9.6 9.6	9.45 9.45	3.1	3	10 10	192.9 202.9	195 205
NR 200	9.6	9.45	3.1	3	10	202.9	205

A 52 A 53

Note (1) The locating snap rings and snap ring grooves of these bearings are not specified by ISO.

1. The dimensions of these snap ring grooves are not applicable to bearings of dimension series 00, 82, and 83.

2. The minimum permissible chamfer dimension r_N on the snap-ring side of outer rings is 0.5mm. However, for bearings of diameter series 0 having outside diameters 35mm and below, it is 0.3mm.

(Example 4) NU 3 18 M CM

(Example 5) NN 3 0 17 K CC1 P4

Radial Clearance for

Machined Brass Cage

Bearing Bore 90mm

Diameter Series 3

NU Type Cylindrical

Accuracy of ISO Class 4

Radial Clearance in Non-

Roller Bearing

Electric-Motor Bearings CM



7.2 Formulation of Bearing Numbers

Bearing numbers are alphanumeric combinations that indicate the bearing type, boundary dimensions, dimensional and running accuracies, internal clearance. and other related specifications. They consist of basic numbers and supplementary symbols. The boundary dimensions of commonly used bearings mostly conform to the organizational concept of ISO, and the bearing numbers of these standard bearings are specified by JIS B 1513 (Bearing Numbers for Rolling Bearings). Due to a need for more detailed classification, NSK uses auxiliary symbols other than those specified by JIS.

Bearing numbers consist of a basic number and supplementary symbols. The basic number indicates

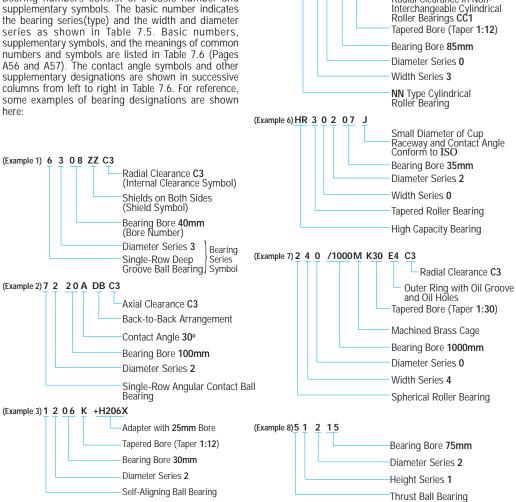


Table 7. 5 Bearing Series Symbols

			Table	7.5 Bear	ing Series Symbols				
			Dimensio	n Symbols				Dimensio	n Symbols
Bearing Type	Bearing Series Symbols	Type Symbols	Width Symbols	Diameter Symbols	Bearing Type	Bearing Series Symbols	Type Symbols	Width Symbols or Height Symbols	Diameter Symbols
	68	6	(1)	8	Double-Row	NNU49	NNU	4	9
Single-Row	69	6	(1)	9	Cylindrical	NN30	NN	3	0
Deep Groove	60	6	(1)	0	Roller Bearings				
Ball Bearings	62	6	(0)	2		NA48	NA	4	8
	63	6	(0)	3	Needle Roller	NA49	NA	4	9
	79	7	(1)	9	Bearings	NA59	NA	5	9
Single-Row	70	7	(1)	o o	J.	NA69	NA	6	9
Angular Contact	72	7	(0)	2					
Ball Bearings	73	7	(0)	3		329	3	2	9
			(0)			320	3	2	0
Calf Alianian	12	1	(0)	2		330	3	3	0
Self-Aligning	13 22	1 (1)	(0)	3		331	3	3	1
Ball Bearings	23	(1) (1)	2 2	2	Tapered Roller	302	3	0	2
					Bearings	322	3	2	2
	NU10	NU	1	0		332	3	3	2
	NU2	NU	(0)	2					
	NU22	NU	2	2		303	3	0	3
	NU3	NU	(0)	3		323	3	2	3
	NU23	NU	2	3	-				
	NU4	NU	(0)	4		230	2	3	0
	NJ2	NJ	(0)	2	Cubariani	231	2	3	1
	NJ22	NJ	2	2	Spherical Roller	222	2	2	2
	NJ3	NJ	(0)	3	Bearings	232	2	3	2
	NJ23	NJ	2	3	bearings	213 (1)	2	0	3
Single-Row	NJ4	NJ	(0)	4		223	2	2	3
Cylindrical	NUP2	NUP	(0)	2					
Roller	NUP22	NUP	2	2		511	5	1	1
Bearings	NUP3	NUP	(0)	3		512	5	1	2
	NUP23	NUP	2	3	Thrust Ball	513	5	1	3
	NUP4	NUP	(0)	4	Bearings with	514	5	1	4
	NIAO	N.	-		Flat Seats	522	5	2	2
	N10 N2	N N	(0)	0 2		523	5	2	3
	N2 N3	N N	(0)	3		523 524	5	2	4
	N4	N	(0)	4		524	J		-
		- ''	(3)		Sphorical	292	2	9	2
	NF2	NF	(0)	2	Spherical Thrust Roller	292	2	9	3
	NF3	NF	(0)	3	Bearings	294	2	9	4
	NF4	NF	(0)	4		274	-	_ ´	
Note (1) Res	oring Corioc C	umbal 212	chould lo	aicelly be 20	13 hut customarily it is r	numbered 212	,		

Note (1) Bearing Series Symbol 213 should logically be 203, but customarily it is numbered 213. Remarks Numbers in () in the column of width symbols are usually omitted from the bearing number.

A 54 A 55



Table 7. 6 Formulation of

		Bas	ic Numbers	S									
Bear	ing Series	Dore	o Numbor	Coi	ntact Angle	Intorn	ool Doolan Cumbol	Mai	torial Cumbal	Coa	o Cumbal	Exter	nal Features
Syr	mbols (1)	DOL	e Number		Symbol	men	nal Design Symbol	IVIa	terial Symbol	Cay	e Symbol		ls, Shields Symbol
Symbol	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
68 69 60 :	Single- Row Deep Groove Ball Bearings	1 2 3	Bearing 1mm 2 3	C	ngular ontact Ball earings Standard Contact Angle	A	Internal Design Differs from Standard One Smaller Diameter	g	Case-Hardened Steel Used in Rings, Rolling Elements	M	Machined Brass Cage	Z ZS	Shield on One Side Only
70 72 73 :	Single-Row Angular Contact Ball Bearings Self-	9 00 01	9 10 12	A 5	of 30° Standard Contact Angle of 25°		of Outer Ring Raceway, Contact Angle, and Outer Ring Width of Tapered Roller Bearings Conform to ISO 355	h	Stainless Steel Used in Rings, Rolling Elements	W	Pressed Steel Cage	ZZ ZZS	Shields on Both Sides
13 22 :	Aligning Ball Bearings Cylindrical	02	15 17	В	Standard Contact Angle of 40°					Т	Synthetic Resin Cage	DU	Contact Rubber Seal on One Side Only
NJ 2 N 3 NN 30	Roller Bearings	/22 /28 /32	22 28 32	С	Standard Contact Angle of 15°	(F E	or High Capacity) Bearings			٧	Without	DDU	Contact Rubber Seals on Both Sides
NA48 NA49 NA69 : 320 322	Needle Roller Bearings Tapered Roller	04(3) 05 06	20 25 30		Tapered Roller Bearings Contact Angle Less than 17°	CA CD EA	Spherical Roller Bearings				Cage	V	Non- Contact Rubber Seal on One Side Only
323 : 230 222	Bearings (2) Spherical Roller Bearings	88 92 96	440 460 480	С	Contact Angle about 20°	E	Cylindrical Roller Bearings					vv	Non- Contact Rubber Seals on Both Sides
223 : 511 512 513	Thrust Ball Bearing with Flat Seats	/500 /530 /560	500 530 560 :	D	Contact Angle about 28°	E	Spherical Thrust Roller Bearings						
: 292 293 294 :	Thrust Spherical Roller Bearings	/2 360 /2 500	: 2 360 2 500										
HR(4)	High Capacity Tapered Rolle Bearings, and	r											
	Symbols	and Nu	mbers Confe	orm to	JIS(5)			NSK	Symbol			NS	K Symbol
					Marked on Bea	ırinas					t Marked		
						55				on	Bearings		

- Notes
 (1) Bearing Series Symbols conform to Table 7.5.
 (2) For basic numbers of tapered roller bearings in ISO's new series, refer to Page B111.
 (3) For Bearing Bore Numbers 04 through 96, five times the bore number gives the bore size (mm) (except double-direction thrust ball bearings).
 (4) HR is prefix to bearing series symbols and it is NSK's original prefix.

Bearing Numbers

Αι	uxiliary Syn	nbols													
	ol for Design		ngement /mbol	Inter		Clearance Symbol load Symbol		ance Class Symbol	5	Spe	Special ecification Symbol		er or Sleeve Symbol	Grea	se Symbol
	f Rings Meaning	Symbol	Meaning	Symbol	Mea	aning (radial clearance)	Symbol	Meaning	Svm	hol	Meaning	Symbol	Meaning	Symbol	Meaning
K	Ü	DB	Back-to-Back	,	IVICE	Clearance Less	,	ISO Normal	,		arings \	+ K	Bearings	AS2	SHELL
	Tapered Bore of Inner Ring (Taper 1:12)	DB	Arrangement		Brgs.	than C2 Clearance Less than CN	Onniceu	130 Normal		trea Din	ated for nensional	+11	with Outer Ring Spacers	H32	ALVANIA GREASE S2
	(1	DF	Face-to-	Omitted		CN Clearance	P6	ISO Class 6	١ ،	Sta	bilization /	+L	Bearings	ENS	ENS GREASE
K30	Tapered Bore of	J.	Face Arrangement	C3 C4	For All Ra	Clearance Greater than CN Clearance Greater than C3	P6X	ISO Class 6X	X2		Working Temperature Lower than 150 °C		with Inner Ring Spacers	NS7	NS HI-LUBE
	Inner Ring (Taper 1:30)	DT	Arrangement than C4 CC1 Clearance Less		Clearance Greater than C4	. P5	ISO Class 5	X2	28	Working Temperature	+KL	Bearings with Both Inner and	PS2	MULTEMP PS No. 2	
E	Notch or Lubricating Croove in than CC2				than CC2 Clearance Less	P4	ISO Class 4			Lower than 200 °C		Outer Ring Spacers		110. 2	
	Groove in Ring			CC3	Interchan	Normal Clearance Clearance Greater	P2	ISO Class 2	X2	29	Working Temperature Lower than 250 °C	Н	Adapter Designation		
E4	Lubricating			CC4	Clearance Greater than CC3 Clearance Greater than CC3 Clearance Greater than CC3			MA(⁷)				АН	Withdrawal Sleeve Designation		
	Groove in Outside Surface and Holes in			CC5		than CC4 Clearance Less than		pered ler bearing		F	Spherical Roller Bearings	HJ	Thrust Collar Designation		
	Outer Ring			MC2	mall all Brgs.	MC2 Clearance Less than MC3	Omitted	Class 4	S1		Dimensional Stabilizing				
N	Snap Ring Groove in Outer Ring			MC3 MC4	Extra-Sm niature Bal	Normal Clearance Clearance Greater than MC3	PN2	Class 2			Treatment Working Temperature Lower than				
NR	Snap Ring Groove with			MC5	For and Mir	Clearance Greater than MC4 Clearance Greater	PN3	Class 3			200°C				
	Snap Ring in Outer Ring			MC6		than MC5	PN0	Class 0							
	ŭ			CM	Ball Mot	rance in Deep Groove Bearings for Electric ors									
				CT CM		rance in Cylindrical er Bearings for Electric ors	PN00	Class 00							
				(Preloa Ball Be	d of Angular Contact)									
				EL L		ra light Preload nt Preload									
			M	Med	dium Preload										
S	rtially the same as JIS(5)		ame as IIS(5)	NSK S		Partially the same as JIS(5)/BAS(6)	San	ne as JIS(5)			NSK Sym	nbol, Pa	rtially the same	as JIS(i)
				In I	Princi	ple, Marked on Bearing	ıs						Not Marked	on Bear	ings
	-4 (5)	***			2.10	Standards									

- Notes (5) JIS: Japanese Industrial Standards.
 (6) BAS: The Japan Bearing Industrial Association Standard.
 (7) ABMA: The American Bearing Manufacturers Association.



8. BEARING TOLERANCES

8.1 Bearing Tolerance Standards

The tolerances for the boundary dimensions and running accuracy of rolling bearings are specified by ISO 492/199/582 (Accuracies of Rolling Bearings). Tolerances are specified for the following items:

Regarding bearing accuracy classes, besides ISO normal accuracy, as the accuracy improves there are Class 6X (for tapered roller bearings), Class 6, Class 5, Class 4, and Class 2, with Class 2 being the highest in ISO. The applicable accuracy classes for each bearing type and the correspondence of these classes are shown in Table 8.1.

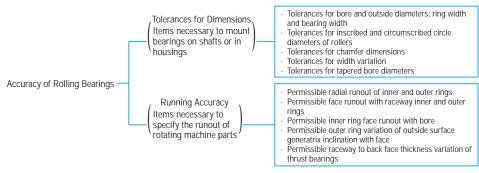


Table 8. 1 Bearing Types and Tolerance Classes

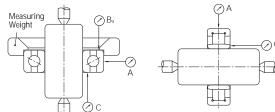
								I	
	Bearing	Types		Applica	able Tolerance (Classes		Applicable Tables	Reference Pages
	Deep Groove B	all Bearings	Normal	Class 6	Class 5	Class 4	Class 2		
	Angular Contac	t Ball Bearings	Normal	Class 6	Class 5	Class 4	Class 2		
	Self-Aligning Ba	all Bearings	Normal	Class 6 equivalent	Class 5 equivalent	_	_	Table	A60
	Cylindrical Roll	er Bearings	Normal	Class 6	Class 5	Class 4	Class 2	8.2	to A63
	Needle Roller B (solid type)	earings	Normal	Class 6	Class 5	Class 4	_		
	Spherical Rolle	r Bearings	Normal	Class 6	Class 5	_	_		
	Tapered	Metric Design	Normal Class 6X	_	Class 5	Class 4	_	Table 8.3	A64 to A67
	Roller Bearings Inch Design		ANSI/ABMA CLASS 4	ANSI/ABMA CLASS 2	ANSI/ABMA CLASS 3	ANSI/ABMA CLASS 0	ANSI/ABMA CLASS 00	Table 8.4	A68 and A69
	Magneto Bearir	ngs	Normal	Class 6	Class 5	_	_	Table 8.5	A70 and A71
	Thrust Ball Bea	rings	Normal	Class 6	Class 5	Class 4	_	Table 8.4	A72 to A74
	Thrust Spherica	al Roller Bearings	Normal	_	_	_	_	Table 8.7	A75
S	JIS	(1)	Class 0	Class 6	Class 5	Class 4	Class 2	_	_
indard ce)	DIN	J(2)	P0	P6	P5	P4	P2	_	_
Equivalent standards (Reference)		Ball Bearings	ABEC 1	ABEC 3	ABEC 5 (CLASS 5P)	ABEC 7 (CLASS 7P)	ABEC 9 (CLASS 9P)	Table 8.2	A60 to A63
quival (Re	ANSI/ ABMA(3)	Roller Bearings	RBEC 1	RBEC 3	RBEC 5	_	_	Table 8.8	(A76 and A77)
ш		Tapered Roller Bearings	CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00	Table 8.4	(A68 and A69)

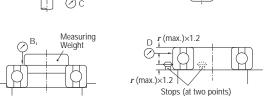
Notes (1) JIS: Japanese Industrial Standards (2) DIN: Deutsch Industrie Norm

(3) ANSI/ABMA: The American Bearing Manufacturers Association

Remarks The permissible limit of chamfer dimensions shall conform to Table 8.9 (Page A78), and the tolerances and permissible tapered bore diameters shall conform to Table 8.10 (Page A80).

(Reference) Rough definitions of the items listed for Running Accuracy and their measuring methods are shown in Fig. 8.1, and they are described in detail in ISO 5593 (Rolling Bearings-Vocabulary) and JIS B 1515 (Rolling Bearings-Tolerances) and elsewhere.





Supplementary Table

Running Accuracy	Inner Ring	Outer Ring	Dial Gauge
K _{ia}	Rotating	Stationary	Α
K_{ea}	Stationary	Rotating	А
S_{ia}	Rotating	Stationary	B ₁
S_{ea}	Stationary	Rotating	B ₂
S_d	Rotating	Stationary	С
S_D	_	Rotating	D
S_i , $S_{ m e}$	Only the shaft or central was rotated.	or housing her is to be	E

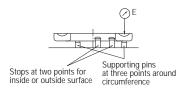


Fig. 8.1 Measuring Methods for Running Accuracy (summarized)

Symbols for Boundary Dimensions and Running Accuracy

Brg bore dia., nominal

Deviation of a single bore dia. Δ_{ds}

Single plane mean bore dia. deviation

Bore dia. Variation in a single radial plane

 $V_{d\mathrm{mp}}$ Mean bore dia. Variation

В Inner ring width, nominal

Deviation of a single inner ring width Δ_{Bs}

Inner ring width variation V_{Bs}

Radial runout of assembles brg inner ring K_{ia}

inner ring reference face (backface, where applicable) runout with bore

Assembled brg inner ring face (back face) runout with raceway

 S_h S_e Raceway to backface thickness variation of thrust brg

Brg width, nominal T

Deviation of the actual brg width

Brg outside dia., nominal

 Δ_{Ds} Deviation of a single outside dia.

Single plane mean outside dia. Deviation V_{Dp}

Outside dia. Variation in a single radial

Mean outside dia. Variation

COuter ring width, nominal

Deviation of a single outer ring width $\Delta c_{\rm s}$

Outer ring width variation

 K_{ea} Radial runout of assembled brg outer ring Variation of brg outside surface generatrix

inclination with outer ring reference face (backface)

Assembled brg outer ring face (backface) runout with raceway







Table 8. 2 Tolerances for Radial Bearings Table 8. 2. 1 Tolerances for Inner Rings and

Nominal	Bore Diameter					Δ,	_{dmp} (2)						Δ	ds (2)	
	d (mm)			-							n o		ass 4		
'	(11111)	N	ormal	CI	ass 6	C	lass 5	Ci	lass 4	(Class 2	S	eries 2, 3, 4	- 0	lass 2
OL/OF.	inal	hiah	low	hiah	low	hiah	lour	hiah	low	hiah	lour	_	low	hiah	low
over	incl.	high	low	high	low	high	low	high	low	high	low	high	IOW	high	IOW
0.6(1) 2.5 10	2.5 10 18	0 0 0	- 8 - 8 - 8	0 0	- 7 - 7 - 7	0 0	- 5 - 5 - 5	0 0	- 4 - 4 - 4	0 0	-2.5 -2.5 -2.5	0 0 0	- 4 - 4 - 4	0 0	-2.5 -2.5 -2.5
18 30 50	30 50 80	0 0 0	- 10 - 12 - 15	0 0 0	- 8 -10 -12	0 0 0	- 6 - 8 - 9	0 0 0	- 5 - 6 - 7	0 0 0	-2.5 -2.5 -4	0 0 0	- 5 - 6 - 7	0 0 0	-2.5 -2.5 -4
80 120 150 180	120 150 180 250	0 0 0 0	- 20 - 25 - 25 - 30	0 0 0 0	-15 -18 -18 -22	0 0 0 0	-10 -13 -13 -15	0 0 0 0	- 8 -10 -10 -12	0 0 0	-5 -7 -7 -8	0 0 0	- 8 -10 -10 -12	0 0 0	-5 -7 -7 -8
250 315 400	315 400 500	0 0 0	- 35 - 40 - 45	0 0 0	-25 -30 -35	0 0 -	-18 -23 -	- - -	_ _ _	- - -	- - -	- - -	- - -	- - -	- - -
500 630 800	630 800 1 000	0 0 0	- 50 - 75 -100	0 - -	-40 -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1 000 1 250 1 600	1 250 1 600 2 000	0 0 0	-125 -160 -200	- - -	- - -	 - - -	 - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -

				Δ_{E}	$_{ m g}_{ m s}$ (or $arDelta$	Cs)(3)							V_{\cdot}	$_{Bs}$ (or V	_{Cs})	
		Single	Bearing				Со	mbined	d Bearing:	s (4)		Inner Ri Outer Ri	ing (or ing) (³)		Inner Rin	ıg
	formal Class 6		ass 5 ass 4	Cl	ass 2		ormal ass 6		lass 5 lass 4	C	ass 2	Normal	Class 6	Class 5	Class 4	Clas 2
high	low	high	low	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max
0 0 0	- 40 - 120 - 120	0 0 0	- 40 - 40 - 80	0 0 0	- 40 - 40 - 80	_ 0 0	-250 -250	0 0 0	-250 -250 -250	0 0 0	-250 -250 -250	12 15 20	12 15 20	5 5 5	2.5 2.5 2.5	1.5 1.5 1.5
0 0 0	- 120 - 120 - 150	0 0 0	-120 -120 -150	0 0 0	-120 -120 -150	0 0 0	-250 -250 -380	0 0 0	-250 -250 -250	0 0 0	-250 -250 -250	20 20 25	20 20 25	5 5 6	2.5 3 4	1.5 1.5 1.5
0 0 0 0	- 200 - 250 - 250 - 300	0 0 0 0	-200 -250 -250 -300	0 0 0	-200 -250 -250 -300	0 0 0	-380 -500 -500 -500	0 0 0 0	-380 -380 -380 -500	0 0 0 0	-380 -380 -380 -500	25 30 30 30	25 30 30 30	7 8 8 10	4 5 5 6	2.! 2.! 4 5
0 0 0	- 350 - 400 - 450	0 0 -	-350 -400 -	- - -	- - -	0 0 -	-500 -630 -	0 0 -	-500 -630 -	- - -	- - -	35 40 50	35 40 45	13 15 -	- - -	- - -
0 0 0	- 500 - 750 -1 000	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	60 70 80	50 - -	- - -	- - -	- -
0 0 0	-1 250 -1 600 -2 000	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	100 120 140	- - -	_ _ _	- - -	- -

Notes (1) 0.6mm is included in the group.

Applicable to bearings with cylindrical bores.
 Tolerance for width deviation and tolerance limits for the width variation of the outer ring should be the same bearing.
 Tolerances for the width variation of the outer ring of Class 5, 4, and 2 are shown in Table 8.2.2.
 Applicable to individual rings manufactured for combined bearings.
 Applicable to ball bearings such as deep groove ball bearings, angular contact ball bearings, etc.

(excluding Tapered Roller Bearings) Widths of Outer Rings

					V_{dp} (2)								V_{dn}	np (2)	
	Norma	l		Class 6	3	Cla	ıss 5	Cla	iss 4	Class 2					
Dia	meter Se	eries	Dia	meter S	eries		meter ries		neter ries	Diameter Series	Normal	Class 6	Class 5	Class 4	Class 2
9	0, 1	2, 3, 4	9	0, 1	2, 3, 4	9	0,1,2,3,4	9	0,1,2,3,4	0,1,2,3,4					
	max.			max.		m	ax.	m	ax.	max.	max.	max.	max.	max.	max.
10 10 10	8 8 8	6 6 6	9 9 9	7 7 7	5 5 5	5 5 5	4 4 4	4 4 4	3 3 3	2.5 2.5 2.5	6 6 6	5 5 5	3 3 3	2 2 2	1.5 1.5 1.5
13 15 19	10 12 19	8 9 11	10 13 15	8 10 15	6 8 9	6 8 9	5 6 7	5 6 7	4 5 5	2.5 2.5 4	8 9 11	6 8 9	3 4 5	2.5 3 3.5	1.5 1.5 2
25 31 31 38	25 31 31 38	15 19 19 23	19 23 23 28	19 23 23 28	11 14 14 17	10 13 13 15	8 10 10 12	8 10 10 12	6 8 8 9	5 7 7 8	15 19 19 23	11 14 14 17	5 7 7 8	4 5 5 6	2.5 3.5 3.5 4
44 50 56	44 50 56	26 30 34	31 38 44	31 38 44	19 23 26	18 23 -	14 18 -	 	-	- - -	26 30 34	19 23 26	9 12 -	- - -	- - -
63	63	38	50	50	30	-	-	-	-	_	38	30	-	-	-
_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
-	-	-	-	_	-	_	_	_	-	_	-	-	-	_	_
-	_	-	_	-	-	-	-	-	-	-	-	-	-	-	-

Units : μm

		K ia				S_d			S _{fa} (5)		Nominal Bore	Diameter
Normal	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	d (mm)	
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	over	incl.
10	5	4	2.5	1.5	7	3	1.5	7	3	1.5	0.6(1)	2.5
10	6	4	2.5	1.5	7	3	1.5	7	3	1.5	2.5	10
10	7	4	2.5	1.5	7	3	1.5	7	3	1.5	10	18
13	8	4	3	2.5	8	4	1.5	8	4	2.5	18	30
15	10	5	4	2.5	8	4	1.5	8	4	2.5	30	50
20	10	5	4	2.5	8	5	1.5	8	5	2.5	50	80
25 30 30 40	13 18 18 20	6 8 8 10	5 6 6 8	2.5 2.5 5	9 10 10 11	5 6 6 7	2.5 2.5 4 5	9 10 10 13	5 7 7 8	2.5 2.5 5	80 120 150 180	120 150 180 250
50	25	13	-	-	13	-	-	15	-	-	250	315
60	30	15	-	-	15	-	-	20	-	-	315	400
65	35	–	-	-	-	-	-	–	-	-	400	500
70	40	-	-	-	-	-	-	_	-	-	500	630
80	-	-	-	-	-	-	-	_	-	-	630	800
90	-	-	-	-	-	-	-	_	-	-	800	1 000
100	-	_	_	-	_	-	-	-	-	-	1 000	1 250
120	-	_	_	-	_	-	-	-	-	-	1 250	1 600
140	-	_	_	-	_	-	-	-	-	-	1 600	2 000

Remarks
1. The cylindrical bore diameter "no-go side" tolerance limit (high) specified in this table does not necessarily apply within a distance of 1.2 times the chamfer dimension *r* (max.) from the ring face.
2. ABMA Std 20-1996: ABEC1-RBEC1, ABEC3-RBEC3, ABEC5-RBEC5, ABEC7-RBEC7, and ABEC9-RBEC9

are equivalent to Classes Normal, 6, 5, 4, and 2 respectively.



Table 8. 2 Tolerances for Radial Bearings

Table 8. 2. 2 Tolerances

N	lominal Ou	ıtside					Δ	<i>D</i> mp						۷	D_{S}	
	Diamete D (mm)	er	N	ormal	Cl	ass 6	Cl	ass 5	Cl	ass 4	C	lass 2	Dia S	ass 4 imeter eries 2, 3, 4	Cl	lass 2
	over	incl.	high	0 - 8 0 - 8		low	high	low	high	low	high	low	high	low	high	low
	2.5(¹) 6 18	6 18 30			0 0 0	- 7 - 7 - 8	0 0 0	- 5 - 5 - 6	0 0 0	- 4 - 4 - 5	0 0 0	- 2.5 - 2.5 - 4	0 0 0	- 4 - 4 - 5	0 0 0	- 2.5 - 2.5 - 4
	30 50 80	50 80 120	0 0 0	- 11 - 13 - 15	0 0 0	- 9 -11 -13	0 0 0	- 7 - 9 -10	0 0 0	- 6 - 7 - 8	0 0 0	- 4 - 4 - 5	0 0 0	- 6 - 7 - 8	0 0 0	- 4 - 4 - 5
1	20 50 80	150 180 250	0 0 0	- 18 - 25 - 30	0 0 0	-15 -18 -20	0 0 0	-11 -13 -15	0 0 0	- 9 -10 -11	0 0 0	- 5 - 7 - 8	0 0 0	- 9 -10 -11	0 0 0	- 5 - 7 - 8
3	250 815 100	315 400 500	0 0 0	- 35 - 40 - 45	0 0 0	-25 -28 -33	0 0 0	-18 -20 -23	0 0 -	-13 -15 -	0 0 -	- 8 -10 -	0 0 -	-13 -15 -	0 0 -	- 8 -10 -
6	500 530 800	630 800 1 000	0 0 0	- 50 - 75 -100	0 0 0	-38 -45 -60	0 0 -	-28 -35 -	- - -	- - -	- - -	- - -	_ _ _	- - -	- - -	- - -
1 2 1 6 2 0	000	1 250 1 600 2 000 2 500	0 0 0 0	-125 -160 -200 -250	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - -	- - - -	- - -	- - - -	- - -	- - - -

Notes

(1) 2.5mm is included in the group.

(2) Applicable only when a locating snap ring is not used.

(3) Applicable to ball bearings such as deep groove ball bearings and angular contact ball bearings.

(4) The tolerances for outer ring width variation of bearings of Classes Normal and 6 are shown in Table 8.2.1.

Remarks

1. The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension \(r\) (max.) from the ring face.

2. ABMA Std 20-1996: ABEC1-RBEC1, ABEC3-RBEC3, ABEC5-RBEC5, ABEC7-RBEC7, and ABEC9-RBEC9 are equivalent to Classes Normal, 6, 5, 4, and 2 respectively.

(excluding Tapered Roller Bearings) for Outer Rings

		Dmp (2)	V								²)	V_{Dp} (
					Class 2	ss 4	Cla	ss 5	Cla		ss 6	Cla			nal	Nori					
Class	Class	Class	Class	Normal	Open Type	Туре	Open	Туре	Open	Shielded Sealed	е	Open Type Shielded Sealed Open Type Diameter Series Diameter Series									
2	4	5	6	INOFIIIAI	Diameter Series		Dian Ser	neter ies	Dian Ser	S	r Serie	Diameter Series Diameter Seri									
					0,1,2,3,4	0,1,2,3,4	9	0,1,2,3,4	9	0,1,2,3,4	2, 3, 4										
max.	max.	max.	max.	max.	max.	ax.	ma	ax.	ma		max. max.										
1.5 1.5 2	2 2 2.5	3 3 3	5 5 6	6 6 7	2.5 2.5 4	3 3 4	4 4 5	4 4 5	5 5 6	9 9 10	8 6 10 9 7 5 9 8 6 10 9 7 5 9						10 10 12				
2 2 2.5	3 3.5 4	4 5 5	7 8 10	8 10 11	4 4 5	5 5 6	6 7 8	5 7 8	7 9 10	13 16 20	11 8 16 11 9 7 13 10 20 14 11 8					11 13 19	14 16 19				
2.5 3.5 4	5 5 6	6 7 8	11 14 15	14 19 23	5 7 8	7 8 8	9 10 11	8 10 11	11 13 15	25 30 -							23 31 38				
4 5 –	7 8 -	9 10 12	19 21 25	26 30 34	8 10 –	10 11 -	13 15 -	14 15 17	18 20 23	- - -	19 21 25	31 35 41	31 35 41	- - -	26 30 34	44 50 56	44 50 56				
- - -	- - -	14 18 -	29 34 45	38 55 75	- - -	- - -	- - -	21 26 -	28 35 -	- - -	29 34 45	48 56 75	48 56 75	- - -	38 55 75	63 94 125	63 94 125				
_ _	_	-	- -	- -	- -	-	-	- -	_	-							_				
_ _	_	_	_	<u>-</u>	-	-	_	-	_	_											

Units :	μm
---------	----

			K_{ea}				S_D			S _{ea} (3)			V _{Cs} (4)		. Nominal (Outside
Nor	rmal	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Diame D (mn	eter
ma	ах.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	over	incl.
1	15	8	5	3	1.5	8	4	1.5	8	5	1.5	5	2.5	1.5	2.5 (¹)) 6
	15	8	5	3	1.5	8	4	1.5	8	5	1.5	5	2.5	1.5	6	18
	15	9	6	4	2.5	8	4	1.5	8	5	2.5	5	2.5	1.5	18	30
2	20	10	7	5	2.5	8	4	1.5	8	5	2.5	5	2.5	1.5	30	50
	25	13	8	5	4	8	4	1.5	10	5	4	6	3	1.5	50	80
	35	18	10	6	5	9	5	2.5	11	6	5	8	4	2.5	80	120
4	40	20	11	7	5	10	5	2.5	13	7	5	8	5	2.5	120	150
	45	23	13	8	5	10	5	2.5	14	8	5	8	5	2.5	150	180
	50	25	15	10	7	11	7	4	15	10	7	10	7	4	180	250
7	60	30	18	11	7	13	8	5	18	10	7	11	7	5	250	315
	70	35	20	13	8	13	10	7	20	13	8	13	8	7	315	400
	80	40	23	-	-	15	-	-	23	-	-	15	-	-	400	500
10	20	50	25	-	-	18	-	-	25	-	-	18	-	-	500	630
12		60	30	-	-	20	-	-	30	-	-	20	-	-	630	800
14		75	–	-	-	–	-	-	-	-	-	-	-	-	800	1 000
16 19 22 25	90 20	- - - -	- - -	- - -	- - -	- - - -	- - - -	- - -	- - - -	- - -	- - - -	- - - -	- - -	- - - -	1 000 1 250 1 600 2 000	1 250 1 600 2 000 2 500

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Table 8. 3 Tolerances for Metric Design Tapered Roller Bearings

Table 8. 3. 1 Tolerances for Inner Ring Bore Diameter and Running Accuracy

	Nomina Diam				Δ	<i>d</i> mp				1 _{ds}		V	<i>d</i> p			V _{dmp}		
	(m)			ormal ss 6X		ass 6 ass 5	Cl	ass 4	Cla	ass 4	Normal Class 6X	Class 6	Class 5	Class 4	Normal Class 6X	Class 6	Class 5	Class 4
Ī	over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	max.	max.
	10	18	0	- 8	0	- 7	0	- 5	0	- 5	8	7	5	4	6	5	5	4
	18	30	0	-10	0	- 8	0	- 6	0	- 6	10	8	6	5	8	6	5	4
	30	50	0	-12	0	-10	0	- 8	0	- 8	12	10	8	6	9	8	5	5
	50	80	0	-15	0	-12	0	- 9	0	- 9	15	12	9	7	11	9	6	5
	80	120	0	-20	0	-15	0	-10	0	-10	20	15	11	8	15	11	8	5
	120	180	0	-25	0	-18	0	-13	0	-13	25	18	14	10	19	14	9	7
	180	250	0	-30	0	-22	0	-15	0	-15	30	22	17	11	23	16	11	8
	250	315	0	-35	0	-25	0	-18	0	-18	35	-	-	-	26	-	-	-
	315	400	0	-40	0	-30	0	-23	0	-23	40	-	-	-	30	-	-	-
	400	500	0	-45	0	-35	0	-27	0	-27		-	-	-	-	-	-	-
	500	630	0	-50	0	-40	-	-	-	-	-	-	-	-	-	-	-	-
	630	800	0	-75	0	-60	-	-	-	-		-	-	-	-	-	-	-

Remarks	The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance
	of 1.2 times the chamfer dimension r (max.) from the ring face.

2. Some of these tolerances conform to the NSK Standard.

Table 8. 3. 2 Tolerances for Outer Ring Outside Diameter and Running Accuracy

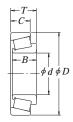
ľ		I Outside neter			Δ	<i>D</i> mp				1 _{Ds}		V	<i>D</i> p		$V_{D\! m mp}$			
		D nm)		ormal ass 6X		ass 6 ass 5	Cl	ass 4	Cl	ass 4	Normal Class 6X	Class 6	Class 5	Class 4	Normal Class 6X	Class 6	Class 5	Class 4
Ī	over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	max.	max.
	18 30 50	30 50 80	0 0 0	- 9 - 11 - 13	0 0 0	- 8 - 9 -11	0 0 0	- 6 - 7 - 9	0 0 0	- 6 - 7 - 9	9 11 13	8 9 11	6 7 8	5 5 7	7 8 10	6 7 8	5 5 6	4 5 5
	80 120 150	120 150 180	0 0 0	- 15 - 18 - 25	0 0 0	-13 -15 -18	0 0 0	-10 -11 -13	0 0 0	-10 -11 -13	15 18 25	13 15 18	10 11 14	8 8 10	11 14 19	10 11 14	7 8 9	5 6 7
	180 250 315	250 315 400	0 0 0	- 30 - 35 - 40	0 0 0	-20 -25 -28	0 0 0	-15 -18 -20	0 0 0	-15 -18 -20	30 35 40	20 25 28	15 19 22	11 14 15	23 26 30	15 19 21	10 13 14	8 9 10
	400 500 630	500 630 800	0 0 0	- 45 - 50 - 75	0 0 0	-33 -38 -45	0 0 -	-23 -28 -	0 0 -	-23 -28 -	45 50 -	- - -	-	- - -	34 38 -	- - -	- - -	- - -
	800	1 000	0	-100	0	-60	-	-	-	-	-	-	-	_	-	-	_	-

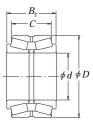
Remarks
1. The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.
2. Some of these tolerances conform to the NSK Standard.

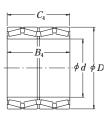
					Units : μ	ιm
	K	ia		s	d	S ia
Normal	Class	Class	Class	Class	Class	Class
Class 6X	6	5	4	5	4	4
max.	max.	max.	max.	max.	max.	max.
15	7	3.5	2.5	7	3	3
18	8	4	3	8	4	4
20	10	5	4	8	4	4
25	10	5	4	8	5	4
30	13	6	5	9	5	5
35	18	8	6	10	6	7
50	20	10	8	11	7	8
60	25	13	10	13	8	10
70	30	15	12	15	10	14
70	35	18	14	19	13	17
85	40	20	-	22	-	-
100	45	22	-	27	-	-

П	Inits	٠	11	m	

	K	ea		S	D	S_{ea}
Normal	Class	Class	Class	Class	Class	Class
Class 6X	6	5	4	5	4	4
max.	max.	max.	max.	max.	max.	max.
18	9	6	4	8	4	5
20	10	7	5	8	4	5
25	13	8	5	8	4	5
35	18	10	6	9	5	6
40	20	11	7	10	5	7
45	23	13	8	10	5	8
50	25	15	10	11	7	10
60	30	18	11	13	8	10
70	35	20	13	13	10	13
80	40	23	15	15	11	15
100	50	25	18	18	13	18
120	60	30	–	20	-	–
120	75	35	-	23	-	_







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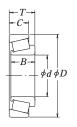


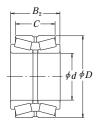
Table 8. 3 Tolerances for Metric Design Table 8. 3. 3 Tolerances for Width, Overall Bearing Width,

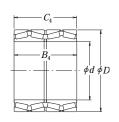
N	omina Diam	al Bore neter			Δ	1 _{Bs}					4	1 _{Cs}					Δ_T	's		
	(m)			ormal ass 6	Cla	ss 6X		ass 5 ass 4		ormal ass 6	Cla	ass 6X		lass 5 lass 4		rmal iss 6	Class	6X		iss 5 iss 4
	over	incl.	high	low	high	low	high	low	high	low	high	low	high	n low	high	low	high	low	high	low
	10 18 30	18 30 50	0 0 0	-120 -120 -120	0 0 0	-50 -50 -50	0 0 0	-200 -200 -240	0 0 0	-120 -120 -120	0 0 0	-100 -100 -100	0 0 0	-200 -200 -240	+200 +200 +200	0 0 0	+100 +100 +100	0 0 0	+200 +200 +200	-200 -200 -200
	50 80 120	80 120 180	0 0 0	-150 -200 -250	0 0 0	-50 -50 -50	0 0 0	-300 -400 -500	0 0 0	-150 -200 -250	0 0 0	-100 -100 -100	0 0 0	-300 -400 -500	+200 +200 +350	0 -200 -250	+100 +100 +150	0 0 0	+200 +200 +350	-200 -200 -250
	180 250 315	250 315 400	0 0 0	-300 -350 -400	0 0 0	-50 -50 -50	0 0 0	-600 -700 -800	0 0 0	-300 -350 -400	0 0 0	-100 -100 -100	0 0 0	-600 -700 -800	+350 +350 +400	-250 -250 -400	+150 +200 +200	0 0 0	+350 +350 +400	-250 -250 -400
	400 500 630	500 630 800	0 0 0	-450 -500 -750	- - -	- - -	0 0 0	-800 -800 -800	0 0 0	-450 -500 -750	- - -	- - -	0 0 0	-800 -800 -800	+400 +500 +600	-400 -500 -600	- - -	- - -	+400 +500 +600	-400 -500 -600

Remarks The effective width of an inner ring with rollers T_1 is defined as the overall bearing width of an inner ring with rollers combined with a master outer ring.

The effective width of an outer ring T_2 is defined as the overall bearing width of an outer ring combined with a master inner ring with rollers.







Tapered Roller Bearings and Combined Bearing Width

 $\text{Units}: \mu m$

	Ri		with Roller	S	Outer Ri	٠,	ve Width D	eviation		Combined Bea		Deviation , $\Delta_{C4\mathrm{s}}$		nal Bore meter
	Nor	mal	Class	s 6X	Nor	mal	Class	s 6X	All classes row be			of four-row ings		d nm)
	high	low	high	low	high	low	high	low	high	low	high	low	over	incl.
_	+100	0	+ 50	0	+100	0	+ 50	0	+ 200	- 200	-	-	10	18
	+100	0	+ 50	0	+100	0	+ 50	0	+ 200	- 200	-	-	18	30
	+100	0	+ 50	0	+100	0	+ 50	0	+ 200	- 200	-	-	30	50
	+100	0	+ 50	0	+100	0	+ 50	0	+ 300	- 300	+ 300	- 300	50	80
	+100	-100	+ 50	0	+100	-100	+ 50	0	+ 300	- 300	+ 400	- 400	80	120
	+150	-150	+ 50	0	+200	-100	+100	0	+ 400	- 400	+ 500	- 500	120	180
	+150	-150	+ 50	0	+200	-100	+100	0	+ 450	- 450	+ 600	- 600	180	250
	+150	-150	+100	0	+200	-100	+100	0	+ 550	- 550	+ 700	- 700	250	315
	+200	-200	+100	0	+200	-200	+100	0	+ 600	- 600	+ 800	- 800	315	400
	-	-	-	-	-	-	-	-	+ 700	- 700	+ 900	- 900	400	500
	-	-	-	-	-	-	-	-	+ 800	- 800	+1 000	-1 000	500	630
	-	-	-	-	-	-	-	-	+1 200	-1 200	+1 500	-1 500	630	800

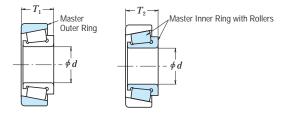




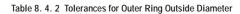
Table 8. 4 Tolerances for Inch Design Tapered Roller Bearings

(Refer to page A58 Table 8. 1 for the tolerance class "CLASS ** " that is the tolerance classes of ANSI/ABMA.)

Table 8. 4. 1 Tolerances for Inner Ring Bore Diameter

Units : $\mu \, m$

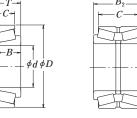
	Nominal Bo	1				Δ	ds		
over		incl.		CLAS	S 4, 2	CLAS	S 3, 0	CLAS	SS 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low
- 76.200 266.700	3.0000 10.5000	76.200 266.700 304.800	3.0000 10.5000 12.0000	+ 13 + 25 + 25	0 0 0	+13 +13 +13	0 0 0	+8 +8 -	0 0 -
304.800 609.600 914.400 1 219.200	12.0000 24.0000 36.0000 48.0000	609.600 914.400 1 219.200	24.0000 36.0000 48.0000	+ 51 + 76 +102 +127	0 0 0	+25 +38 +51 +76	0 0 0	- - - -	- - - -

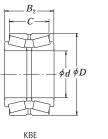


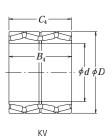
	Nominal Outs					Δ	Ds		
over		incl.		CLAS	S 4, 2	CLAS	S 3, 0	CLAS	SS 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low
266.700 304.800	10.5000 12.0000	266.700 304.800 609.600	10.5000 12.0000 24.0000	+ 25 + 25 + 51	0 0 0	+13 +13 +25	0 0 0	+8 +8 -	0 0 -
609.600 914.400 1 219.200	24.0000 36.0000 48.0000	914.400 1 219.200 -	36.0000 48.0000 –	+ 76 +102 +127	0 0 0	+38 +51 +76	0 0 0	- - -	- - -

Table 8. 4. 3 Tolerances for

	Nominal Bo	re Diameter 1						Δ	Ts				
OV	er	in	cl.	CL	ASS 4	CLA	SS 2	D≦508.0		SS 3	.000 (mm)	CLAS	S 0, 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low	high	low	high	low
101.600	4.0000	101.600 304.800	4.0000 12.0000	+203 +356	0 -254	+203 +203	0	+203 +203	-203 -203	+203 +203	-203 -203	+203 +203	-203 -203
304.800 609.600	12.0000 24.0000	609.600	24.0000	+381 +381	-381 -381	+381	-381 -	+203 +381	-203 -381	+381 +381	-381 -381	- -	-







and Radial Runout of Inner and Outer Rings

Units : μm

		K_{ia} , K_{ea}		
CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00
max.	max.	max.	max.	max.
51 51 51	38 38 38	8 8 18	4 4 -	2 2 -
76 76 76	51 - -	51 76 76	- - -	- - -

Overall Width and Combined Width

Units : μm

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			Dou		ırings (KBE T <i>B</i> 2s	ype)				(KV	v Bearings Type) Δ_{C4s}
CLA	SS 4	CLAS	55.9		CLA	SS 3		CLAS	S 0.00	CLAS	SS 4. 3
CLA	33 4	CLA	33 L	D≦508.0	000 (mm)	D>508.	000 (mm)	CLA	55 0,00	CLA	33 4, 3
high	low	high	low	high	low	high	low	high	low	high	low
+406 +711	0 -508	+406 +406	0 -203	+406 +406	-406 -406	+406 +406	-406 -406	+406 +406	-406 -406	+1 524 +1 524	-1 524 -1 524
+762 +762	-762 -762	+762	-762 -	+406 +762	-406 -762	+762 +762	-762 -762	_ _	<u>-</u>	+1 524 +1 524	-1 524 -1 524

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Table 8. 5 Tolerances
Table 8. 5. 1 Tolerances for Inner Rings

Nomina Diam	neter			Δ	<i>d</i> mp				$V_{d\mathrm{p}}$			$V_{d\mathrm{mp}}$			$\it \Delta$ $_{\it Bs}$ (or	Δ $_{C\mathrm{s}}$) (1)
(m		No	rmal	Cla	ass 6	Cla	ass 5	Normal	Class 6	Class 5	Normal	Class 6	Class 5		rmal ss 6	Cla	ass 5
over	incl.	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	high	low	high	low
2.5	10	0	- 8	0	-7	0	-5	6	5	4	6	5	3	0	-120	0	- 40
10	18	0	- 8	0	-7	0	-5	6	5	4	6	5	3	0	-120	0	- 80
18	30	0	-10	0	-8	0	-6	8	6	5	8	6	3	0	-120	0	-120

Note (1) The width deviation and width variation of an outer ring is determined according to the inner ring of the same

Remarks The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

Table 8. 5. 2 Tolerances

Nominal Diam	eter			Bearing S	ieries E		Δ	Omp	ı	Bearing Se	eries EN	I			$V_{D\mathrm{p}}$	
	D (mm)	Norr	nal	Clas	s 6	Clas	ss 5	Nor	mal	Clas	s 6	Clas	ss 5	Normal	Class 6	Class 5
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	max.	max.	max.
6	18	+ 8	0	+7	0	+5	0	0	- 8	0	-7	0	-5	6	5	4
18	30	+ 9	0	+8	0	+6	0	0	- 9	0	-8	0	-6	7	6	5
30	50	+11	0	+9	0	+7	0	0	-11	0	-9	0	-7	8	7	5

Remarks The outside diameter "no-go side" tolerances (low) do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

for Magneto Bearings and Width of Outer Rings

							Un	its:μ m
${V}_{B\! m s}$ (or	V _{Cs}) (1)	Δ	Ts		K ia		S_d	S _{ia}
Normal Class 6	Class 5	Normal Class 6 Class 5		Normal	Class 6	Class 5	Class 5	Class 5
max.	max.	high low		max.	max.	max.	max.	max.
15	5	+120	-120	10	6	4	7	7
20	5	+120	-120	10	7	4	7	7
20	5	+120	-120	13	8	4	8	8

for Outer Rings

	9-					Units : μ	ιm
	$V_{D{ m mp}}$			K _{ea}		S_{ea}	S_D
Normal	Class 6	Class 5	Normal	Class 6	Class 5	Class 5	Class 5
max.	max.	max.	max.	max.	max.	max.	max.
6	5	3	15	8	5	8	8
7	6	3	15	9	6	8	8
8	7	4	20	10	7	8	8



Table 8. 6 Tolerances for Thrust Ball Bearings

Table 8. 6. 1 Tolerances for Shaft Washer Bore Diameter and Running Accuracy

Units: μm

Nominal Bore Diameter $oldsymbol{d}$ or $oldsymbol{d}_2$	Diameter		Δ_{dmp} O	r ⊿ _{d2mp}		·	V_{d2p}		$S_{\it i}$ or	S _e (¹)	
(mm)		Nor Clas Clas		Cla	ss 4	Normal Class 6 Class 5	Class 4	Normal	Class 6	Class 5	Class 4
over ir	ncl.	high	low	high	low	max.	max.	max.	max.	max.	max.
-	18	0	- 8	0	- 7	6	5	10	5	3 3 3	2
18	30	0	- 10	0	- 8	8	6	10	5		2
30	50	0	- 12	0	-10	9	8	10	6		2
	80	0	- 15	0	-12	11	9	10	7	4	3
	120	0	- 20	0	-15	15	11	15	8	4	3
	180	0	- 25	0	-18	19	14	15	9	5	4
250	250	0	- 30	0	-22	23	17	20	10	5	4
	315	0	- 35	0	-25	26	19	25	13	7	5
	400	0	- 40	0	-30	30	23	30	15	7	5
500	500	0	- 45	0	-35	34	26	30	18	9	6
	630	0	- 50	0	-40	38	30	35	21	11	7
	800	0	- 75	0	-50	-	-	40	25	13	8
	000	0	-100	-	-	-	<u>-</u>	45	30	15	-
	250	0	-125	-	-	-	-	50	35	18	-

Note (1) For double-direction bearings, the thickness variation doesn't depend on the bore diameter d_2 , but on d for single-direction bearings with the same D in the same diameter series.

The thickness variation of housing washers, S_e , applies only to flat-seat thrust bearings.



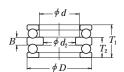
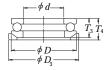


Table 8. 6. 2 Tolerances for Outside Diameter of Housing Washers and Aligning Seat Washers

 $\text{Units}: \mu \, m$

Nominal Outside Diame Bearing or Aligning Seat Washer			Flat Se		<i>D</i> mp	Alignii Wash	ng Seat er Type	V	<i>D</i> p	Outside Dev	eat Washer Diameter iation D3s
D or D_3 (mm)		Cla	rmal ss 6 ss 5	Cla	ss 4	No	rmal ss 6	Normal Class 6 Class 5	Class 4	No	rmal ss 6
over i	incl.	high	low	high	low	high	low	max.	max.	high	low
10	18	0	- 11	0	- 7	0	- 17	8	5	0	- 25
18	30	0	- 13	0	- 8	0	- 20	10	6	0	- 30
30	50	0	- 16	0	- 9	0	- 24	12	7	0	- 35
50	80	0	- 19	0	-11	0	- 29	14	8	0	- 45
80	120	0	- 22	0	-13	0	- 33	17	10	0	- 60
120	180	0	- 25	0	-15	0	- 38	19	11	0	- 75
250	250	0	- 30	0	-20	0	- 45	23	15	0	- 90
	315	0	- 35	0	-25	0	- 53	26	19	0	-105
	400	0	- 40	0	-28	0	- 60	30	21	0	-120
500	500	0	- 45	0	-33	0	- 68	34	25	0	-135
	630	0	- 50	0	-38	0	- 75	38	29	0	-180
	800	0	- 75	0	-45	0	-113	55	34	0	-225
1 000 1	000	0	-100	-	-	-	-	75	-	-	-
	250	0	-125	-	-	-	-	-	-	-	-
	600	0	-160	-	-	-	-	-	-	-	-



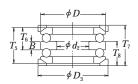




Table 8. 6. 3 Tolerances for Thrust Ball Bearing Height and Central Washer Height

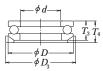
Units: um

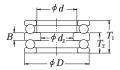
Nomina	al Bore		Flat Se	at Type		Aliç	gning Seat	Washer	Туре	Witl	n Aligning	Seat Wa	sher		Deviation
Diam		$\Delta T_{\rm S}$ C	or Δ $_{T2s}$	Δ	Tis	Δ_{T3s}	or Δ $_{T68}$	Δ	T5s	Δ_{T4s} C	or $ extstyle \Delta extstyle T_{88}$	Δ	T7s		al Washer 1 _{Bs}
(m)			, Class 6 , Class 4		,		rmal ass 6		rmal ss 6	Noi Clas	rmal ss 6	Nor Clas	rmal ss 6		l, Class 6 , Class 4
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low
- 30 50	30 50 80	0 0 0	- 75 -100 -125	+ 50 + 75 +100	-150 -200 -250	0 0 0	- 75 -100 -125	+ 50 + 75 +100	-150 -200 -250	+ 50 + 50 + 75	- 75 -100 -125	+150 +175 +250	-150 -200 -250	0 0 0	- 50 - 75 -100
80 120 180	120 180 250	0 0 0	-150 -175 -200	+125 +150 +175	-300 -350 -400	0 0 0	-150 -175 -200	+125 +150 +175	-300 -350 -400	+ 75 +100 +100	-150 -175 -200	+275 +350 +375	-300 -350 -400	0 0 0	-125 -150 -175
250 315	315 400	0 0	-225 -300	+200 +250	-450 -600	0 0	-225 -300	+200 +250	-450 -600	+125 +150	-225 -275	+450 +550	-450 -550	0 0	-200 -250

Note (1) For double-direction bearings, its classification depends on d for single-direction bearings with the same D in the same diameter series.

Remarks Δ_{T_s} in the table is the deviation in the respective heights T in figures below.







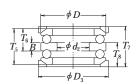


Table 8. 7 Tolerances for Thrust Spherical Roller Bearings

Table 8. 7. 1 Tolerances for Bore Diameters of Shaft Rings and Height (Class Normal)

Units: μm

Nomina						Reference	
Diam <i>C</i> (mi	ĺ	Δ,	<i>l</i> mp	V_{dp}	S_d	Δ	Ts
over	incl.	high	low	max.	max.	high	low
50 80 120	80 120 180	0 0 0	-15 -20 -25	11 15 19	25 25 30	+150 +200 +250	-150 -200 -250
180 250 315	250 315 400	0 0 0	-30 -35 -40	23 26 30	30 35 40	+300 +350 +400	-300 -350 -400
400	500	0	-45	34	45	+450	-450

Remarks The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

Table 8. 7. 2 Tolerances for Housing Ring Diameter (Class Normal)

Jnits : μm

		UI	ιιι3 . μ ΙΙΙ			
1	side Diameter D m)	$\it \Delta \it _{Dmp}$				
over	incl.	high	low			
120 180 250	180 250 315	0 0 0	- 25 - 30 - 35			
315 400 500	400 500 630	0 0 0	- 40 - 45 - 50			
630 800	800 1 000	0	- 75 -100			

Remarks

The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension \boldsymbol{r} (max.) from the ring face.

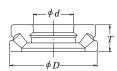




Table 8. 8 Tolerances of

CLASS 5P, CLASS 7P, and CLASS 9P

(1) Tolerances for Inner Rings

	Nominal Bore Diameter d (mm)		Δ_{dmp}				$\it \Delta _{\it ds}$			V_{dp}		$V_{d\mathrm{mp}}$		_	1 _{Bs}	
			CLASS 5P CLASS 7P		CLASS 9P		CLASS 5P CLASS 7P		CLASS 9P		CLASS 5P CLASS 7P	CLASS 9P	CLASS 5P CLASS 7P	CLASS 9P	CLA CLA	le Brgs SS 5P SS 7P SS 9P
i	over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	high	low
ı	-	10	0	-5.1	0	-2.5	0	-5.1	0	-2.5	2.5	1.3	2.5	1.3	0	-25.4
	10	18	0	-5.1	0	-2.5	0	-5.1	0	-2.5	2.5	1.3	2.5	1.3	0	-25.4
	18	30	0	-5.1	0	-2.5	0	-5.1	0	-2.5	2.5	1.3	2.5	1.3	0	-25.4

Note (i) Applicable to bearings for which the axial clearance (preload) is to be adjusted by combining two selected bearings.

Remarks For the CLASS 3P and the tolerances of Metric design Instrument Ball Bearings, it is advisable to consult NSK.

(2) Tolerances for

Nominal	$\it \Delta _{Dmp}$			Δ $_{Ds}$				V_{Dp}			$V_{D{ m mp}}$					
Outside Diameter D	CLASS 5P		G1 4 GG 4 B		CLASS 5P CLASS 7P			CLA	SS 9P	CLASS 5P CLASS 7P		CLASS 9P		SS 5P SS 7P	CLASS 9P	
(mm)		SS 7P	CLA	CLASS 9P		Open Shielded Sealed		Open		Open	Shielded Sealed	Open	Open	Shielded Sealed	Open	
over incl.	high	low	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.
- 18	0	-5.1	0	-2.5	0	-5.1	+1	-6.1	0	-2.5	2.5	5.1	1.3	2.5	5.1	1.3
18 30	0	-5.1	0	-3.8	0	-5.1	+1	-6.1	0	-3.8	2.5	5.1	2	2.5	5.1	2
30 50	0	-5.1	0	-3.8	0	-5.1	+1	-6.1	0	-3.8	2.5	5.1	2	2.5	5.1	2

Notes (i) Applicable to flange width variation for flanged bearings.
(2) Applicable to flange back face.

Instrument Ball Bearings (Inch design)

(ANSI/ABMA Equivalent)

and Width of Outer Rings

Hr	nite	11	-

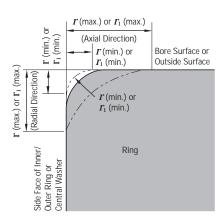
(or	(or Δ_{C_S}) V_{B_S}		K _{fa}			S ia			S_d				
Combi	ned Brgs (1)												
CLA	ASS 5P ASS 7P ASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P
high	low	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.
0	-400	5.1	2.5	1.3	3.8	2.5	1.3	7.6	2.5	1.3	7.6	2.5	1.3
0	-400	5.1	2.5	1.3	3.8	2.5	1.3	7.6	2.5	1.3	7.6	2.5	1.3
0	-400	5.1	2.5	1.3	3.8	3.8	2.5	7.6	3.8	1.3	7.6	3.8	1.3

Outer Rings

Units : $\mu\,m$

	V _{Cs} (1)			S_D			K _{ea}		S _{ea}			Deviation of Flange Outside		Deviation of Flange Width		Flange Backface Runout
CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	Dia	meter D 1s		e Width C is	with Raceway (²) S_{ea1}
5P	7P	9P	5P	7P	9P	5P	7P	9P	5P	7P	9P	CLASS 5P CLASS 7P				CLASS 5P CLASS 7P
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	high	low	high	low	max.
5.1	2.5	1.3	7.6	3.8	1.3	5.1	3.8	1.3	7.6	5.1	1.3	0	-25.4	0	-50.8	7.6
5.1	2.5	1.3	7.6	3.8	1.3	5.1	3.8	2.5	7.6	5.1	2.5	0	-25.4	0	-50.8	7.6
5.1	2.5	1.3	7.6	3.8	1.3	5.1	5.1	2.5	7.6	5.1	2.5	0	-25.4	0	-50.8	7.6





- r: Chamfer Dimension of Inner/Outer Ring
- r_1 : Chamfer Dimension of Inner/Outer Ring (Front Side) or of Central Washer of Thrust Ball Bearings

Remarks The precise shape of chamfer surfaces has not been specified but its profile in the axial plane shall not intersect an arc of radius r (min.) or r_1 (min.) touching the side face of an inner ring or central washer and bore surface, or the side face of an outer ring and outside surface.

Table 8. 9 Chamfer Dimension Limits (for Metric Design Bearings)

Table 8. 9. 1 Chamfer Dimension Limits for Radial Bearings (excluding Tapered Roller Bearings) Units : mm

Permissible			Permissibl	o Chamfor	Reference		
Chamfer Dimension for Inner/ Outer Rings r (min.) or	Nomina Dian		Dimens Inner/Ou r (max.) o	sion for ter Rings r $m{r}_1$ (max.)	Corner Radius of Shaft or Housing r a		
$m{r}_1$ (min.)	over	incl.	Radial Direction	Axial Direction	max.		
0.05	-	-	0.1	0.2	0.05		
0.08 0.1	-	-	0.16 0.2	0.3 0.4	0.08 0.1		
		_					
0.15 0.2	-	-	0.3 0.5	0.6 0.8	0.15 0.2		
0.3	- 40	40 -	0.6 0.8	1 1	0.3		
0.6	- 40	40 -	1 1.3	2 2	0.6		
1	- 50	50 -	1.5 1.9	3 3	1		
1.1	- 120	120 -	2 2.5	3.5 4	1		
1.5	- 120	120 -	2.3 3	4 5	1.5		
2	- 80 220	80 220 –	3 3.5 3.8	4.5 5 6	2		
2.1	- 280	280 –	4 4.5	6.5 7	2		
2.5	- 100 280	100 280 –	3.8 4.5 5	6 6 7	2		
3	- 280	280 -	5 5.5	8 8	2.5		
4 5	- -	- -	6.5 8	9 10	3 4		
6 7.5 9.5	- - -	- - -	10 12.5 15	13 17 19	5 6 8		
12 15 19	- - -	- - -	18 21 25	24 30 38	10 12 15		

Remarks For bearings with nominal widths less than 2mm, the value of r (max.) in the axial direction is the same as that in the radial direction.

Table 8. 9. 2 Chamfer Dimension Limits for **Tapered Roller Bearings**

Units : mm

Permissible	Nomina	Bore or	Dormiccih	le Chamfer	Reference
Chamfer Dimension for Inner/ Outer Rings	nsion Nominal Outsiner/ Diameter (d or D		Dimensior Outer	n for Inner/ Rings nax.)	Corner Radius of Shaft or Housing r_a
$m{r}$ (min.)	over	incl.	Radial Direction	Axial Direction	max.
0.15	-	-	0.3	0.6	0.15
0.3	- 40	40 -	0.7 0.9	1.4 1.6	0.3
0.6	- 40	40 -	1.1 1.3	1.7 2	0.6
1	- 50	50 -	1.6 1.9	2.5 3	1
1.5	- 120 250	120 250 –	2.3 2.8 3.5	3 3.5 4	1.5
2	- 120 250	120 250 –	2.8 3.5 4	4 4.5 5	2
2.5	- 120 250	120 250 –	3.5 4 4.5	5 5.5 6	2
3	- 120 250 400	120 250 400 –	4 4.5 5 5.5	5.5 6.5 7 7.5	2.5
4	- 120 250 400	120 250 400 –	5 5.5 6 6.5	7 7.5 8 8.5	3
5	- 180	180 –	6.5 7.5	8 9	4
6	- 180	180	7.5 9	10 11	5
Note	(1) Inne	r Rings a	re classified	i by <i>d</i> and (Juter Rings

Note (1) Inner Rings are classified by d and Outer Rings by D.

Table 8. 9. 3 Chamfer Dimension Limits for Thrust Bearings

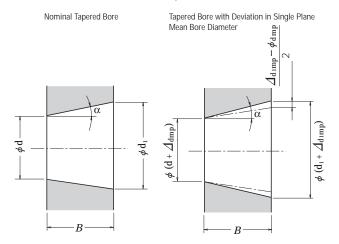
Units: mm

Permissible Chamfer	Permissible Chamfer	Reference		
Dimension for Shaft (or Central)/Housing Washers *\mathcal{\varPsi}(\text{min.})\text{ or } \mathcal{\varPsi}_1\text{ (min.})\text{ or } \mathcal{\varPsi}_	Dimension for Shaft (or Central)/Housing Washers r (max.) or r 1 (max.)	Corner Radius of Shaft or Housing $oldsymbol{r_a}$		
2 () 5: 21 ()	Radial or Axial Direction	max.		
0.05	0.1	0.05		
0.08	0.16	0.08		
0.1	0.2	0.1		
0.15	0.3	0.15		
0.2	0.5	0.2		
0.3	0.8	0.3		
0.6	1.5	0.6		
1	2.2	1		
1.1	2.7	1		
1.5	3.5	1.5		
2	4	2		
2.1	4.5	2		
3	5.5	2.5		
4	6.5	3		
5	8	4		
6	10	5		
7.5	12.5	6		
9.5	15	8		
12	18	10		
15	21	12		
19	25	15		

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Table 8.10 Tolerances for Tapered Bores (Class Normal)



d: Nominal Bore Diameter

 d_1 : Theoretical Diameter of Larger End of Tapered Bore

Taper 1:12 $d_1 = d + 1/12B$ Taper 1:30 $d_1 = d + /30B$

 $\Delta_{
m dmp}$: Single Plane Mean Bore Diameter Deviation in Theoretical Diameter of Smaller End of Bore $\Delta_{
m dmp}$: Single Plane Mean Bore Diameter Deviation in Theoretical Diameter of Larger End of Bore

 V_{dp} : Bore diameter variation in a single radial plane

 \vec{B} : Nominal Inner Ring width

 α : Half of Taper Angle of Tapered Bore

Taper 1:12

Units : $\mu\,m$

Nominal Bore Diameter $oldsymbol{d}$ (mm)		Δ	l mp	⊿ _{d1mp} -	V _{dp} (1) (2)	
over	incl.	high	low	high	low	max.
18	30	+33	0	+21	0	13
30	50	+39	0	+25	0	16
50	80	+46	0	+30	0	19
80	120	+54	0	+35	0	22
120	180	+63	0	+40	0	40
180	250	+72	0	+46	0	46
250	315	+81	0	+52	0	52
315	400	+89	0	+57	0	57
400	500	+97	0	+63	0	63
500	630	+110	0	+70	0	70
630	800	+125	0	+80	0	-
800	1 000	+140	0	+90	0	-
1 000	1 250	+165	0	+105	0	-
1 250	1 600	+195	0	+125	0	-

Notes (1) Applicable to all radial planes of tapered bores.

(2) Not applicable to diameter series 7 and 8.

Taper 1:30

Units:	μm
--------	----

Nominal Bore Diameter d (mm)		Δ,	<i>l</i> mp	<i>∆</i> _{d1mp} -	V _{dp} (1) (2)	
over	incl.	high	low	high	low	max.
80 120 180	120 180 250	+20 +25 +30	0 0 0	+35 +40 +46	0 0 0	22 40 46
250 315 400	315 400 500	+35 +40 +45	0 0 0	+52 +57 +63	0 0 0	52 57 63
500	630	+50	0	+70	0	70

Notes (1) Applicable to all radial planes of tapered bores.

(2) Not applicable to diameter series 7 and 8.

Remarks For a value exceeding 630 mm, please contact NSK.

8.2 Selection of Accuracy Classes

For general applications, Class Normal tolerances are adequate in nearly all cases for satisfactory performance, but for the following applications, bearings having an accuracy class of 5,4 or higher are more suitable.

For reference, in Table 8.11, examples of applications and appropriate tolerance classes are listed for various bearing requirements and operating conditions.

Table 8. 11 Typical Tolerance Classes for Specific Applications (Reference)

Bearing Requirement, Operating Conditions	Examples of Applications	Tolerance Classes		
	VTR Drum Spindles	P5		
	Magnetic Disk Spindles for Computers	P5, P4, P2		
	Machine-Tool Main Spindles	P5, P4, P2		
High running accuracy	Rotary Printing Presses	P5		
is required	Rotary Tables of Vertical Presses, etc.	P5, P4		
	Roll Necks of Cold Rolling Mill Backup Rolls	Higher than P4		
	Slewing Bearings for Parabolic Antennas	Higher than P4		
	Dental Drills	CLASS 7P, CLASS 5P		
	Gyroscopes	CLASS 7P, P4		
Extra high speed is	High Frequency Spindles	CLASS 7P, P4		
required	Superchargers	P5, P4		
	Centrifugal Separators	P5, P4		
	Main Shafts of Jet Engines	Higher than P4		
Low torque and low	Gyroscope Gimbals	CLASS 7P, P4		
torque variation are	Servomechanisms	CLASS 7P, CLASS 5P		
required	Potentiometric Controllers	CLASS 7P		

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9. FITS AND INTERNAL CLEARANCES

9.1 Fits

9.1.1 Importance of Proper Fits

In the case of a rolling bearing with the inner ring fitted to the shaft with only slight interference, a harmful circumferential slipping may occur between the inner ring and shaft. This slipping of the inner ring, which is called "creep", results in a circumferential displacement of the ring relative to the shaft if the interference fit is not sufficiently tight. When creep occurs, the fitted surfaces become abraded, causing wear and considerable damage to the shaft. Abnormal heating and vibration may also occur due to abrasive metallic particles entering the interior of the bearing.

It is important to prevent creep by having sufficient interference to firmly secure that ring which rotates to either the shaft or housing. Creep cannot always be eliminated using only axial tightening through the bearing ring faces. Generally, it is not necessary, however, to provide interference for rings subjected only to stationary loads. Fits are sometimes made without any interference for either the inner or outer ring, to accommodate certain operating conditions, or to facilitate mounting and dismounting. In this case, to prevent damage to the fitting surfaces due to creep, lubrication of other applicable methods should be considered.

9.1.2 Selection of Fit

(1) Load Conditions and Fit

The proper fit may be selected from Table 9.1 based on the load and operating conditions.

(2) Magnitude of Load and Interference

The interference of the inner ring is slightly reduced by the bearing load; therefore, the loss of interference should be estimated using the following equations:

$$\Delta d_{\rm F} = 0.08 \sqrt{\frac{d}{B} F_{\rm r}} \times 10^{-3} \dots (N)$$

$$\Delta d_{\rm F} = 0.25 \sqrt{\frac{d}{B} F_{\rm r}} \times 10^{-3} \dots {\rm \{kgf\}}$$
... (9.1)

where $\Delta d_{\rm F}$: Interference decrease of inner ring (mm)

d: Bearing bore diameter (mm)

B: Nominal inner ring width (mm)

 $F_{\rm r}$: Radial load applied on bearing

(N), {kgf}

Table 9.1 Loading Conditions and Fits

Load Application	Bearing (Operation	Load	Fitting		
Load Application	Inner Ring	Outer Ring	Conditions	Inner Ring	Outer Ring	
TO T	Rotating	Stationary	Rotating Inner Ring Load			
Load Rotating O O O O O O O O O O O O O	Stationary	Rotating	Stationary Outer Ring Load	Tight Fit	Loose Fit	
Load Stationary	Stationary	Rotating	Rotating Outer Ring Load	Loose Fit	Tight Fit	
[Coad Rotating Coad Rotating	Rotating	Stationary	- Stationary Inner Ring Load			
Direction of load indeterminate due to variation of direction or unbalanced load	Rotating or Stationary	Rotating or Stationary	Direction of Load Indeterminate	Tight Fit	Tight Fit	

Therefore, the effective interference Δd should be larger than the interference given by Equation (9.1). However, in the case of heavy loads where the radial load exceeds 20% of the basic static load rating $C_{\rm or}$, under the operating condition, interference often becomes shortage. Therefore, interference should be estimated using Equation (9.2):

where Δd : Effective interference (mm)

 $F_{\rm r}$: Radial load applied on bearing (N), {kgf}

B: Nominal inner ring width (mm)

(3) Interference Variation Caused by Temperature Difference between Bearing and Shaft or Housing

The effective interference decreases due to the increasing bearing temperature during operation. If the temperature difference between the bearing and housing is ΔT (°C), then the temperature difference between the fitted surfaces of the shaft and inner ring is estimated to be about (0.1~0.15) ΔT in case that the shaft is cooled. The decrease in the interference of the inner ring due to this temperature difference $\Delta d_{\rm T}$ may be calculated using Equation (9.3):

$$\Delta d_{\rm T} = (0.10 \text{ to } 0.15) \times \Delta T \cdot \alpha \cdot d$$

= 0.0015 \Delta T \cdot d \times 10^{-3}(9.3)

where Δd_T : Decrease in interference of inner ring due to temperature difference (mm)

△ T: Temperature difference between bearing interior and surrounding parts (°C)

 α : Coefficient of linear expansion of bearing steel=12.5×10⁻⁶ (1/°C)

d: Bearing nominal bore diameter (mm)

In addition, depending on the temperature difference between the outer ring and housing, or difference in their coefficients of linear expansion, the interference may increase.

(4) Effective Interference and Finish of Shaft and Housing

Since the roughness of fitted surfaces is reduced during fitting, the effective interference becomes less than the apparent interference. The amount of this interference decrease varies depending on the

roughness of the surfaces and may be estimated using the following equations:

For ground shafts
$$\Delta d = \frac{d}{d+2} \Delta d_a \dots (9.4)$$

For machined shafts
$$\Delta d = \frac{d}{d+3} \Delta d_a$$
(9.5)

where Δd : Effective interference (mm)

 Δd_a : Apparent interference (mm)

d: Bearing nominal bore diameter (mm)

According to Equations (9.4) and (9.5), the effective interference of bearings with a bore diameter of 30 to 150 mm is about 95% of the apparent interference.

(5) Fitting Stress and Ring Expansion and Contraction

When bearings are mounted with interference on a shaft or in a housing, the rings either expand or contract and stress is produced. Excessive interference may damage the bearings; therefore, as a general guide, the maximum interference should be kept under approximately 7/10 000 of the shaft diameter.

The pressure between fitted surfaces, expansion or contraction of the rings, and circumferential stress may be calculated using the equations in Section 15.2, Fitting(1) (Pages A130 and A131).

9.1.3 Recommended Fits

As described previously, many factors, such as the characteristics and magnitude of bearing load, temperature differences, means of bearing mounting and dismounting, must be considered when selecting the proper fit.

If the housing is thin or the bearing is mounted on a hollow shaft, a tighter than usual fit is necessary. A split housing often deforms the bearing into an oval shape; therefore, a split housing should be avoided when a tight fit with the outer ring is required.

The fits of both the inner and outer rings should be tight in applications where the shaft is subjected to considerable vibration.

The recommended fits for some common applications are shown in Table 9.2 to 9.7. In the case of unusual operating conditions, it is advisable to consult NSK. For the accuracy and surface finish of shafts and housings, please refer to Section 11.1 (Page A100).



Table 9.2 Fits of Radial Bearings with Shafts

			9	Shaft Diameter (mm	1)						
Load	Load Conditions		Ball Brgs	Cylindrical Roller Brgs, Tapered Roller Brgs	Spherical Roller Brgs	Tolerance of Shaft	Remarks				
			Radial Bearings	with Cylindrical Bo	res						
Rotating Outer	Easy axial displacement of inner ring on shaft desirable.	Wheels on Stationary Axles		All Shaft Diameters		g6	Use g5 and h5 where accuracy is required. In case of large				
Ring Load	Easy axial displacement of inner ring on shaft unnecessary	Tension Pulleys Rope Sheaves		All Shall Diameters		h6	bearings, f6 can be used to allow easy axial movement.				
	liabt landa	Electrical Home	<18	_	_	js5					
	Light Loads or Variable	Appliances Pumps, Blowers, Transport	18 to 100	<40	_	js6(j6)					
	Loads $(<0.06C_r(^1))$	Vehicles, Precision Machinery,	100 to 200	40 to 140	_	k6					
	(< 0.00C _T ())	Machine Tools	_	140 to 200	_	m6					
	Normal Loads (0.06 to 0.13 <i>C</i> _r (¹))	General Bearing Applications, Medium and Large Motors(3), Turbines, Pumps, Engine Main Bearings, Gears, Woodworking Machines	<18	_		js5 or js6 (j5 or j6)					
			18 to 100	<40	<40	k5 or k6	k6 and m6 can be used for single-row tapered roller				
Rotating Inner			100 to 140	40 to 100	40 to 65	m5 or m6					
Ring Load or Direction of			140 to 200	100 to 140	65 to 100	m6	bearings and single-				
Load			200 to 280	140 to 200	100 to 140	n6	row angular contact - ball bearings instead of k5 and m5.				
Indeterminate				200 to 400	140 to 280	p6					
				_	280 to 500	r6					
				_	over 500	r7					
		Railway Axleboxes, Industrial Vehicles.	_	50 to 140	50 to 100	n6	More than CN				
	Heavy Loads or Shock Loads	Traction Motors,		140 to 200	100 to 140	p6	bearing internal				
	$(>0.13C_{\rm r}(^1))$	Construction Equipment,	_	over 200	140 to 200	r6	clearance is necessary.				
		Crushers	_	_	200 to 500	r7	necessary.				
Axial Loads Only				All Shaft Diameters	i	js6 (j6)	_				
	Radial Bearings with Tapered Bores and Sleeves										
All Tyrn	All Types of Loading			All Shaft Diameters	h9/IT5(2)	IT5 and IT7 mean that the deviation of the shaft from its true geometric form, e. g. roundness and					
Ан тур	cs or Ecounty	Transmission Shafts, Woodworking Spindles		All Shart Didiffeters	,	h10/IT7(2)	cylindricity should be within the tolerances of IT5 and IT7 respectively.				

 Notes (1) C_r represents the basic load rating of the bearing.
 (2) Refer to Appendix Table 11 on page C22 for the values of standard tolerance grades IT.
 (3) Refer to Tables 9.13.1 and 9.13.2 for the recommended fits of shafts used in electric motors for deep groove ball bearings with bore diameters ranging from 10 mm to 160 mm, and for cylindrical roller bearings with bore diameters ranging from 24 mm to 200 mm.

Remarks This table is applicable only to solid steel shafts.

Table 9.3 Fits of Thrust Bearings with Shafts

			<u> </u>		
Load	Load Conditions		Shaft Diameter (mm)	Tolerance of Shaft	Remarks
Central A	Axial Load Only	Main Shafts of Lathes	All Shaft Diameters	h6 or js6 (j6)	
Combined	Stationary Inner Ring Load	Cone Crushers	All Shaft Diameters	js6 (j6)	
Radial and Axial Loads	Rotating Inner Ring	Paper Pulp Refiners.	<200	k6	_
(Spherical	(Spherical Thrust Roller Bearings) Load or Direction of Load Indeterminate		200 to 400	m6	
			over 400	n6	

Table 9.4 Fits of Radial Bearings with Housings

	Load Co	nditions	Examples	Tolerances for Housing Bores	Axial Displacement of Outer Ring	Remarks	
		Heavy Loads on Bearing in Thin-Walled Housing or Heavy Shock Loads	Automotive Wheel Hubs (Roller Bearings) Crane Travelling Wheels	P7			
	Rotating Outer Ring	Normal or Heavy Loads	Automotive Wheel Hubs (Ball Bearings) Vibrating Screens	N7	- Impossible		
Solid Housings	Load	Light or Variable Loads	Conveyor Rollers Rope Sheaves Tension Pulleys	M7	impossible	_	
		Heavy Shock Loads	Traction Motors				
	Direction of Load	Normal or Heavy Loads	Pumps Crankshaft Main Bearings	K7	Generally Impossible	If axial displacement of the outer ring is not required.	
	mucterminate	Normal or Light Loads	Medium and Large Motors(¹)	JS7 (J7)	Possible	Axial displacement of outer ring is necessary.	
Solid or Split		Loads of All kinds	General Bearing Applications, Railway Axleboxes	Н7			
Housings		Normal or Light Loads	Plummer Blocks	H8	Easily possible	_	
	Rotating Inner Ring Load	High Temperature Rise of Inner Ring Through Shaft	Paper Dryers	G7			
	Loau	Accurate Running Desirable under	Grinding Spindle Rear Ball Bearings High Speed Centrifugal Compessor Free Bearings	JS6 (J6)	Possible	_	
Solid Housing	Direction of Load Indeterminate	Normal or Light Loads	Grinding Spindle Front Ball Bearings High Speed Centrifugal Compressor Fixed Bearings	K6	Generally Impossible	For heavy loads, interference fit tighter than K is used. When high accuracy is	
	Rotating	Accurate Running and High Rigidity Desirable under Variable Loads	Cylindrical Roller Bearings for Machine Tool Main Spindle	M6 or N6	Impossible	required, very strict tolerances should be used for fitting.	
	Inner Ring Load	Minimum noise is required.	Electrical Home Appliances	Н6	Easily Possible	_	

Note (1) Refer to Tables 9.13.1 and 9.13.2 for the recommended fits of housing bores of deep groove ball bearings and cylindrical roller bearings for electric motors.

Remarks 1. This table is applicable to cast iron and steel housings. For housings made of light alloys, the interference should

be tighter than those in this table.

2. Refer to the introductory section of the bearing dimension tables (blue pages) for special fits such as drawn cup needle roller bearings.

Table 9.5 Fits of Thrust Bearings with Housings

Load Conditions		Bearing Types	Tolerances for Housing Bores	Remarks
		Thrust Ball	Clearance over 0.25mm	For General Applications
		Bearings	H8	When precision is required
	Axial Loads Only	Spherical Thrust Roller Bearings Steep Angle Tapered Roller Bearings	Outer ring has radial clearance.	When radial loads are sustained by other bearings.
Combined Radial	Stationary Outer Ring Loads	Spherical Thrust	H7 or JS7 (J7)	_
and Axial	Rotating Outer Ring Loads or	Roller Bearings	K7	Normal Loads
Loads	Direction of Load Indeterminate		M7	Relatively Heavy Radial Loads

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Table 9.6 Fits of Inch Design Tapered Roller Bearings with Shafts

(1) Bearings of Precision Classes 4 and 2

Unite : um

(.,	Dournigo or r .	imgs of Freedom of Casses Fund 2									
Ono	rating Conditions		Nominal Bore	e Diameters $oldsymbol{d}$		Bore Diameter Tolerances Δ_{ds}		Shaft Diameter Tolerances		- Remarks	
Ope	atting conditions	OV	ver .	inc	:l.					IXEITIBI K3	
		(mm)	1/25.4	(mm)	1/25.4	high	low	high	low		
		-	_	76.200	3.0000	+13	0	+ 38	+ 25		
_	Normal Loads	76.200	3.0000	304.800	12.0000	+25	0	+ 64	+ 38	For bearings with $d \le 152.4 \text{ mm}$,	
S	NOTHIAI LUAUS	304.800	12.0000	609.600	24.0000	+51	0	+127	+ 76	clearance is usually larger than CN.	
g Ir		609.600	24.0000	914.400	36.0000	+76	0	+190	+114		
Rotating Inner Ring Loads	Home Loods	_		76.200	3.0000	+13	0	+ 64	+ 38	In general, bearings with a clear-	
Sot	Heavy Loads Shock Loads High Speeds	76.200	3.0000	304.800	12.0000	+25	0	*		ance larger than CN are used.	
		304.800	12.0000	609.600	24.0000	+51	0	*		* means that the average	
	riigii opoodo	609.600	24.0000	914.400	36.0000	+76	0	+381	+305	interference is about 0.0005 <i>d</i> .	
		_	_	76.200	3.0000	+13	0	+ 13	0	The inner ring cannot be displaced axially.	
<u>_</u>		76.200	3.0000	304.800	12.0000	+25	0	+ 25	0	When heavy or shock loads exist, the	
Sute		304.800	12.0000	609.600	24.0000	+51	0	+ 51	0	figures in the above (Rotating inner ring	
Rotating Outer Ring Loads	Normal Loads	609.600	24.0000	914.400	36.0000	+76	0	+ 76	0	loads, heavy or shock loads) apply.	
atir g L	without Shocks	_	_	76.200	3.0000	+13	0	0	- 13		
Rot		76.200	3.0000	304.800	12.0000	+25	0	0	- 25	The inner ring can be displaced	
		304.800	12.0000	609.600	24.0000	+51	0	0	- 51	axially.	
		609.600	24.0000	914.400	36.0000	+76	0	0	- 76		

(2) Bearings of Precision Classes 3 and 0 (1)

Units : $\mu \, m$

One	rating Conditions	Nominal Bore Diameters $oldsymbol{d}$					Bore Diameter Tolerances \$\Delta_{ds}\$ Shaft Diameter Tolerances				
Ope	rating Conditions	OV	er	inc	il.					Remarks	
		(mm)	1/25.4	(mm)	1/25.4	high	low	high	low		
	Danaisia a	_	_	76.200	3.0000	+13	0	+ 30	+18		
_	Precision Machine-Tool	76.200	3.0000	304.800	12.0000	+13	0	+ 30	+18		
inel.	Main Spindles	304.800	12.0000	609.600	24.0000	+25	0	+ 64	+38	_	
n g	iviairi Spiridics	609.600	24.0000	914.400	36.0000	+38	0	+102	+64		
Rotating Inner Ring Loads		_		76.200	3.0000	+13	0	_			
Sing Sing	Heavy Loads Shock Loads	76.200	3.0000	304.800	12.0000	+13	0	_	_	A minimum interference of about	
4	High Speeds	304.800	12.0000	609.600	24.0000	+25	0	_	_	0.00025 d is used.	
	J '	609.600	24.0000	914.400	36.0000	+38	0	_	_		
Rotating Outer Ring Loads	Descision	_	-	76.200	3.0000	+13	0	+ 30	+18		
g Or	Precision Machine-Tool	76.200	3.0000	304.800	12.0000	+13	0	+ 30	+18		
atin	Main Spindles	304.800	12.0000	609.600	24.0000	+25	0	+ 64	+38	_	
종등	waiii Spiriules	609.600	24.0000	914.400	36.0000	+38	0	+102	+64		

Note (1) For bearings with d greater than 304.8 mm, Class 0 does not exist.

Table 9.7 Fits of Inch Design Tapered Roller Bearings with Housings

(1) Bearings of Precision Classes 4 and 2

Units : μm

										onits . µm	
Ono	rating Conditions	Nominal Outside Diameters $oldsymbol{D}$					Outside Diameter Tolerances Δ_{Ds}		ng Bore neter ances	- Remarks	
Ope	alling Conditions	OVE	er	ind	cl.					Remarks	
		(mm)	1/25.4	(mm)	1/25.4	high	low	high	low		
		_	_	76.200	3.0000	+25	0	+ 76	+ 51		
	Used either	76.200	3.0000	127.000	5.0000	+25	0	+ 76	+ 51	The outer ring can be easily	
	on free-end or	127.000	5.0000	304.800	12.0000	+25	0	+ 76	+ 51	The outer ring can be easily displaced axially.	
SS	fixed-end	304.800	12.0000	609.600	24.0000	+51	0	+152	+102	displaced axially.	
-0a		609.600	24.0000	914.400	36.0000	+76	0	+229	+152		
Rotating Inner Ring Loads		_	-	76.200	3.0000	+25	0	+ 25	0	The outer ring can be displaced	
돌	The outer ring position can be adjusted axially.	76.200	3.0000	127.000	5.0000	+25	0	+ 25	0		
ner		127.000	5.0000	304.800	12.0000	+25	0	+ 51	0	axially.	
J L		304.800	12.0000	609.600	24.0000	+51	0	+ 76	+ 25	umany.	
ţiu		609.600	24.0000	914.400	36.0000	+76	0	+127	+ 51		
ota	The autorian	_	-	76.200	3.0000	+25	0	- 13	- 38		
~	The outer ring position cannot	76.200	3.0000	127.000	5.0000	+25	0	- 25	- 51	Generally, the outer ring is fixed	
	be adjusted	127.000	5.0000	304.800	12.0000	+25	0	- 25	- 51	axially.	
	axially.	304.800	12.0000	609.600	24.0000	+51	0	- 25	- 76	axiany.	
		609.600	24.0000	914.400	36.0000	+76	0	- 25	-102		
Rotating Outer Ring Loads	Normal Loads	_	-	76.200	3.0000	+25	0	- 13	- 38		
3g	The outer ring	76.200	3.0000	127.000	5.0000	+25	0	- 25	- 51		
200	position cannot	127.000	5.0000	304.800	12.0000	+25	0	- 25	- 51	The outer ring is fixed axially.	
200	be adjusted	304.800	12.0000	609.600	24.0000	+51	0	- 25	- 76		
ᅐ	axially.	609.600	24.0000	914.400	36.0000	+76	0	- 25	-102		

(2) Bearings of Precision Classes 3 and 0 (1)

Units : μm

One	rating Conditions	Nominal Outside Diameters $oldsymbol{D}$					Outside Diameter Tolerances Δ_{Ds}		g Bore neter nnces	- Remarks	
Ope	rating conditions	OVE	er	incl.						Kemarks	
		(mm)	1/25.4	(mm)	1/25.4	high	low	high	low		
		_	-	152.400	6.0000	+13	0	+38	+25		
	Used on free-	152.400	6.0000	304.800	12.0000	+13	0	+38	+25	The outer ring can be easily	
	end	304.800	12.0000	609.600	24.0000	+25	0	+64	+38	displaced axially.	
		609.600	24.0000	914.400	36.0000	+38	0	+89	+51		
Rotating Inner Ring Loads		_	-	152.400	6.0000	+13	0	+25	+13		
J.	Used on fixed-	152.400	6.0000	304.800	12.0000	+13	0	+25	+13	The outer ring can be displaced	
ÿi	end	304.800	12.0000	609.600	24.0000	+25	0	+51	+25	axially.	
er F		609.600	24.0000	914.400	36.0000	+38	0	+76	+38		
드	The outer ring	_	-	152.400	6.0000	+13	0	+13	0		
р	position can be	152.400	6.0000	304.800	12.0000	+13	0	+25	0	Generally, the outer ring is fixed	
tati	adjusted axially.	304.800	12.0000	609.600	24.0000	+25	0	+25	0	axially.	
&	. ,	609.600	24.0000	914.400	36.0000	+38	0	+38	0		
	The outer ring	_	-	152.400	6.0000	+13	0	0	-13		
	position cannot	152.400	6.0000	304.800	12.0000	+13	0	0	-25	The outer ring is fixed axially.	
	be adjusted	304.800	12.0000	609.600	24.0000	+25	0	0	-25	The cater ring is tinea amany.	
	axially.	609.600	24.0000	914.400	36.0000	+38	0	0	-38		
ıter	Normal Loads	_	-	76.200	3.0000	+13	0	-13	-25		
35 Sp	The outer ring	76.200	3.0000	152.400	6.0000	+13	0	-13	-25		
Log	position cannot	152.400	6.0000	304.800	12.0000	+13	0	-13	-38	The outer ring is fixed axially.	
Rotating Outer Ring Loads	be adjusted	304.800	12.0000	609.600	24.0000	+25	0	-13	-38		
200	axially.	609.600	24.0000	914.400	36.0000	+38	0	-13	-51		

Note (1) For bearings with D greater than 304.8 mm, Class 0 does not exist.

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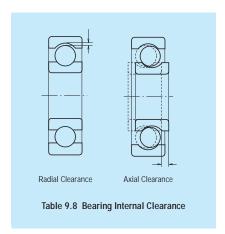


9.2 Bearing Internal Clearances

9.2.1 Internal Clearances and Their Standards

The internal clearance in rolling bearings in operation greatly influences bearing performance including fatique life, vibration, noise, heat-generation, etc. Consequently, the selection of the proper internal clearance is one of the most important tasks when choosing a bearing after the type and size have been determined.

This bearing internal clearance is the combined clearances between the inner/outer rings and rolling elements. The radial and axial clearances are defined as the total amount that one ring can be displaced relative to the other in the radial and axial directions respectively (Fig. 9.1).



To obtain accurate measurements, the clearance is generally measured by applying a specified measuring load on the bearing: therefore, the measured clearance (sometimes called "measured clearance" to make a distinction) is always slightly larger than the theoretical internal clearance (called "geometrical clearance" for radial bearings) by the amount of elastic deformation caused by the measuring load.

Therefore, the theoretical internal clearance may be obtained by correcting the measured clearance by the amount of elastic deformation. However, in the case of roller bearings this elastic deformation is negligibly

Usually the clearance before mounting is the one specified as the theoretical internal clearance.

In Table 9.8, reference table and page numbers are listed by bearing types.

Table 9.8 Index for Radial Internal Clearances by Bearing Types

Ве	earing Types	Table Number	Page Number
Deep Groove Ba	III Bearings	9.9	A89
Extra Small and	Miniature Ball Bearings	9.10	A89
Magneto Bearin	gs	9.11	A89
Self-Aligning Ba	III Bearings	9.12	A90
Deep Groove Ball Bearings		9.13.1	A90
Cylindrical Roller Bearings	For Motors	9.13.2	A90
Cylindrical Roller Bearings	With Cylindrical Bores With Cylindrical Bores (Matched) With Tapered Bores (Matched)	9.14	A91
Spherical Roller Bearings	With Cylindrical Bores With Tapered Bores	9.15	A92
Double-Row an Roller Bearings	d Combined Tapered	9.15	A93
Combined Angu Bearings (1)	ılar Contact Ball	9.17	A94
Four-Point Cont	act Ball Bearings (¹)	9.18	A94

Note (1) Values given are axial clearances.

Table 9.9 Radial Internal Clearances in **Deep Groove Ball Bearings**

Clearance

Units: um

Diamet						Oicui	unicc				
d (mn		C	2	С	N	С	3	С	24	C	:5
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
10 only 10 18	18 24	0 0 0	7 9 10	2 3 5	13 18 20	8 11 13	23 25 28	14 18 20	29 33 36	20 25 28	37 45 48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370
315	355	3	60	45	125	110	210	195	300	275	410
355	400	3	70	55	145	130	240	225	340	315	460
400	450	3	80	60	170	150	270	250	380	350	510
450	500	3	90	70	190	170	300	280	420	390	570
500	560	10	100	80	210	190	330	310	470	440	630
560	630	10	110	90	230	210	360	340	520	490	690
630	710	20	130	110	260	240	400	380	570	540	760
710	800	20	140	120	290	270	450	430	630	600	840
Remarks	To obt	ain th	e mea	surec	l value	es. use	e the o	leara	nce co	rrecti	

Nominal Bore

Remarks To obtain the measured values, use the clearance correction for radial clearance increase caused by the measuring load in the table below.

> For the C2 clearance class, the smaller value should be used for bearings with minimum clearance and the larger value for bearings near the maximum clearance range.

Units: μm

Nominal E Dia. d (n		Meas Lo			lial Cle ount	arance	Correc	tion
over	incl.	(N)	au {kgf}	C2	CN	C3	C4	C5
10 (incl) 18 50	18 50 280	24.5 49 147		3 to 4 4 to 5 6 to 8	4 5 8	4 6 9	4 6 9	4 6 9

Remarks For values exceeding 280 mm, please contact NSK.

Table 9.10 Radial Internal Clearances in Extra Small and Miniature Ball Bearings

Units: um

Clear- ance Symbol		C1	M	C2	M	СЗ	M	C4	M	C5	M	C6
	min.	max.										
Clear- ance	0	5	3	8	5	10	8	13	13	20	20	28

Remarks 1. The standard clearance is MC3.

2. To obtain the measured value, add correction amount in the table below.

Units: μm

Clearance Symbol	MC1	MC2	МС3	MC4	MC5	MC6
Clearance Correction Value	1	1	1	1	2	2

The measuring loads are as follows:

For miniature ball bearings* 2.5N {0.25kgf} For extra small ball bearings*

4.4N {0.45kgf} *For their classification, refer to Table 1 on Page B 31.

Table 9.11 Radial Internal Clearances in Magneto Bearings

Units: um

Nomina Diam $oldsymbol{d}$ (n	neter	Bearing Series	Clea	rance
over	incl.		min.	max.
2.5	30	EN	10	50
2.5	30	E	30	60

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Table 9.12 Radial Internal Clearances in **Self-Aligning Ball Bearings**

Units : μm

Nomina			Cl	earanc	e in Be	arings	with C	ylindri	cal Bo	es			(learan	ice in E	earing	s with	Tapere	d Bore	S	
Dia. d ((mm)	C	22	C	N	C	C3	C	:4	C	5	(C 2	C	N	C	23	C	4		C5
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
2.5 6 10	6 10 14	1 2 2	8 9 10	5 6 6	15 17 19	10 12 13	20 25 26	15 19 21	25 33 35	21 27 30	33 42 48	<u> </u>	_	_	_	=	=	=	_	=	=
14 18 24	18 24 30	3 4 5	12 14 16	8 10 11	21 23 24	15 17 19	28 30 35	23 25 29	37 39 46	32 34 40	50 52 58		17 20	13 15	 26 28	20 23	33 39	28 33	42 50	37 44	55 62
30 40 50	40 50 65	6 6 7	18 19 21	13 14 16	29 31 36	23 25 30	40 44 50	34 37 45	53 57 69	46 50 62	66 71 88	12 14 18	24 27 32	19 22 27	35 39 47	29 33 41	46 52 61	40 45 56	59 65 80	52 58 73	72 79 99
65 80 100	80 100 120	8 9 10	24 27 31	18 22 25	40 48 56	35 42 50	60 70 83	54 64 75	83 96 114	76 89 105	108 124 145	23 29 35	39 47 56	35 42 50	57 68 81	50 62 75	75 90 108	69 84 100	98 116 139	91 109 130	123 144 170
120 140	140 160	10 15	38 44	30 35	68 80	60 70	100 120	90 110	135 161	125 150	175 210	40 45	68 74	60 65	98 110	90 100	130 150	120 140	165 191	155 180	205 240

Table 9.13 Radial Internal Clearances in **Bearings for Electric Motors**

Table 9.13. 1 Deep Groove Ball Bearings for Electric Motors

				Units	i:μm
Nominal E		Clea	rance	Ren	narks
Dia. d (m	ım)	C	M	Recomm	nended fit
over	incl.	min.	max.	Shaft	Housing Bore
10 (incl)	18	4	11	js5 (j5)	
18	30	5	12		
30	50	9	17		H6, H7(1)
				k5	or
50	80	12	22		JS6, JS7
80	100	18	30		(J6, J7)(²)
					1
100	120	18	30	m5	
120	160	24	38		

Notes (1) Applicable to outer rings that require movement in the axial direction.

> (2) Applicable to outer rings that do not require movement in the axial direction.

Remarks The radial clearance increase caused by the measuring load is equal to the correction amount for CN clearance in the remarks under Table 9.9.

Table 9.13.2	Cylindrical Roller Bearings
	for Flectric Motors

Units: um

							110 : pt 111
Nomina	l Bore		Clear	ance		F	Remarks
Dia. d	(mm)	Interchan	geable CT	Non-Interch	angeable CM	Recor	mmended Fit
over	incl.	min.	max.	min.	max.	Shaft	Housing Bore
24	40	15	35	15	30	k5	
40	50	20	40	20	35		
50	65	25	45	25	40		
65	80	30	50	30	45		
80	100	35	60	35	55	m5	JS6, JS7 (J6, J7)(1)
100	120	35	65	35	60		or
120	140	40	70	40	65		K6, K7(2)
140	160	50	85	50	80		
160	180	60	95	60	90	n6	
180	200	65	105	65	100	110	

Notes (1) Applicable to outer rings that require movement in the axial direction.

(2) Applicable to outer rings that do not require movement in the axial direction.

Table 9.14 Radial Internal Clearances in Cylindrical Roller Bearings and Solid-Type Needle Roller Bearings

Units : μm

	lom ore						ances Cylind									Cleara				angeal I Bores	ole Bea	rings		
	d (m	nm)	C	2	С	N	C	3	C	4	C	5	C	C1	С	C2	CC	(1)	C	C3	C	C4	C	C5
0	ver	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.								
	10 24	10 24 30	0 0 0	25 25 25	20 20 20	45 45 45	35 35 35	60 60 60	50 50 50	75 75 75	— 65 70	90 95	 5 5	 15 15	10 10	 20 25	20 25	30 35	35 40	— 45 50	45 50	 55 60	65 70	75 80
	30 40 50	40 50 65	5 5 10	30 35 40	25 30 40	50 60 70	45 50 60	70 80 90	60 70 80	85 100 110	80 95 110	105 125 140	5 5 5	15 18 20	12 15 15	25 30 35	25 30 35	40 45 50	45 50 55	55 65 75	55 65 75	70 80 90	80 95 110	95 110 130
		80 100 120	10 15 15	45 50 55	40 50 50	75 85 90	65 75 85	100 110 125	90 105 125	125 140 165	130 155 180	165 190 220	10 10 10	25 30 30	20 25 25	40 45 50	40 45 50	60 70 80	70 80 95	90 105 120	90 105 120	110 125 145	130 155 180	150 180 205
1	40	140 160 180	15 20 25	60 70 75	60 70 75	105 120 125	100 115 120	145 165 170	145 165 170	190 215 220	200 225 250	245 275 300	10 10 10	35 35 40	30 35 35	60 65 75	60 65 75	90 100 110	105 115 125	135 150 165	135 150 165	160 180 200	200 225 250	230 260 285
2	00	200 225 250	35 45 45	90 105 110	90 105 110	145 165 175	140 160 170	195 220 235	195 220 235	250 280 300	275 305 330	330 365 395	15 15 15	45 50 50	40 45 50	80 90 100	80 90 100	120 135 150	140 155 170	180 200 215	180 200 215	220 240 265	275 305 330	315 350 380
2	80	280 315 355	55 55 65	125 130 145	125 130 145	195 205 225	190 200 225	260 275 305	260 275 305	330 350 385	370 410 455	440 485 535	20 20 20	55 60 65	55 60 65	110 120 135	110 120 135	165 180 200	185 205 225	240 265 295	240 265 295	295 325 360	370 410 455	420 470 520
4	00	400 450 500	100 110 110	190 210 220	190 210 220	280 310 330	280 310 330	370 410 440	370 410 440	460 510 550	510 565 625	600 665 735	25 25 25	75 85 95	75 85 95	150 170 190	150 170 190	225 255 285	255 285 315	330 370 410	330 370 410	405 455 505	510 565 625	585 650 720

Note (1) CC denotes normal clearance for non-Interchangeable cylindrical roller bearings and solid-type needle roller bearings.

Units : μm

	minal e Dia.					Clearan	ices in N	on-Inter	changea	ble Bear	ings witl	n Tapere	d Bores				
	e Dia. (mm)	CC	9 (1)	C	C 0	C	C1	C	C2	CC	(2)	C	C3	C	C4	C	C5
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
10	24	5	10		—	10	20	20	30	35	45	45	55	55	65	75	85
24	30	5	10	8	15	10	25	25	35	40	50	50	60	60	70	80	95
30	40	5	12	8	15	12	25	25	40	45	55	55	70	70	80	95	110
40	50	5	15	10	20	15	30	30	45	50	65	65	80	80	95	110	125
50	65	5	15	10	20	15	35	35	50	55	75	75	90	90	110	130	150
65	80	10	20	15	30	20	40	40	60	70	90	90	110	110	130	150	170
80	100	10	25	20	35	25	45	45	70	80	105	105	125	125	150	180	205
100	120	10	25	20	35	25	50	50	80	95	120	120	145	145	170	205	230
120	140	15	30	25	40	30	60	60	90	105	135	135	160	160	190	230	260
140	160	15	35	30	50	35	65	65	100	115	150	150	180	180	215	260	295
160	180	15	35	30	50	35	75	75	110	125	165	165	200	200	240	285	320
180	200	20	40	30	50	40	80	80	120	140	180	180	220	220	260	315	355
200	225	20	45	35	60	45	90	90	135	155	200	200	240	240	285	350	395
225	250	25	50	40	65	50	100	100	150	170	215	215	265	265	315	380	430
250	280	25	55	40	70	55	110	110	165	185	240	240	295	295	350	420	475
280 315 355	315 355 400	30 30 35	60 65 75	=	_	60 65 75	120 135 150	120 135 150	180 200 225	205 225 255	265 295 330	265 295 330	325 360 405	325 360 405	385 430 480	470 520 585	530 585 660
400 450	450 500	40 45	85 95		=	85 95	170 190	170 190	255 285	285 315	370 410	370 410	455 505	455 505	540 600	650 720	735 815

(1) Clearance CC9 is applicable to cylindrical roller bearings with tapered bores in ISO Tolerance Classes 5 and 4.
(2) CC denotes normal clearance for non-Interchangeable cylindrical roller bearings and solid-type needle roller bearings.



Table 9.15 Radial Internal Clearances in Spherical Roller Bearings

Units : μm

	ninal Dia.		(Cleara	nce in	Beari	ings wit	th Cylin	drical B	ores				Cle	arance	in Beari	ngs wit	h Taper	ed Bore	!S	
	nm)	C	2	C	N	(C3	C	24	(C5	C	22	(CN	C	23	C	24	C	5
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
24	30	15	25	25	40	40	55	55	75	75	95	20	30	30	40	40	55	55	75	75	95
30	40	15	30	30	45	45	60	60	80	80	100	25	35	35	50	50	65	65	85	85	105
40	50	20	35	35	55	55	75	75	100	100	125	30	45	45	60	60	80	80	100	100	130
50	65	20	40	40	65	65	90	90	120	120	150	40	55	55	75	75	95	95	120	120	160
65	80	30	50	50	80	80	110	110	145	145	180	50	70	70	95	95	120	120	150	150	200
80	100	35	60	60	100	100	135	135	180	180	225	55	80	80	110	110	140	140	180	180	230
100	120	40	75	75	120	120	160	160	210	210	260	65	100	100	135	135	170	170	220	220	280
120	140	50	95	95	145	145	190	190	240	240	300	80	120	120	160	160	200	200	260	260	330
140	160	60	110	110	170	170	220	220	280	280	350	90	130	130	180	180	230	230	300	300	380
160	180	65	120	120	180	180	240	240	310	310	390	100	140	140	200	200	260	260	340	340	430
180	200	70	130	130	200	200	260	260	340	340	430	110	160	160	220	220	290	290	370	370	470
200	225	80	140	140	220	220	290	290	380	380	470	120	180	180	250	250	320	320	410	410	520
225	250	90	150	150	240	240	320	320	420	420	520	140	200	200	270	270	350	350	450	450	570
250	280	100	170	170	260	260	350	350	460	460	570	150	220	220	300	300	390	390	490	490	620
280	315	110	190	190	280	280	370	370	500	500	630	170	240	240	330	330	430	430	540	540	680
315	355	120	200	200	310	310	410	410	550	550	690	190	270	270	360	360	470	470	590	590	740
355	400	130	220	220	340	340	450	450	600	600	750	210	300	300	400	400	520	520	650	650	820
400	450	140	240	240	370	370	500	500	660	660	820	230	330	330	440	440	570	570	720	720	910
450 500 560	500 560 630	140 150 170	260 280 310	260 280 310	410 440 480	410 440 480	550 600 650	550 600 650	720 780 850		900 1 000 1 100	260 290 320	370 410 460	370 410 460	490 540 600	490 540 600	630 680 760	630 680 760	790 870 980	870	1 000 1 100 1 230
630 710 800	710 800 900	190 210 230	350 390 430	350 390 430	530 580 650	530 580 650	700 770 860	700 770 860	920 1 010 1 120	1 010	1 190 1 300 1 440	350 390 440	510 570 640	510 570 640	670 750 840	670 750 840	850 960 1 070	850 960 1 070	1 090 1 220 1 370	1 090 1 220 1 370	1 360 1 500 1 690
900 1 000 1 120 1 250	1 000 1 120 1 250 1 400	260 290 320 350	480 530 580 640	480 530 580 640	710 780 860 950	710 780 860 950	930 1 020 1 120 1 240		1 220 1 330 1 460 1 620	1 220 — — —	1 570 — — —	490 530 570 620	710 770 830 910	830	930 1 030 1 120 1 230	1 030	1 190 1 300 1 420 1 560	1 190 1 300 1 420 1 560	1 520 1 670 1 830 2 000	1 520 — — —	

Table 9.16 Radial Internal Clearances in Double-Row and Combined Tapered Roller Bearings

 $\text{Units}: \mu m$

	ndrical		Clearance										
Bore Tape	ered Bore	C	C1	C	22	C	N	C	C3	C	24	C	5
Nominal Bo Dia. d (mr		-	_	C	1	C	22	C	N	C	23	С	4
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
18 24	18 24 30	0 0 0	10 10 10	10 10 10	20 20 20	20 20 20	30 30 30	35 35 40	45 45 50	50 50 50	60 60 60	65 65 70	75 75 80
30	40	0	12	12	25	25	40	45	60	60	75	80	95
40	50	0	15	15	30	30	45	50	65	65	80	95	110
50	65	0	15	15	35	35	55	60	80	80	100	110	130
65	80	0	20	20	40	40	60	70	90	90	110	130	150
80	100	0	25	25	50	50	75	80	105	105	130	155	180
100	120	5	30	30	55	55	80	90	115	120	145	180	210
120	140	5	35	35	65	65	95	100	130	135	165	200	230
140	160	10	40	40	70	70	100	110	140	150	180	220	260
160	180	10	45	45	80	80	115	125	160	165	200	250	290
180	200	10	50	50	90	90	130	140	180	180	220	280	320
200	225	20	60	60	100	100	140	150	190	200	240	300	340
225	250	20	65	65	110	110	155	165	210	220	270	330	380
250	280	20	70	70	120	120	170	180	230	240	290	370	420
280	315	30	80	80	130	130	180	190	240	260	310	410	460
315	355	30	80	80	130	140	190	210	260	290	350	450	510
355	400	40	90	90	140	150	200	220	280	330	390	510	570
400	450	45	95	95	145	170	220	250	310	370	430	560	620
450	500	50	100	100	150	190	240	280	340	410	470	620	680
500	560	60	110	110	160	210	260	310	380	450	520	700	770
560	630	70	120	120	170	230	290	350	420	500	570	780	850
630	710	80	130	130	180	260	310	390	470	560	640	870	950
710	800	90	140	150	200	290	340	430	510	630	710	980	1 060
800	900	100	150	160	210	320	370	480	570	700	790	1 100	1 200
900	1 000	120	170	180	230	360	410	540	630	780	870	1 200	1 300
1 000 1 120 1 250	1 120 1 250 1 400	130 150 170	190 210 240	200 220 250	260 280 320	400 450 500	460 510 570	600 670 750	700 770 870		=	_ _ _	

 $\begin{array}{ll} \textbf{Remarks} & \textbf{Axial internal clearance} & \varDelta_{\textbf{a}} = \varDelta_{\textbf{r}} \cot \alpha \stackrel{:}{=} \frac{1.5}{e} \ \varDelta_{\textbf{r}} \\ & \text{where} \ \varDelta_{\textbf{r}} : \textbf{Radial internal clearance} \\ & \alpha : \textbf{Contact angle} \\ & e : \textbf{Constant (Listed in bearing tables)} \\ \end{array}$

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Table 9.17 Axial Internal Clearances in Combined Angular Contact Ball Bearings (Measured Clearance)

Units: u.m.

Nomi	nal Bore		Axial Internal Clearance											
Dia	Diameter.			Contact	Angle 30°			Contact Angle 40°						
a	(mm)	CN		(C3		C4		CN		C3		C4	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	
—	10	9	29	29	49	49	69	6	26	26	46	46	66	
10	18	10	30	30	50	50	70	7	27	27	47	47	67	
18	24	19	39	39	59	59	79	13	33	33	53	53	73	
24	30	20	40	40	60	60	80	14	34	34	54	54	74	
30	40	26	46	46	66	66	86	19	39	39	59	59	79	
40	50	29	49	49	69	69	89	21	41	41	61	61	81	
50	65	35	60	60	85	85	110	25	50	50	75	75	100	
65	80	38	63	63	88	88	115	27	52	52	77	77	100	
80	100	49	74	74	99	99	125	35	60	60	85	85	110	
100	120	72	97	97	120	120	145	52	77	77	100	100	125	
120	140	85	115	115	145	145	175	63	93	93	125	125	155	
140	160	90	120	120	150	150	180	66	96	96	125	125	155	
160	180	95	125	125	155	155	185	68	98	98	130	130	160	
180	200	110	140	140	170	170	200	80	110	110	140	140	170	

Remarks This table is applicable to bearings in Tolerance Classes Normal and 6. For internal axial clearances in bearings in tolerance classes better than 5 and contact angles of 15° and 25°, it is advisable to consult NSK.

Table 9.18 Axial Internal Clearance in Four-Point **Contact Ball Bearings** (Measured Clearances)

Unite : um

							UI	IIIS : μ1	111
Nomin	al Bore			Axia	l Intern	al Clear	ance		
Dia. d	(mm)	C	2	C	CN		C3		24
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
10	18	15	55	45	85	75	125	115	165
18	40	26	66	56	106	96	146	136	186
40	60	36	86	76	126	116	166	156	206
60	80	46	96	86	136	126	176	166	226
80	100	56	106	96	156	136	196	186	246
100	140	66	126	116	176	156	216	206	266
140	180	76	156	136	196	176	246	226	296
180	220	96	176	156	226	206	276	256	326
220	260	115	196	175	245	225	305	285	365
260	300	135	215	195	275	255	335	315	395
300	350	155	235	215	305	275	365	345	425
350	400	175	265	245	335	315	405	385	475
400	500	205	305	285	385	355	455	435	525

9.2.2 Selection of Bearing Internal Clearances

Among the bearing internal clearances listed in the tables, the CN Clearance is adequate for standard operating conditions. The clearance becomes progressively smaller from C2 to C1 and larger from C3 to C5.

Standard operating conditions are defined as those where the inner ring speed is less than approximately 50% of the limiting speed listed in the bearing tables, the load is less than normal $(P = 0.1C_r)$, and the bearing is tight-fitted on the shaft.

As a measure to reduce bearing noise for electric motors, the radial clearance range is narrower than the normal class and the values are somewhat smaller for deep groove ball bearings and cylindrical roller bearings for electric motors. (Refer to Table 9.13.1 and

Internal clearance varies with the fit and temperature differences in operation. The changes in radial clearance in a roller bearing are shown in Fig. 9.2.

(1) Decrease in Radial Clearance Caused by Fitting and Residual Clearance

When the inner ring or the outer ring is tight-fitted on a shaft or in a housing, a decrease in the radial internal clearance is caused by the expansion or contraction of the bearing rings. The decrease varies according to the bearing type and size and design of the shaft and housing. The amount of this decrease is approximately 70 to 90% of the interference (refer to Section 15.2, Fits (1), Pages A130 to A133). The internal clearance after subtracting this decrease from the theoretical internal clearance Δ_0 is called the residual clearance, $\Delta_{\rm f}$

(2) Decrease in Radial Internal Clearance Caused by Temperature Differences between Inner and Outer Rings and Effective Clearance

The frictional heat generated during operation is conducted away through the shaft and housing. Since housings generally conduct heat better than shafts, the temperature of the inner ring and the rolling elements is usually higher than that of the outer ring by 5 to 10°C. If the shaft is heated or the housing is cooled, the difference in temperature between the inner and outer rings is greater. The radial clearance decreases due to the thermal expansion caused by the temperature difference between the inner and outer rings. The amount of this decrease can be calculated using the following equations:

$$\delta_t = \alpha \Delta_t D_e$$
 (9.6)

where δ_t : Decrease in radial clearance due to temperature difference between inner and outer rings (mm)

α : Coefficient of linear expansion of bearing steel $= 12.5 \times 10^{-6} (1/^{\circ}C)$

 Δ_t : Temperature difference between inner and outer rings (°C)

 $D_{\rm e}$: Outer ring raceway diameter (mm)

For ball bearings

$$D_{\rm e} = \frac{1}{5} (4D + d) \dots (9.7)$$

For roller bearings
$$D_{\rm e} = \frac{1}{4} (3D + d) \dots (9.8)$$

The clearance after substracting this δ_t from the residual clearance. Δ_f is called the effective clearance. Δ . Theoretically, the longest life of a bearing can be expected when the effective clearance is slightly negative. However, it is difficult to achieve such an ideal condition, and an excessive negative clearance will greatly shorten the bearing life. Therefore, a clearance of zero or a slightly positive amount, instead of a negative one, should be selected. When single-row angular contact ball bearings or tapered roller bearings are used facing each other, there should be a small effective clearance, unless a preload is required. When two cylindrical roller bearings with a rib on one side are used facing each other, it is necessary to provide adequate axial clearance to allow for shaft elongation during operation.

The radial clearances used in some specific applications are given in Table 9.19. Under special operating conditions, it is advisable to consult NSK.

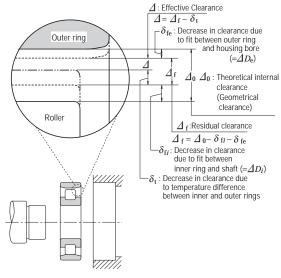


Fig. 9.2 Changes in Radial Internal Clearance of Bearings

Table 9. 19 Examples of Clearances for Specific **Applications**

Operating Conditions	Examples	Internal Clearance
When shaft deflection is large.	Semi-floating rear wheels of automobiles	C5 or equivalent
When steam passes	Dryers in paper making machines	C3, C4
through hollow shafts or roller shafts are heated.	Table rollers for rolling mills	C3
When impact leads and	Traction motors for railways	C4
When impact loads and vibration are severe or	Vibrating screens	C3, C4
when both the inner and outer rings are tight-	Fluid couplings	C4
fitted.	Final reduction gears for tractors	C4
When both the inner and outer rings are loose-fitted	Rolling mill roll necks	C2 or equivalent
When noise and vibration restrictions are severe	Small motors with special specifications	C1, C2, CM
When clearance is adjusted after mounting to prevent shaft deflection, etc.	Main shafts of lathes	CC9, CC1



10. PRELOAD

Rolling bearings usually retain some internal clearance while in operation. In some cases, however, it is desirable to provide a negative clearance to keep them internally stressed. This is called "preloading". A preload is usually applied to bearings in which the clearance can be adjusted during mounting, such as angular contact ball bearings or tapered roller bearings. Usually, two bearings are mounted face-to-face or back-to-back to form a duplex set with a preload.

10.1 Purpose of Preload

The main purposes and some typical applications of preloaded bearings are as follows:

- (1) To maintain the bearings in exact position both radially and axially and to maintain the running accuracy of the shaft.
 - ... Main shafts of machine tools, precision instruments, etc.
- (2) To increase bearing rigidity
- ... Main shafts of machine tools, pinion shafts of final drive gears of automobiles, etc.
- (3) To minimize noise due to axial vibration and resonance
 - .. Small electric motors, etc.
- (4) To prevent sliding between the rolling elements and raceways due to gyroscopic moments
- ... High speed or high acceleration applications of angular contact ball bearings, and thrust ball
- (5) To maintain the rolling elements in their proper position with the bearing rings
 - ... Thrust ball bearings and spherical thrust roller bearings mounted on a horizontal shaft

10.2 Preloading Methods

10.2.1 Position Preload

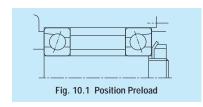
A position preload is achieved by fixing two axially opposed bearings in such a way that a preload is imposed on them. Their position, once fixed, remain unchanged while in operation.

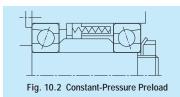
In practice, the following three methods are generally used to obtain a position preload.

- (1) By installing a duplex bearing set with previously adjusted stand-out dimensions (see Page A7, Fig. 1.1) and axial clearance.
- (2) By using a spacer or shim of proper size to obtain the required spacing and preload. (Refer to Fig.
- (3) By utilizing bolts or nuts to allow adjustment of the axial preload. In this case, the starting torque should be measured to verify the proper preload.

10.2.2 Constant-Pressure Preload

A constant pressure preload is achieved using a coil or leaf spring to impose a constant preload. Even if the relative position of the bearings changes during operation, the magnitude of the preload remains relatively constant (refer to Fig. 10.2)

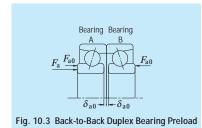




10.3 Preload and Rigidity

10.3.1 Position Preload and Rigidity

When the inner rings of the duplex bearings shown in Fig.10.3 are fixed axially, bearings A and B are displaced δ_{a0} and axial space $2\delta_{a0}$ between the inner rings is eliminated. With this condition, a preload F_{a0} is imposed on each bearing. A preload diagram showing bearing rigidity, that is the relation between load and displacement with a given axial load F_a imposed on a duplex set, is shown in Fig. 10.4.



10.3.2 Constant-Pressure Preload and Rigidity

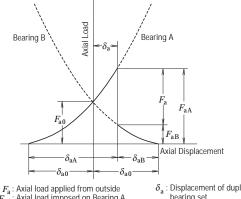
A preload diagram for duplex bearings under a constant-pressure preload is shown in Fig. 10.5. The deflection curve of the spring is nearly parallel to the horizontal axis because the rigidity of springs is lower than that of the bearing. As a result, the rigidity under a constant-pressure preload is approximately equal to that for a single bearing with a preload F_{a0} applied to it. Fig. 10.6 presents a comparison of the rigidity of a bearing with a position preload and one with a constant-pressure preload.

10.4 Selection of Preloading Method and Amount of Preload

10.4.1 Comparison of Preloading Methods

A comparison of the rigidity using both preloading methods is shown in Fig. 10.6. The position preload and constant-pressure preload may be compared as follows:

- (1) When both of the preloads are equal, the position preload provides greater bearing rigidity, in other words, the deflection due to external loads is less for bearings with a position preload.
- (2) In the case of a position preload, the preload varies depending on such factors as a difference in axial expansion due to a temperature difference between the shaft and housing, a difference in radial expansion due to a temperature difference between the inner and outer rings, deflection due to load, etc.



 F_{aA} : Axial load imposed on Bearing A F_{aB} : Axial load imposed on Bearing B

 δ_a : Displacement of duplex bearing set

: Displacement of Bearing A Displacement of Bearing B



In the case of a constant-pressure preload, it is possible to minimize any change in the preload because the variation of the spring load with shaft expansion and contraction is negligible. From the foregoing explanation, it is seen that position preloads are generally preferred for increasing rigidity and constant-pressure preloads are more suitable for high speed applications, for prevention of axial vibration, for use with thrust bearings on horizontal shafts, etc.

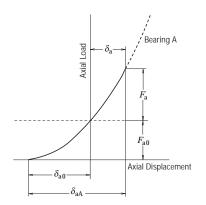


Fig. 10.5 Axial Displacement with Constant-Pressure Preload

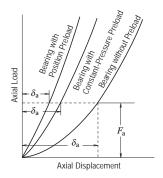


Fig. 10.6 Comparison of Rigidities and Preloading Methods



10.4.2 Amount of Preload

If the preload is larger than necessary, abnormal heart generation, increased frictional torque, reduced fatigue life, etc. may occur. The amount of the preload should be carefully determined considering the operating conditions and the purpose of the preload.

(1) Preloading of Duplex Angular Contact Ball **Bearings**

Average preloads for duplex angular contact ball bearings (contact angle of 15°) with precision better than P5 class, which are used on the main shafts of machine tools, are listed in Table 10.2.

The recommended fitting between the shaft and inner ring and between the housing and outer ring are listed in Table 10.1. In the case of fits with housings, the lower limit of the fitting range should be selected for fixed-end bearings and the upper limit for free-end

As a general rule, an extra light or light preload should be selected for grinding spindles and the main shafts of machining centers, while a medium preload should be adopted for the main shafts of lathes requiring

When speeds result in a value of $D_{pw} \times n$ ($d_{m}n$ value) higher than 500000, the preload should be very carefully studied and selected. In such a case, please consult with NSK beforehand.

Table 10 2 1 Duplex Bearings of Series 79

	Table To	. 2. 1 Duplex beal	ings of Series 79	Units : N				
	Preloads							
Bearing	Extra light	Light	Medium	Heavy				
No.	Preload EL	Preload L	Preload M	Preload H				
7900 C	7	15	29	59				
7901 C	8.6	15	39	78				
7902 C	12	25	49	100				
7903 C	12	25	59	120				
7904 C	19	39	78	150				
7905 C	19	39	100	200				
7906 C	24	49	100	200				
7907 C	34	69	150	290				
7908 C	39	78	200	390				
7909 C	50	100	200	390				
7910 C	50	100	250	490				
7911 C	60	120	290	590				
7912 C	60	120	290	590				
7913 C	75	150	340	690				
7914 C	100	200	490	980				
7915 C	100	200	490	980				
7916 C	100	200	490	980				
7917 C	145	290	640	1 270				
7918 C	145	290	740	1 470				
7919 C	145	290	780	1 570				
7920 C	195	390	880	1 770				

Table 10. 1 Recommended Fitting for High Accuracy Duplex Angular Contact Ball Bearings with Preload

omo. pm						
Nominal Bore Dia. $oldsymbol{d}$ (mm)		Target Shaft Interference		Outside ia. nm)	Target Housing	
over	incl.		over incl.		Clearance	
18 30	18 30 50	0 to 2 0 to 2.5 0 to 2.5	18 30	18 30 50	 2 to 6 2 to 6	
50 80 120	80 120 150	0 to 3 0 to 4 —	50 80 120	80 120 150	3 to 8 3 to 9 4 to 12	
150 180	180 250	_	150 180	180 250	4 to 12 5 to 15	

Bearing

No.

7000 C

7001 C

7002 C

7003 C

7004 C

7005 C

7006 C

7007 C

7008 C

7009 C

7010 C

7011 C

7012 C

7013 C

7014 C

7015 C

7016 C

7017 C

7018 C

7019 C

7020 C

Table 10. 2 Preloads for Duplex

Light

Preload L

25

25

29

29

49

59

78

120

120

150

150

200

200

250

290

290

390

390

490

540

540

Extra light

Preload EL

12

12

14

14

24

29

39

60

75

75

100

100

125

145

195

195

245

270

Units · um

Table 10. 2. 2 Duplex

(2) Preload of Thrust Ball Bearings

When the balls in thrust ball bearings rotate at relatively high speeds, sliding due to gyroscopic moments on the balls may occur. The larger of the two values obtained from Equations(10.1) and (10.2) below should be adopted as the minimum axial load in order to prevent such sliding

$$F_{\text{a min}} = \frac{C_{0 \text{ a}}}{100} \left(\frac{n}{N_{\text{max}}}\right)^2 \dots (10.1)$$

$$F_{\rm a\,min} = \frac{C_{0\,\rm a}}{1000}$$
(10.2)

 $\begin{array}{cc} \text{where} & F_{\text{a}\min}: \text{Minimum axial load (N), \{kgf\}} \\ & n: \text{Speed (min}^{\text{-1}}) \end{array}$

 C_{0a} : Basic static load rating (N), {kgf} N_{max} : Limiting speed (oil lubrication) (min⁻¹)

Angular Contact Ball Bearings

Bearings of Series 70

Medium

Preload M

59

69

69

120

150

200

250

290

340

390

490

540

540

740

780

930

980

1 180

1 180

1 270

Preloads

Units : N

1 5 7 0

1 860

1 960

2 350

2 350

2 5 5 0

Heavy Preload H	
100 120 150	
150 250 290	
390 490 590	
690 780 980	
1 080 1 080 1 470	

				Orinto .					
		Preloads							
Bearing	Extra light	Light	Medium	Heavy					
No.	Preload EL	Preload L	Preload M	Preload H					
7200 C	14	29	69	150					
7201 C	19	39	100	200					
7202 C	19	39	100	200					
7203 C	24	49	150	290					
7204 C	34	69	200	390					
7205 C	39	78	200	390					
7206 C	60	120	290	590					
7207 C	75	150	390	780					
7208 C	100	200	490	980					
7209 C	125	250	540	1 080					
7210 C	125	250	590	1 180					
7211 C	145	290	780	1 570					
7212 C	195	390	930	1 860					
7213 C	220	440	1 080	2 160					
7214 C	245	490	1 180	2 350					
7215 C	270	540	1 230	2 450					
7216 C	295	590	1 370	2 750					
7217 C	345	690	1 670	3 330					
7218 C	390	780	1 860	3 730					
7219 C	440	880	2 060	4 120					
7220 C	490	980	2 350	4 710					

(3) Preload of Spherical Thrust Roller Bearings

When spherical thrust roller bearings are used, damage such as scoring may occur due to sliding between the rollers and outer ring raceway. The minimum axial load $F_{\rm a \ min}$ necessary to prevent such sliding is obtained from the following equation:

$$F_{\rm a\,min} = \frac{C_{0\,\rm a}}{1000} \qquad (10.3)$$

Units: N



11. DESIGN OF SHAFTS AND HOUSINGS

11.1 Accuracy and Surface Finish of Shafts and Housings

If the accuracy of a shaft or housing does not meet the specification, the performance of the bearings will be affected and they will not provide their full capability. For example, inaccuracy in the squareness of the shaft shoulder may cause misalignment of the bearing inner and outer rings, which may reduce the bearing fatigue life by adding an edge load in addition to the normal load. Cage fracture and seizure sometimes occur for this same reason. Housings should be rigid in order to provide firm bearing support. High rigidity housings are advantageous also from he standpoint of noise, load distribution, etc.

For normal operating conditions, a turned finish or smooth bored finish is sufficient for the fitting surface; however, a ground finish is necessary for applications where vibration and noise must be low or where heavy loads are applied.

In cases where two or more bearings are mounted in one single-piece housing, the fitting surfaces of the housing bore should be designed so both bearing seats may be finished together with one operation such as in -line boring. In the case of split housings, care must be taken in the fabrication of the housing so the outer ring will not become deformed during installation. The accuracy and surface finish of shafts and housings are listed in Table 11.1 for normal operating conditions.

Table 11. 1 Accuracy and Roughness of Shaft and Housing

Item	Class of Bearings	Shaft	Housing Bore
Tolerance for	Normal, Class 6	$\frac{\text{IT3}}{2}$ to $\frac{\text{IT4}}{2}$	$\frac{\text{IT4}}{2}$ to $\frac{\text{IT5}}{2}$
Out-of-roundness	Class 5, Class 4	$\frac{\text{IT2}}{2}$ to $\frac{\text{IT3}}{2}$	$\frac{\text{IT2}}{2}$ to $\frac{\text{IT3}}{2}$
Tolerance for	Normal, Class 6	$\frac{\text{IT3}}{2}$ to $\frac{\text{IT4}}{2}$	$\frac{\text{IT4}}{2}$ to $\frac{\text{IT5}}{2}$
Cylindricality	Class 5, Class 4	$\frac{\text{IT2}}{2}$ to $\frac{\text{IT3}}{2}$	$\frac{\text{IT2}}{2}$ to $\frac{\text{IT3}}{2}$
Tolerance for	Normal, Class 6	IT3	IT3 to IT4
Shoulder Runout	Class 5, Class 4	IT3	IT3
Roughness of Fitting Surfaces R _a	Small Bearings Large Bearings	0.8 1.6	1.6 3.2

Remarks This table is for general recommendation using radius measuring method, the basic tolerance (IT) class should be selected in accordance with the bearing precision class. Regarding the figures of IT, please refer to the Appendix Table 11 (page C22). In cases that the outer ring is mounted in the housing bore with interference or that a thin crosssection bearing is mounted on a shaft and housing. the accuracy of the shaft and housing should be higher since this affects the bearing raceway directly.

11.2 Shoulder and Fillet Dimensions

The shoulders of the shaft or housing in contact with the face of a bearing must be perpendicular to the shaft center line. (Refer to Table 11.1) The front face side shoulder bore of the housing for a tapered roller bearing should be parallel with the bearing axis in order to avoid interference with the cage.

The fillets of the shaft and housing should not come in contact with the bearing chamfer; therefore, the fillet radius r_a must be smaller than the minimum bearing chamfer dimension r or r_1 .

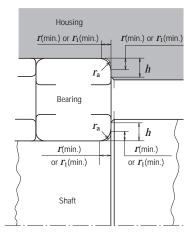


Fig. 11.1 Chamfer Dimensions, Fillet Radius of Shaft and Housing, and Shoulder Height

The shoulder heights for both shafts and housings for radial bearings should be sufficient to provide good support over the face of the bearings, but enough face should extend beyond the shoulder to permit use of special dismounting tools. The recommended minimum shoulder heights for metric series radial bearings are listed in Table 11.2

Nominal dimensions associated with bearing mounting are listed in the bearing tables including the proper shoulder diameters. Sufficient shoulder height is particularly important for supporting the side ribs of tapered roller bearings and cylindrical roller bearings subjected to high axial loads.

The values of \vec{h} and \vec{r}_a in Table 11.2 should be adopted in those cases where the fillet radius of the shaft or housing is as shown in Fig. 11.2 (a), while the values in Table 11.3 are generally used with an undercut fillet radius produced when grinding the shaft as shown in Fig. 11.2 (b).

Table 11. 2 Recommended Minimum Shoulder Heights for Use with Metric Series Radial Bearings

Units: mm

			Units : mm				
Nominal	Shaft or Housing						
Chamfer	Fillet	Minimun Sho	ulder Heights				
Dimensions		h (n	nin.)				
$m{arGamma}(ext{min.})$ or $m{arGamma}_1$ (min.)	Radius $oldsymbol{arGamma}_{a}$ (max.)	Deep Groove Ball Bearings, Self-Aligning Ball Bearings, Cylindrical Roller Bearings, Solid Needle Roller Bearings	Angular Contact Ball Bearings, Tapered Roller Bearings, Spherical Roller Bearings				
0.05	0.05	0.2	_				
0.08	0.08	0.3	_				
0.1	0.1	0.4	_				
0.15	0.15	0.6	_				
0.2	0.2	0.8	_				
0.3	0.3	1	1.25				
0.6	0.6	2	2.5				
1	1	2.5	3				
1.1	1	3.25	3.5				
1.5	1.5	4	4.5				
2	2	4.5	5				
2.1	2	5.5	6				
2.5	2	—	6				
3	2.5	6.5	7				
4	3	8	9				
5	4	10	11				
6	5	13	14				
7.5	6	16	18				
9.5	8	20	22				
12	10	24	27				
15	12	29	32				
19	15	38	42				



- Remarks 1. When heavy axial loads are applied, the shoulder height must be sufficiently higher than the values listed.
 - 2. The fillet radius of the corner is also applicable to thrust bearings.
 - 3. The shoulder diameter is listed instead of shoulder height in the bearing tables.



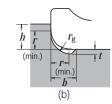


Fig. 11. 2 Chamfer Dimensions, Fillet Radius, and Shoulder Height

Table 11. 3 Shaft Undercut

Units: mm

Chamfer Dimensions of Inner and	Undercut Dimensions						
Outer Rings $m{r}$ (min.) or $m{r}_1$ (min.)	t	$r_{ m g}$	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				
2.5	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				



For thrust bearings, the squareness and contact area of the supporting face for the bearing rings must be adequate. In the case of thrust ball bearings, the housing shoulder diameter D_a should be less than the pitch circle diameter of the balls, and the shaft shoulder diameter d_a should be greater than the pitch circle diameter of the balls (Fig. 11.3).

For thrust roller bearings, it is advisable for the full contact length between rollers and rings to be supported by the shaft and housing shoulder (Fig. 11.4).

These diameters d_a and D_a are listed in the bearing tables.

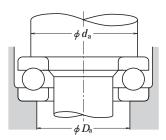


Fig. 11.3 Face Supporting Diameters for Thrust Ball Bearings

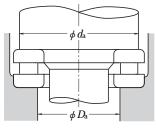


Fig. 11.4 Face Supporting Diameters for Thrust Roller Bearings

(a)

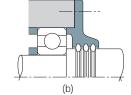


Fig. 11.5 Examples of Oil Grooves

11.3 Bearing Seals

To insure the longest possible life of a bearing, it may be necessary to provide seals to prevent leakage of lubricant and entry of dust, water and other harmful material like metallic particles. The seals must be free from excessive running friction and the probability of seizure. They should also be easy to assemble and disassemble. It is necessary to select a suitable seal for each application considering the lubricating method.

11.3.1 Non-Contact Type Seals

Various sealing devices that do not contact the shaft, such as oil grooves, flingers, and labyrinths, are available. Satisfactory sealing can usually be obtained with such seals because of their close running clearance. Centrifugal force may also assist in preventing internal contamination and leakage of the lubricant.

(1) Oil Groove Seals

The effectiveness of oil groove seals is obtained by means of the small gap between the shaft and housing bore and by multiple grooves on either or both of the housing bore and shaft surface (Fig. 11.5 (a), (b)).

Since the use of oil grooves alone is not completely effective, except at low speeds, a flinger or labyrinth type seal is often combined with an oil groove seal (Fig. 11.5 (c)). The entry of dust is impeded by packing grease with a consistency of about 200 into the

The smaller the gap between the shaft and housing, the greater the sealing effect; however, the shaft and housing must not come in contact while running. The recommended gaps are given in Table 11.4.

The recommended groove width is approximately 3 to 5mm, with a depth of about 4 to 5mm. In the case of sealing methods using grooves only, there should be three or more grooves.

(c)

(2) Flinger (Slinger) Type Seals

A flinger is designed to force water and dust away by means of the centrifugal force acting on any contaminants on the shaft. Sealing mechanisms with flingers inside the housing as shown in Fig. 11.6 (a), (b) are mainly intended to prevent oil leakage, and are used in environments with relatively little dust. Dust and moisture are prevented from entering by the centrifugal force of flingers shown in Figs 11.6 (c), (d).

Table 11. 4 Gaps between Shafts and Housings for Oil-Groove Type Seals

	Units : mm
Nominal Shaft Diameter	Radial Gap
Under 50	0.25 to 0.4
50-200	0.5 to 1.5

(3) Labyrinth Seals

Labyrinth seals are formed by interdigitated segments attached to the shaft and housing that are separated by a very small gap. They are particularly suitable for preventing oil leakage from the shaft at high speeds. The type shown in Fig. 11.7 (a) is widely used because of its ease of assembly, but those shown in Fig. 11.7 (b), (c) have better seal effectiveness.

Table 11. 5 Labyrinth Seal Gaps

Units: mm

Nominal Shaft Diameter	Labyrinth Gaps				
Norminal Shart Diameter	Radial Gap	Axiall Gap			
Under 50	0.25 to 0.4	1 to 2			
50-200	0.5 to 1.5	2 to 5			

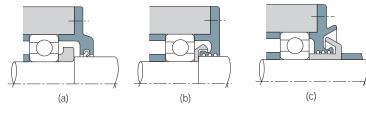
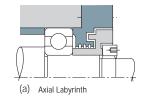
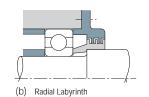


Fig. 11.6 Examples of Flinger Configurations







(d)

Fig. 11.7 Examples of Labyrinth Designs



11.3.2 Contact Type Seals

The effectiveness of contact seals is achieved by the physical contact between the shaft and seal, which may be made of synthetic rubber, synthetic resin, felt, etc. Oil seals with synthetic rubber lips are most frequently used.

(1) Oil Seals

Many types of oil seals are used to prevent lubricant from leaking out as well as to prevent dust, water, and other foreign matter from entering (Figs. 11.8 and

In Japan, such oil seals are standardized (Refer to JIS B 2402) on the basis of type and size. Since many oil seals are equipped with circumferential springs to maintain adequate contact force, oil seals can follow the non-uniform rotational movement of a shaft to some degree.

Seal lip materials are usually synthetic rubber including nitrile, acrylate, silicone, and fluorine. Tetrafluoride ethylene is also used. The maximum allowable operating temperature for each material increases in this same order.

Synthetic rubber oil seals may cause trouble such as overheating, wear, and seizure, unless there is an oil film between the seal lip and shaft. Therefore, some lubricant should be applied to the seal lip when the

seals are installed. It is also desirable for the lubricant inside the housing to spread a little between the sliding surfaces. However, please be aware that ester-based grease will cause acrylic rubber material to swell. Also, low aniline point mineral oil, silicone-based grease, and silicon-based oil will cause silicone-based material to swell. Moreover, urea-based grease will cause fluorinebased material to deteriorate.

The permissible circumferential speed for oil seals varies depending on the type, the finish of the shaft surface, liquid to be sealed, temperature, shaft eccentricity, etc. The temperature range for oil seals is restricted by the lip material. Approximate circumferential surface speeds and temperature permitted under favorable conditions are listed in Table

When oil seals are used at high circumferential surface speed or under high internal pressure, the contact surface of the shaft must be smoothly finished and the shaft eccentricity should be less than 0.02 to 0.05 mm. The hardness of the shaft's contact surface should be made higher than HRC40 by means of heat treatment or hard chrome plating in order to gain abrasion resistance. If possible, a hardness of more than HRC 55 is recommended.

The approximate level of contact surface finish required for several shaft circumferential surface speeds is given in Table 11.7.

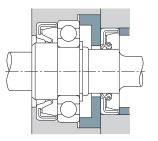


Fig. 11.8 Example of Application of Oil Seal (1)

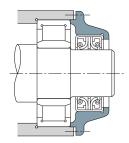


Fig. 11.9 Example of Application of Oil Seal (2)

Table 11. 6 Permissible Circumferential Surface Speeds and Temperature Range for Oil Seals

Seal Materials		Permissible Circumferential Speeds(m/sec)	Operating Temperature Range(°C)(¹)
	Nitrile Rubber	Under 16	-25 to +100
Synthetic	Acrylic Rubber	Under 25	-15 to +130
Rubber	Silicone Rubber	Under 32	-70 to +200
	Fluorine- containes Rubber	Under 32	-30 to +200
Tetrafluoride Ethylene Resin		Under 15	-50 to +220

Note (1) The upper limit of the temperature range may be raised about 20 °C for operation for short intervals.

Table 11. 7 Shaft Circumferential Surface Speeds and Finish of Contact Surfaces

Surface Finish $R_a\ (\mu m)$
0.8
0.4
0.2

(2) Felt Seals

Felt seals are one of the simplest and most common seals being used for transmission shafts, etc. However, since oil permeation and leakage are

unavoidable if oil is used, this type of seal is used only

for grease lubrication, primarily to prevent dust and other foreign matter from entering. Felt seals are not suitable for circumferential surface speeds exceeding 4 m/sec; therefore, it is preferable to replace them with synthetic rubber seals depending on the application.

12. LUBRICATION

12.1 Purposes of Lubrication

The main purposes of lubrication are to reduce friction and wear inside the bearings that may cause premature failure. The effects of lubrication may be briefly explained as follows:

(1) Reduction of Friction and Wear

Direct metallic contact between the bearing rings, rolling elements and cage, which are the basic components of a bearing, is prevented by an oil film which reduces the friction and wear in the contact areas.

(2) Extension of Fatigue Life

The rolling fatigue life of bearings depends greatly upon the viscosity and film thickness between the rolling contact surfaces. A heavy film thickness prolongs the fatigue life, but it is shortened if the viscosity of the oil is too low so the film thickness is insufficient.

(3) Dissipation of Frictional Heat and Cooling Circulation lubrication may be used to carry away frictional heat or heat transferred from the outside to prevent the bearing from overheating and the oil from deteriorating.

(4) Others

Adequate lubrication also helps to prevent foreign material from entering the bearings and guards against corrosion or rusting.

12.2 Lubricating Methods

The various lubricating methods are first divided into either grease or oil lubrication. Satisfactory bearing performance can be achieved by adopting the lubricating method which is most suitable for the particular application and operating condition.

In general, oil offers superior lubrication; however, grease lubrication allows a simpler structure around the bearings. A comparison of grease and oil lubrication is given in Table 12.1.

Table 12. 1 Comparison of Grease and Oil Lubrication

Item	Grease Lubrication	Oil Lubrication		
Housing Structure and Sealing Method	Simple	May be complex, Careful maintenance required.		
Speed	Limiting speed is 65% to 80% of that with oil lubrication.	Higher limiting speed.		
Cooling Effect	Poor	Heat transter is possible using forced oil circulation.		
Fluidity	Poor	Good		
Full Lubricant Replacement	Sometimes difficult	Easy		
Removal of Foreign Matter	Removal of particles from grese is impossible.	Easy		
External Contamination due to Leakage	Surroundings seldom contaminated by leakage.	Often leaks without proper countermeasures. Not suitable if external contamination must be avoided.		

12.2.1 Grease Lubrication

(1) Grease Quantity

The quantity of grease to be packed in a housing depends on the housing design and free space, grease characteristics, and ambient temperature. For example, the bearings for the main shafts of machine tools, where the accuracy may be impaired by a small temperature rise, require only a small amount of grease. The quantity of grease for ordinary bearings is determined as follows.

Sufficient grease must be packed inside the bearing including the cage guide face. The available space inside the housing to be packed with grease depends on the speed as follows:

1/2 to 2/3 of the space ... When the speed is less than 50% of the limiting speed.

1/3 to 1/2 of the space ... When the speed is more than 50% of the limiting speed.

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(2) Replacement of Grease

Grease, once packed, usually need not be replenished for a long time; however, for severe operating conditions, grease should be frequently replenished or replaced. In such cases, the bearing housing should be designed to facilitate grease replenishment and replacement.

When replenishment intervals are short, provide replenishment and discharge ports at appropriate positions so deteriorated grease is replaced by fresh grease. For example, the housing space on the grease supply side can be divided into several sections with partitions. The grease on the partitioned side gradually passes through the bearings and old grease forced from the bearing is discharged through a grease valve (Fig. 12.1). If a grease valve is not used, the space on

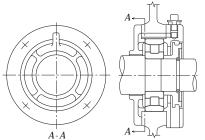


Fig. 12.1 Combination of Partitioned Grease Reservoir and Grease Valve

Radial Ball Bearings 20 000 10 0 Interval, t 8 000 6 000-5 000-4 000-3 000 2 000-1 000-800-600-Speed n

(1) Radial Ball Bearings, Cylindrical Roller Bearings

(3) Load factor

≤0.06 0.1 0.13 0.16 0.65 0.45 Load factor 1.5

the discharge side is made larger than the partitioned side so it can retain the old grease, which is removed periodically by removing the cover.

(3) Replenishing Interval

Even if high-quality grease is used, there is deterioration of its properties with time; therefore, periodic replenishment is required. Figs 12.2 (1) and (2) show the replenishment time intervals for various bearing types running at different speeds. Figs. 12.2 (1) and (2) apply for the condition of high-quality lithium soap-mineral oil grease, bearing temperature of 70°C. and normal load (P/C=0.1).

· Temperature If the bearing temperature exceeds 70°C, the replenishment time interval must be reduced by half for every 15°C temperature rise of the bearings.

· Grease

In case of ball bearings especially, the replenishing time interval can be extended depending on used grease type. (For example, high-quality lithium soapsynthetic oil grease may extend about two times of replenishing time interval shown in Fig.12.2 (1). If the temperature of the bearings is less than 70°C, the usage of lithium soap-mineral oil grease or lithium soap-synthetic oil grease is appropriate.)

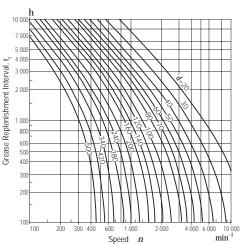
It is advisable to consult NSK.

Load

The replenishing time interval depends on the magnitude of the bearing load.

Please refer to Fig. 12.2 (3).

If P/C exceeds 0.16, it is advisable to consult NSK.



(2) Tapered Roller Bearings, Spherical Roller Bearings

min-1

(4) Grease Life of Sealed Ball Bearings

When grease is packed into single-row deep groove ball bearings, the grease life may be estimated using Equation (12.1) or (12.2) or Fig. 12.3: (General purpose grease (1))

$$log t = 6.54 - 2.6 \frac{n}{N_{\text{max}}} - \left(0.025 - 0.012 \frac{n}{N_{\text{max}}}\right)T$$
.....(12.1)

(Wide-range grease (2))

$$log \ t = 6.12 - 1.4 \frac{n}{N_{\text{max}}} - \left(0.018 - 0.006 \frac{n}{N_{\text{max}}}\right)T$$
.....(12.2)

where *t*: Average grease life, (h)

n: Speed (min⁻¹)

 $N_{\rm max}$: Limiting speed with grease lubrication (values for ZZ and VV types listed in the

bearing tables)

T: Operating temperature °C

Equations (12.1) and (12.2) and Fig. 12.3 apply under the following conditions:

(a) Speed, n

$$0.25 \leq \frac{n}{N_{\text{max}}} \leq 1$$

when
$$\frac{n}{N_{\rm max}}$$
 < 0.25, assume $\frac{n}{N_{\rm max}}$ = 0.25

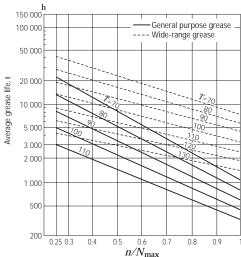


Fig. 12.3 Grease Life of Sealed Ball Bearings

(b) Operating Temperature, T For general purpose grease (1)

70 °C ≤ T ≤ 110 °C

For wide-range grease (2)

70 °C ≤ T ≤ 130 °C

When T < 70 °C assume T = 70 °C

(c) Bearing Loads

The bearing loads should be about 1/10 or less of the basic load rating C_r .

- Notes (1) Mineral-oil base greases (e.g. lithium soap base grease) which are often used over a temperature range of around – 10 to 110 °C.
 - (2) Synthetic-oil base greases are usable over a wide temperature range of around - 40 to 130 °C.

12.2.2 Oil Lubrication

(1) Oil Bath Lubrication

Oil bath lubrication is a widely used with low or medium speeds. The oil level should be at the center of the lowest rolling element. It is desirable to provide a sight gauge so the proper oil level may be maintained (Fig. 12.4)

(2) Drip-Feed Lubrication

Drip feed lubrication is widely used for small ball bearings operated at relatively high speeds. As shown in Fig. 12.5, oil is stored in a visible oiler. The oil drip rate is controlled with the screw in the top

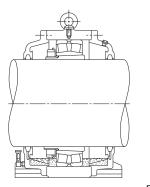


Fig. 12.4 Oil Bath Lubrication



Lubrication



(3) Splash Lubrication

With this lubricating method, oil is splashed onto the bearings by gears or a simple rotating disc installed near bearings without submerging the bearings in oil. It is commonly used in automobile transmissions and final drive gears. Fig. 12.6 shows this lubricating method used on a reduction gear.

(4) Circulating Lubrication

Circulating lubrication is commonly used for high speed operation requiring bearing cooling and for bearings used at high temperatures. As shown in Fig. 12.7 (a), oil is supplied by the pipe on the right side, it travels through the bearing, and drains out through the pipe on the left. After being cooled in a reservoir, it returns to the bearing through a pump and filter.

The oil discharge pipe should be larger than the supply pipe so an excessive amount of oil will not back up in the housing.

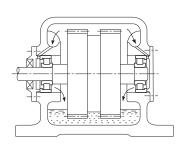


Fig. 12.6 Splash Lubrication

(5) Jet Lubrication

Jet lubrication is often used for ultra high speed bearings, such as the bearings in jet engines with a $d_{\mathbf{m}}n$ valve ($d_{\mathbf{m}}$: pitch diameter of rolling element set in mm; n: rotational speed in \min^{-1}) exceeding one million. Lubricating oil is sprayed under pressure from one or more nozzles directly into the bearing.

Fig. 12.8 shows an example of ordinary jet lubrication. The lubricating oil is sprayed on the inner ring and cage guide face. In the case of high speed operation, the air surrounding the bearing rotates with it causing the oil jet to be deflected. The jetting speed of the oil from the nozzle should be more than 20 % of the circumferential speed of the inner ring outer surface (which is also the guide face for the cage).

More uniform cooling and a better temperature distribution is achieved using more nozzles for a given amount of oil. It is desirable for the oil to be forcibly discharged so the agitating resistance of the lubricant can be reduced and the oil can effectively carry away the heat.

(6) Oil Mist Lubrication

Oil mist lubrication, also called oil fog lubrication, utilizes an oil mist sprayed into a bearing. This method has the following advantages:

(a) Because of the small quantity of oil required, the oil agitation resistance is small, and higher speeds are possible.

(b) Contamination of the vicinity around the bearing is slight because the oil leakage is small.

(c) It is relatively easy to continuously supply fresh oil; therefore, the bearing life is extended.

This lubricating method is used in bearings for the high speed spindles of machine tools, high speed pumps, roll necks of rolling mills, etc (Fig. 12.9).

For oil mist lubrication of large bearings, it is advisable to consult NSK.

(7) Oil/Air Lubricating Method

Using the oil/air lubricating method, a very small amount of oil is discharged intermittently by a constant-quantity piston into a pipe carrying a constant flow of compressed air. The oil flows along the wall of the pipe and approaches a constant flow rate.

The major advantages of oil/air lubrication are:

(a) Since the minimum necessary amount of oil is supplied, this method is suitable for high speeds because less heat is generated.

(b) Since the minimum amount of oil is fed continuously, bearing temperature remains stable. Also, because of the small amount of oil, there is almost no atmospheric pollution.

(c) Since only fresh oil is fed to the bearings, oil deterioration need not be considered.

(d) Since compressed air is always fed to the bearings, the internal pressure is high, so dust, cutting fluid, etc. cannot enter.

For these reasons, this method is used in the main spindles of machine tools and other high speed applications (Fig. 12.10).

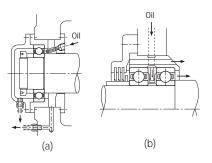


Fig. 12.8 Jet Lubrication

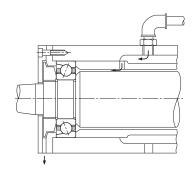


Fig. 12.9 Oil Mist Lubrication

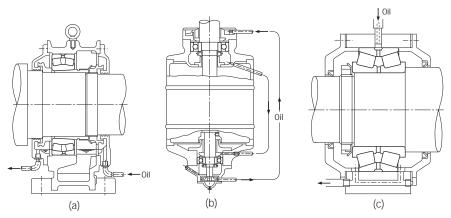


Fig. 12.7 Circulating Lubrication

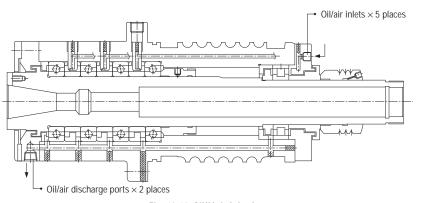


Fig. 12.10 Oil/Air Lubrication

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12.3 Lubricants

12.3.1 Lubricating Grease

Grease is a semi-solid lubricant consisting of base oil, a thickener and additives. The main types and general properties of grease are shown in Table 12.2. It should be remembered that different brands of the same type of grease may have different properties.

(1) Base Oil

Mineral oils or synthetic oils such as silicone or diester oil are mainly used as the base oil for grease. The lubricating properties of grease depend mainly on the characteristics of its base oil. Therefore, the viscosity of the base oil is just as important when selecting grease as when selecting an oil. Usually, grease made with low viscosity base oils is more suitable for high speeds and low temperatures, while greases made with high viscosity base oils are more suited for high temperatures and heavy loads.

However, the thickener also influences the lubricating properties of grease; therefore, the selection criteria for grease is not the same as for lubricating oil. Moreover, please be aware that ester-based grease will cause acrylic rubber material to swell, and that silicone-based grease will cause silicone-based material to swell.

(2) Thickener

As thickeners for lubricating grease, there are several types of metallic soaps, inorganic thickeners such as silica gel and bentonite, and heat resisting organic thickeners such as polyurea and fluoric compounds.

The type of thickener is closely related to the grease dropping point (1); generally, grease with a high dropping point also has a high temperature capability during operation. However, this type of grease does not have a high working temperature unless the base oil is heat-resistant. The highest possible working temperature for grease should be determined considering the heat resistance of the base oil.

The water resistance of grease depends upon the type of thickener. Sodium soap grease or compound grease containing sodium soap emulsifies when exposed to water or high humidity, and therefore, cannot be used where moisture is prevalent. Moreover, please be aware that urea-based grease will cause fluorine-based material to deteriorate.

Note (1) The grease dropping point is that temperature at which a grease heated in a specified small container becomes sufficiently fluid to drip.

Table 12.2

			Table 12.2			
Name (Popular name)						
Thickener	Li Soap					
Base Oil Properties	Mineral Oil	Silicone Oil				
Dropping Point,°C	170 to 195	170 to 195	200 to 210			
Working Temperatures, °C	-20 to +110	-50 to +130	-50 to +160			
Working Speed, %(1)	70	100	60			
Mechanical Stability	Good	Good	Good			
Pressure Resistance	Fair	Poor				
Water Resistance	Good	Good				
Rust Prevention	Good	Good	Poor			
Remarks	General purpose grease used for numerous applications	Good low temperature and torque characteristics. Often used for small motors and instrument bearings. Pay attention to rust caused by insulation varnish.	Mainly for high temperature applications. Unsuitable for bearings for high and low speeds or heavy loads or those having numerous sliding-contact areas (roller bearings, etc.)			

Note (i) The values listed are percentages of the limiting speeds given in the bearing tables.

(3) Additives

Grease often contains various additives such as antioxidants, corrosion inhibitors, and extreme pressure additives to give it special properties. It is recommended that extreme pressure additives be used in heavy load applications. For long use without replenishment, an antioxidant should be added.

(4) Consistency

Consistency indicates the "softness" of grease. Table 12.3 shows the relation between consistency and working conditions.

Grease Properties

Sodium Grease (Fiber Grease)	Calcium Grease (Cup Grease)	Mixed Base Grease	Complex Base Grease (Complex Grease)	Non-Soap Base Grease (Non-Soap Grease)	
Na Soap	Ca Soap	Na + Ca Soap, Li + Ca Soap, etc.	Ca Complex Soap, Al Complex Soap, Li Complex Soap, etc.	Urea, Bentonite, Carbon Black, Fluor Compounds, Heat Resistant Organic Compound, etc.	
Mineral Oil	Mineral Oil	Mineral Oil	Mineral Oil	Mineral Oil	Synthetic Oil (Ester Oil, Polyatomic Ester Oil, Synthetic Hydrocarbon Oil, Silicone Oil, Fluoric Based Oil)
170 to 210	70 to 90	160 to 190	180 to 300	> 230	> 230
-20 to +130	-20 to +60	-20 to +80	-20 to +130	-10 to +130	< +220
70	40	70	70	70	40 to 100
Good	Poor	Good	Good	Good	Good
Fair	Poor	Fair to Good	Fair to Good	Fair	Fair
Poor	Good	Poor for Na Soap Grease	Good	Good	Good
Poor to Good	Good	Fair to Good	Fair to Good	Fair to Good	Fair to Good
Long and short fiber types are available. Long fiber grease is unsuitable for high speeds. Attention to water and high temperature is requred.	Extreme pressure grease containing high viscosity mineral oil and extreme pressure additive (Pb soap, etc.) has high pressure resistance.	Often used for roller bearings and large ball bearing.	Suitable for extreme pressures mechanically stable	Mineral oil base grease is middle and high temperature purpose lubricant. Synthetic oil base grease is recommended for low or high temperature. Some silicone and fluoric oil based grease have poor rust prevention and noise.	

Remarks The grease properties shown here can vary between brands.

Table 12.3 Consistency and Working Conditions

Consistency Number	0 1		2	3	4
Consistency(1) 1/10 mm	355 to 385	310 to 340	265 to 295	220 to 250	175 to 205
Working Conditions (Application)	-For centralized oiling -When fretting is likely to occur	For centralized oiling When fretting is likely to occur For low temperatures	-For general use -For sealed ball bearings	·For general use ·For sealed ball bearings ·For high temperatures	·For high temperatures ·For grease seals

Note (1) Consistency: The depth to which a cone descends into grease when a specified weight is applied, indicated in units of 1/10mm. The larger the value, the softer the grease.

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(5) Mixing Different Types of Grease

In general, different brands of grease must not be mixed. Mixing grease with different types of thickneners may destroy its composition and physical properties. Even if the thickeners are of the same type, possible differences in the additive may cause detrimental effects.

12.3.2 Lubricating Oil

The lubricating oils used for rolling bearings are usually highly refined mineral oil or synthetic oil that have a high oil film strength and superior oxidation and corrosion resistance. When selecting a lubricating oil, the viscosity at the operating conditions is important. If the viscosity is too low, a proper oil film is not formed and abnormal wear and seizure may occur. On the other hand, if the viscosity is too high, excessive viscous resistance may cause heating or large power loss. In general, low viscosity oils should be used at high speed; however, the viscosity should increase

with increasing bearing load and size.

Table 12.4 gives generally recommended viscosities for bearings under normal operating conditions.

For use when selecting the proper lubricating oil, Fig. 12.11 shows the relationship between oil temperature and viscosity, and examples of selection are shown in Table 12.5.

Table 12. 4 Bearing Types and Proper Viscosity of Lubricating Oils

Bearing Type	Proper Viscosity at Operating Temperature
Ball Bearings and Cylindrical Roller Bearings	Higher than 13mm ² /s
Tapered Roller Bearings and Spherical Roller Bearings	Higher than 20mm ² /s
Spherical Thrust Roller Bearings	Higher than $32mm^2/s$

Remarks 1mm²/s=1cSt (centistokes)

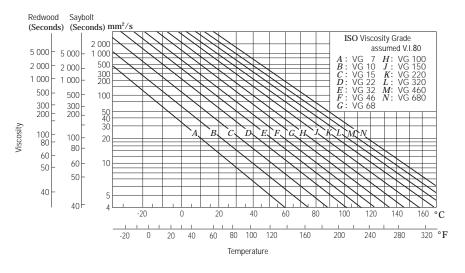


Fig. 12.11 Temperature-Viscosity Chart

Oil Replacement Intervals

Oil replacement intervals depend on the operating conditions and oil quantity.

In those cases where the operating temperature is less than 50°C, and the environmental conditions are good with little dust, the oil should be replaced approximately once a year. However, in cases where the oil temperature is about 100°C, the oil must be changed at least once every three months.

If moisture may enter or if foreign matter may be mixed in the oil, then the oil replacement interval must be shortened.

Mixing different brands of oil must be prevented for the same reason given previously for grease.

Table 12. 5 Examples of Selection Lubricating Oils

Operating Temperature	Speed	Light or normal Load	Heavy or Shock Load
-30 to 0 °C	Less than limiting speed	ISO VG 15, 22, 32 (refrigerating machine oil)	_
	Less than 50% of limiting speed	ISO VG 32, 46, 68 (bearing oil, turbine oil)	ISO VG 46, 68, 100 (bearing oil, turbine oil)
0 to 50 °C	50 to 100% of limiting speed	ISO VG 15, 22, 32 (bearing oil, turbine oil)	ISO VG 22, 32, 46 (bearing oil, turbine oil)
	More than limiting speed	ISO VG 10, 15, 22 (bearing oil)	-
50 to 80 °C	Less than 50% of limiting speed 50 to 100% of limiting speed	ISO VG 100, 150, 220 (bearings oil) ISO VG 46, 68, 100 (bearing oil, turbine oil)	ISO VG 150, 220, 320 (bearing oil) ISO VG 68, 100, 150 (bearing oil, turbine oil)
	More than limiting speed	ISO VG 32, 46, 68 (bearing oil, turbine oil)	_
	Less than 50% of limiting speed	ISO VG 320, 460 (bearing oil)	ISO VG 460, 680 (bearing oil, gear oil)
80 to 110 °C	50 to 100% of limiting speed	ISO VG 150, 220 (bearing oil)	ISO VG 220, 320 (bearing oil)
	More than limiting speed	ISO VG 68, 100 (bearing oil, turbine oil)	_

Remarks 1. For the limiting speed, use the values listed in the bearing tables.

- Refer to Refrigerating Machine Oils (JIS K 2211), Bearing Oils (JIS K 2239), Turbine Oils (JIS K 2213), Gear Oils (JIS K 2219).
- 3. If the operating temperature is near the high end of the temperature range listed in the left column, select a high viscosity oil.
- 4. If the operating temperature is lower than -30 $^{\circ}$ C or higher than 110 $^{\circ}$ C , it is advisable to consult NSK.

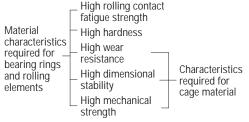
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13. BEARING MATERIALS

The bearing rings and rolling elements of rolling bearings are subjected to repetitive high pressure with a small amount of sliding. The cages are subjected to tension and compression and sliding contact with the rolling elements and either or both of the bearing rings.

Therefore, the materials used for the rings, rolling elements, and cages require the following characteristics:



Other necessary characteristics, such as easy production, shock and heat resistance, and corrosion resistance, are required depending on individual applications.

13.1 Materials for Bearing Rings and Rolling Elements

Primarily, high carbon chromium bearing steel (Table 13.1) is used for the bearing rings and rolling elements. Most NSK bearings are made of SUJ2 among the JIS steel types listed in Table 13.1, while the larger bearings generally use SUJ3. The chemical composition of SUJ2 is approximately the same as AISI 52100 specified in the USA, DIN 100 Cr6 in Germany and BS 535A99 in England.

For bearings that are subjected to very severe shock loads, carburized low-carbon alloy steels such as chrome steel, chrome molybdenum steel, nickel chrome molybdenum steel, etc. are often used. Such steels, when they are carburized to the proper depth and have sufficient surface hardness, are more shock resistant than normal, through-hardened bearing steels because of the softer energy-absorbing core. The chemical composition of common carburized bearing steels is listed in Table 13.2.

Table 13. 1 Chemical Composition of High-Carbon Chromium Bearing Steel (Major Elements)

Chandand	Symbols :	Chemical Composition (%)							
Standard		C	Si	Mn	P	S	Cr	Mo	
JIS G 4805	SUJ 2	0.95 to 1.10	0.15 to 0.35	Less than 0.50	Less than 0.025	Less than 0.025	1.30 to 1.60	-	
	SUJ 3	0.95 to 1.10	0.40 to 0.70	0.90 to 1.15	Less than 0.025	Less than 0.025	0.90 to 1.20	_	
	SUJ 4	0.95 to 1.10	0.15 to 0.35	Less than 0.50	Less than 0.025	Less than 0.025	1.30 to 1.60	0.10 to 0.25	
ASTM A 295	52100	0.93 to 1.05	0.15 to 0.35	0.25 to 0.45	Less than 0.025	Less than 0.015	1.35 to 1.60	Less than 0.10	

Table 13. 2 Chemical Composition of Carburizing Bearing Steels (Major Elements)

Ctandard	Cumbala		Chemical Composition (%)							
Standard	Symbols	С	Si	Mn	P	S	Ni	Cr	Mo	
JIS G 4052	SCr 420 H	0.17 to 0.23	0.15 to 0.35	0.55 to 0.95	Less than 0.030	Less than 0.030	Less than 0.25	0.85 to 1.25	_	
	SCM 420 H	0.17 to 0.23	0.15 to 0.35	0.55 to 0.95	Less than 0.030	Less than 0.030	Less than 0.25	0.85 to 1.25	0.15 to 0.35	
	SNCM 220 H	0.17 to 0.23	0.15 to 0.35	0.60 to 0.95	Less than 0.030	Less than 0.030	0.35 to 0.75	0.35 to 0.65	0.15 to 0.30	
	SNCM 420 H	0.17 to 0.23	0.15 to 0.35	0.40 to 0.70	Less than 0.030	Less than 0.030	1.55 to 2.00	0.35 to 0.65	0.15 to 0.30	
JIS G 4053	SNCM 815	0.12 to 0.18	0.15 to 0.35	0.30 to 0.60	Less than 0.030	Less than 0.030	4.00 to 4.50	0.70 to 1.00	0.15 to 0.30	
ASTM A 534	8620 H	0.17 to 0.23	0.15 to 0.35	0.60 to 0.95	Less than 0.025	Less than 0.015	0.35 to 0.75	0.35 to 0.65	0.15 to 0.25	
	4320 H	0.17 to 0.23	0.15 to 0.35	0.40 to 0.70	Less than 0.025	Less than 0.015	1.55 to 2.00	0.35 to 0.65	0.20 to 0.30	
	9310 H	0.07 to 0.13	0.15 to 0.35	0.40 to 0.70	Less than 0.025	Less than 0.015	2.95 to 3.55	1.00 to 1.40	0.08 to 0.15	

Table 13. 3 Chemical Composition of High Speed Steel for Bearings Used at High Temperatures

						•		•		•	•			
C	londord	Cumbolo					Ch	emical Com	position (%))				
3	lanuan u	Symbols	С	Si	Mn	P	S	Cr	Mo	V	Ni	Cu	Co	W
I	AISI	M50	0.77 to 0.85	Less than 0.25	Less than 0.35	Less than 0.015	Less than 0.015	3.75 to 4.25	4.00 to 4.50	0.90 to 1.10	Less than 0.10	Less than 0.10	Less than 0.25	Less than 0.25

NSK uses highly pure vacuum-degassed bearing steel containing a minimum of oxygen, nitrogen, and hydrogen compound impurities. The rolling fatigue life of bearings has been remarkably improved using this material combined with the appropriate heat treatment. For special purpose bearings, high temperature bearing steel, which has superior heat resistance, and stainless steel having good corrosion resistance may be used. The chemical composition of these special materials are given in Tables 13.3 and 13.4.

13.2 Cage Materials

The low carbon steels shown in Table 13.5 are the main ones for the pressed cages for bearings. Depending on the purpose, brass or stainless steel may be used. For machined cages, high strength brass (Table 13.6) or carbon steel (Table 13.5) is used. Sometimes synthetic resin is also used.

Table 13. 4 Chemical Composition of Stainless Steel for Rolling Bearing (Major Elements)

Standard	Cumbala			Chemi	ical Compositio	n (%)		
Staridard	Symbols	С	Si	Mn	P	S	Cr	Mo
JIS G 4303	SUS 440 C	0.95 to 1.20	Less than 1.00	Less than 1.00	Less than 0.040	Less than 0.030	16.00 to 18.00	Less than 0.75
SAE J 405	51440 C	0.95 to 1.20	Less than 1.00	Less than 1.00	Less than 0.040	Less than 0.030	16.00 to 18.00	Less than 0.75

Table 13. 5 Chemical Composition of Steel sheet and Carbon Steel for Cages (Major Elements)

Classification	Standard	Cumbala	Chemical Composition (%)						
Classification	Standard	Symbols	С	Si	Mn	P	S		
Steel sheet and	JIS G 3141	SPCC	Less than 0.12	_	Less than 0.50	Less than 0.04	Less than 0.045		
strip for pressed	BAS 361	SPB 2	0.13 to 0.20	Less than 0.30	0.25 to 0.60	Less than 0.03	Less than 0.030		
cages	JIS G 3311	S 50 CM	0.47 to 0.53	0.15 to 0.35	0.60 to 0.90	Less than 0.03	Less than 0.035		
Carbon steel for machined cages	JIS G 4051	S 25 C	0.22 to 0.28	0.15 to 0.35	0.30 to 0.60	Less than 0.03	Less than 0.035		

Remarks BAS is Japanese Bearing Association Standard.

Table 13. 6 Chemical Composition of High Strength Brass for Machined Cages

		Chemical Composition (%)										
Standard	Symbols	Symbols	Zn	M	Fe	Al	Sn	Ni	Impurities			
		Cu	ZII	Mn					Pb	Si		
JIS H 5120	CAC301 (HBsC 1)	55.0 to 60.0	33.0 to 42.0	0.1 to 1.5	0.5 to 1.5	0.5 to 1.5	Less than 1.0	Less than 1.0	Less than 0.4	Less than 0.1		
JIS H 3250	C 6782	56.0 to 60.5	Residual	0.5 to 2.5	0.1 to 1.0	0.2 to 2.0	_	_	Less than 0.5	_		

Remarks Improved HBsC 1 is also used.

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14. BEARING HANDLING

14.1 Precautions for Proper Handling of Bearings

Since rolling bearings are high precision machine parts, they must be handled accordingly. Even if high quality bearings are used, their expected performance cannot be achieved if they are not handled properly. The main precautions to be observed are as follows:

(1) Keep Bearings and Surrounding Area Clean

Dust and dirt, even if invisible to the naked eye, have harmful effects on bearings. It is necessary to prevent the entry of dust and dirt by keeping the bearings and their environment as clean as possible.

(2) Careful Handling

Heavy shocks during handling may cause bearings to be scratched or otherwise damaged possibly resulting in their failure. Excessively strong impacts may cause brinelling, breaking, or cracking.

(3) Use Proper Tools

Always use the proper equipment when handling bearings and avoid general purpose tools.

(4) Prevent Corrosion

Since perspiration on the hands and various other contaminants may cause corrosion, keep the hands clean when handling bearings. Wear gloves if possible. Pay attention to rust of bearing caused by corrosive gasses.

14.2 Mounting

The method of mounting rolling bearings strongly affects their accuracy, life, and performance, so their mounting deserves careful attention. Their characteristics should first be thoroughly studied, and then they should be mounted in the proper manner. It is recommended that the handling procedures for bearings be fully investigated by the design engineers and that standards be established with respect to the following items:

- (1) Cleaning the bearings and related parts.
- (2) Checking the dimensions and finish of related parts.
- (3) Mounting
- (4) Inspection after mounting.
- (5) Supply of Jubricants.

Bearings should not be unpacked until immediately before mounting. When using ordinary grease lubrication, the grease should be packed in the bearings without first cleaning them. Even in the case of ordinary oil lubrication, cleaning the bearings is not required. However, bearings for instruments or for high speed operation must first be cleaned with clean filtered oil in order to remove the anti-corrosion agent.

After the bearings are cleaned with filtered oil, they should be protected to prevent corrosion.

Prelubricated bearings must be used without cleaning. Bearing mounting methods depend on the bearing type and type of fit. As bearings are usually used on rotating shafts, the inner rings require a tight fit.

Bearings with cylindrical bores are usually mounted by pressing them on the shafts (press fit) or heating them to expand their diameter (shrink fit). Bearings with tapered bores can be mounted directly on tapered shafts or cylindrical shafts using tapered sleeves.

Bearings are usually mounted in housings with a loose fit. However, in cases where the outer ring has an interference fit, a press may be used. Bearings can be interference-fitted by cooling them before mounting using dry ice. In this case, a rust preventive treatment must be applied to the bearing because moisture in the air condenses on its surface.

14.2.1 Mounting of Bearings with Cylindrical Bores

(1) Press Fits

Fitting with a press is widely used for small bearings. A mounting tool is placed on the inner ring as shown in Fig. 14.1 and the bearing is slowly pressed on the shaft with a press until the side of the inner ring rests against the shoulder of the shaft. The mounting tool must not be placed on the outer ring for press mounting, since the bearing may be damaged. Before mounting, applying oil to the fitted shaft surface is recommended for smooth insertion. The mounting method using a hammer should only be used for small ball bearings with minimally tight fits and when a press is not available. In the case of tight interference fits or for medium and large bearings, this method should not be used. Any time a hammer is used, a mounting tool must be placed on the inner ring.

When both the inner and outer rings of non-separable bearings, such as deep groove ball bearings, require tight-fit, a mounting tool is placed on both rings as shown in Fig. 14.2, and both rings are fitted at the same time using a screw or hydraulic press. Since the outer ring of self-aligning ball bearings may deflect a mounting tool such as that shown in Fig. 14.2 should always be used for mounting them.

In the case of separable bearings, such as cylindrical roller bearings and tapered roller bearings, the inner and outer rings may be mounted separately. Assembly of the inner and outer rings, which were previously mounted separately, should be done carefully to align the inner and outer rings correctly. Careless or forced assembly may cause scratches on the rolling contact surfaces.

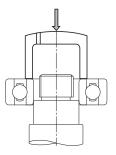


Fig. 14.1 Press Fitting Inner Ring

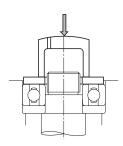
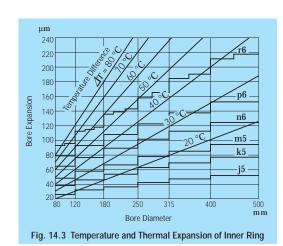


Fig. 14.2 Simultaneous Press Fitting of Inner and Outer Rings



(2) Shrink Fits

Since press fitting large bearings requires a large force, a shrink fit is widely used. The bearings are first heated in oil to expand them before mounting.

This method prevents an excessive force from being imposed on the bearings and allows mounting them in a short time.

The expansion of the inner ring for various temperature differences and bearing sizes is shown in Fig. 14.3. The precautions to follow when making shrink fits are as follows:

- (a) Do not heat bearings to more than 120°C.
- (b) Put the bearings on a wire net or suspend them in an oil tank in order to prevent them from touching the tank's bottom directly.
- (c) Heat the bearings to a temperature 20 to 30°C higher than the lowest temperature required for mounting without interference since the inner ring will cool a little during mounting.
- (d) After mounting, the bearings will shrink in the axial direction as well as the radial direction while cooling. Therefore, press the bearing firmly against the shaft shoulder using locating methods to avoid a clearance between the bearing and shoulder.

NSK Bearing Induction Heaters

Besides heating in oil, NSK Bearing Heaters, which use electromagnetic induction to heat bearings, are widely used. (Refer to Page C7.)

In NSK Bearing Heaters, electricity (AC) in a coil produces a magnetic field that induces a current inside the bearing that generates heat. Consequently, without using flames or oil uniform heating in a short time is possible, making bearing shrink fitting efficient and clean.

In the case of relatively frequent mounting and dismounting such as cylindrical roller bearings for roll necks of rolling mills and for railway journal boxes, induction heating should be used for mounting and dismounting inner rings.

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14.2.2 Mounting of Bearings with Tapered Bores

Bearings with tapered bores are mounted on tapered shafts directly or on cylindrical shafts with adapters or withdrawal sleeves (Figs. 14.4 and 14.5). Large spherical roller bearings are often mounted using hydraulic pressure. Fig. 14.6 shows a bearing mounting utilizing a sleeve and hydraulic nut. Fig. 14.7 shows another mounting method. Holes are drilled in the sleeve which are used to feed oil under pressure to the bearing seat. As the bearing expands radially, the sleeve is inserted axially with adjusting bolts.

Spherical roller bearings should be mounted while checking their radial-clearance reduction and referring to the push-in amounts listed in Table 14.1. The radial clearance must be measured using clearance gauges. In this measurement, as shown in Fig. 14.8, the

In this measurement, as shown in Fig. 14.8, the clearance for both rows of rollers must be measured simultaneously, and these two values should be kept roughly the same by adjusting the relative position of the outer and inner rings.

When a large bearing is mounted on a shaft, the outer ring may be deformed into an oval shape by its own weight. If the clearance is measured at the lowest part of the deformed bearing, the measured value may be bigger than the true value. If an incorrect radial internal clearance is obtained in this manner and the values in Table 14.1 are used, then the interference fit may

become too tight and the true residual clearance may become too small. In this case, as shown in Fig. 14.9. one half of the total clearance at points \boldsymbol{a} and \boldsymbol{b} (which are on a horizontal line passing through the bearing center) and \boldsymbol{c} (which is at the lowest position of the bearing) may be used as the residual clearance. When a self-aligning ball bearing is mounted on a shaft with an adapter, be sure that the residual clearance does not become too small. Sufficient clearance for easy alignment of the outer ring must be allowed.

14.3 Operation Inspection

After the mounting has been completed, a running test should be conducted to determine if the bearing has been mounted correctly. Small machines may be manually operated to assure that they rotate smoothly. Items to be checked include sticking due to foreign matter or visible flaws, uneven torque caused by improper mounting or an improper mounting surface, and excessive torque caused by an inadequate clearance, mounting error, or seal friction. If there are no abnormalities, powered operation may be started.

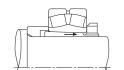


Fig. 14.4 Mounting with Adapter

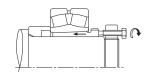


Fig. 14.5 Mounting with Withdrawal Sleeve

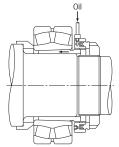


Fig. 14.6 Mounting with Hydraulic Nut

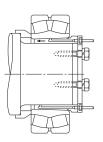


Fig. 14.7 Mounting with Special Sleeve and Hydraulic Pressure

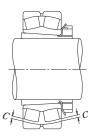
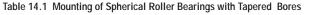


Fig. 14.8 Clearance Measurement of Spherical Roller Bearing



Units: mm

Bearing Bore Diameter		Reduction in Radial Clearance		Push	-in amour	nt in axial di	rection		Permissible Clearance
C	1			Taper	1:12	Taper	1:30		
over	incl.	min.	max.	min.	max.	min.	max.	CN	C3
30	40	0.025	0.030	0.40	0.45	-	_	0.010	0.025
40	50	0.030	0.035	0.45	0.55	-	_	0.015	0.030
50	65	0.030	0.035	0.45	0.55	-	_	0.025	0.035
65	80	0.040	0.045	0.60	0.70	-	_	0.030	0.040
80	100	0.045	0.055	0.70	0.85	1.75	2.15	0.035	0.050
100	120	0.050	0.060	0.75	0.90	1.9	2.25	0.045	0.065
120	140	0.060	0.070	0.90	1.1	2.25	2.75	0.055	0.080
140	160	0.065	0.080	1.0	1.3	2.5	3.25	0.060	0.100
160	180	0.070	0.090	1.1	1.4	2.75	3.5	0.070	0.110
180	200	0.080	0.100	1.3	1.6	3.25	4.0	0.070	0.110
200	225	0.090	0.110	1.4	1.7	3.5	4.25	0.080	0.130
225	250	0.100	0.120	1.6	1.9	4.0	4.75	0.090	0.140
250	280	0.110	0.140	1.7	2.2	4.25	5.5	0.100	0.150
280	315	0.120	0.150	1.9	2.4	4.75	6.0	0.110	0.160
315	355	0.140	0.170	2.2	2.7	5.5	6.75	0.120	0.180
355	400	0.150	0.190	2.4	3.0	6.0	7.5	0.130	0.200
400	450	0.170	0.210	2.7	3.3	6.75	8.25	0.140	0.220
450	500	0.190	0.240	3.0	3.7	7.5	9.25	0.160	0.240
500	560	0.210	0.270	3.4	4.3	8.5	11.0	0.170	0.270
560	630	0.230	0.300	3.7	4.8	9.25	12.0	0.200	0.310
630	710	0.260	0.330	4.2	5.3	10.5	13.0	0.220	0.330
710	800	0.280	0.370	4.5	5.9	11.5	15.0	0.240	0.390
800	900	0.310	0.410	5.0	6.6	12.5	16.5	0.280	0.430
900	1 000	0.340	0.460	5.5	7.4	14.0	18.5	0.310	0.470
1 000	1 120	0.370	0.500	5.9	8.0	15.0	20.0	0.360	0.530
	Over 30 40 50 65 80 100 120 140 160 180 200 225 250 280 315 355 400 450 500 560 630 710 800 900	Diameter d over incl. 30 40 40 50 50 65 80 100 100 120 120 140 140 160 180 200 205 225 225 225 250 280 280 315 315 355 355 400 400 450 450 500 560 630 630 710 800 900 900 1 000	Diameter d Clear over incl. min. 30 40 0.025 40 50 0.030 50 65 0.030 65 80 0.040 80 100 0.055 100 120 0.050 120 140 0.060 140 160 0.065 160 180 0.070 180 200 0.080 200 225 250 0.100 250 280 0.110 250 280 315 315 0.120 315 355 0.140 0.150 400 450 0.170 450 500 560 0.210 560 630 710 0.260 800 900 0.380 800 900 0.310 900 1 000 0.340	Diameter d Clearance d min. max. 30 40 0.025 0.030 40 50 0.030 0.035 50 65 0.030 0.035 65 80 0.040 0.045 80 100 0.045 0.055 100 120 0.050 0.060 120 140 0.060 0.070 140 160 180 0.070 0.090 180 200 0.080 0.100 200 225 0.090 0.110 225 250 0.100 0.120 250 280 0.110 0.140 280 315 315 0.120 0.150 315 355 0.140 0.170 0.210 400 450 0.170 0.210 400 450 0.170 0.210 400 450 0.170 0.210	Diameter d Clearance Taper over incl. min. max. min. 30 40 0.025 0.030 0.40 40 50 0.030 0.035 0.45 50 65 80 0.040 0.045 0.60 80 100 0.045 0.055 0.70 100 120 0.050 0.060 0.75 120 140 0.060 0.070 0.90 140 160 180 0.070 0.090 1.1 180 200 0.080 0.100 1.3 200 225 0.090 0.110 1.4 225 250 0.100 0.120 1.6 250 280 0.110 0.140 1.7 280 315 0.120 0.150 1.9 315 355 0.140 0.170 2.2 400 450 0.170 0.210 2.7	Diameter d Clearance Taper 1: 12 over incl. min. max. min. max. 30 40 0.025 0.030 0.40 0.45 40 50 0.030 0.035 0.45 0.55 50 65 0.030 0.035 0.45 0.55 65 80 0.040 0.045 0.60 0.70 0.85 100 120 0.050 0.060 0.75 0.90 120 140 0.060 0.070 0.90 1.1 140 160 180 0.070 0.090 1.1 1.4 160 180 0.070 0.090 1.1 1.4 180 200 0.080 0.100 1.3 1.6 200 225 250 0.900 0.110 1.4 1.7 2.2 255 250 0.100 0.120 1.6 1.9 2.4 315 <t< th=""><th>Diameter d Clearance Taper 1: 12 Taper 1. 12</th><th>Diameter d Clearance Taper 1: 12 Taper 1: 30 over incl. min. max. min. max. min. max. 30 40 0.025 0.030 0.45 0.55 — — 40 50 0.030 0.035 0.45 0.55 — — 50 65 0.030 0.035 0.45 0.55 — — 65 80 0.040 0.045 0.60 0.70 0.85 1.75 2.15 100 120 0.050 0.060 0.70 0.85 1.75 2.15 100 120 0.050 0.060 0.70 0.90 1.1 2.25 2.75 140 160 0.065 0.080 1.0 1.3 2.5 3.25 140 160 0.065 0.080 1.0 1.3 2.5 3.25 180 200 0.080 0.100 1.2 1.4</th><th>Diameter d Clearance Taper 1: 12 Taper 1: 30 Residual over incl. min. max. min. max. CN 30 40 0.025 0.030 0.45 0.55 — 0.010 40 50 0.030 0.355 — — 0.015 50 65 0.030 0.035 0.45 0.55 — — 0.025 65 80 0.040 0.045 0.60 0.70 0.70 — — 0.025 65 80 0.045 0.055 0.70 0.85 1.75 2.15 0.035 80 100 0.045 0.060 0.75 0.990 1.9 2.25 0.045 0.035 140 160 180 0.070 0.090 1.1 1.4</th></t<>	Diameter d Clearance Taper 1: 12 Taper 1. 12	Diameter d Clearance Taper 1: 12 Taper 1: 30 over incl. min. max. min. max. min. max. 30 40 0.025 0.030 0.45 0.55 — — 40 50 0.030 0.035 0.45 0.55 — — 50 65 0.030 0.035 0.45 0.55 — — 65 80 0.040 0.045 0.60 0.70 0.85 1.75 2.15 100 120 0.050 0.060 0.70 0.85 1.75 2.15 100 120 0.050 0.060 0.70 0.90 1.1 2.25 2.75 140 160 0.065 0.080 1.0 1.3 2.5 3.25 140 160 0.065 0.080 1.0 1.3 2.5 3.25 180 200 0.080 0.100 1.2 1.4	Diameter d Clearance Taper 1: 12 Taper 1: 30 Residual over incl. min. max. min. max. CN 30 40 0.025 0.030 0.45 0.55 — 0.010 40 50 0.030 0.355 — — 0.015 50 65 0.030 0.035 0.45 0.55 — — 0.025 65 80 0.040 0.045 0.60 0.70 0.70 — — 0.025 65 80 0.045 0.055 0.70 0.85 1.75 2.15 0.035 80 100 0.045 0.060 0.75 0.990 1.9 2.25 0.045 0.035 140 160 180 0.070 0.090 1.1 1.4

Remarks The values for reduction in radial internal clearance are for bearings with CN clearance. For bearing with C3 Clearance, the maximum values listed should be used for the reduction in radial internal clearance.

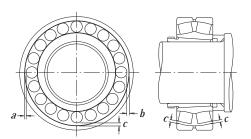


Fig. 14.9 Measuring Clearance in Large Spherical Roller Bearing

Large machines, which cannot be turned by hand, can be started after examination with no load, and the power immediately cutoff and the machine allowed to coast to a stop. Confirm that there is no abnormality such as vibration, noise, contact of rotating parts, etc. Powered operation should be started slowly without load and the operation should be observed carefully until it is determined that no abnormalities exist, then gradually increase the speed, load, etc. to their normal levels. Items to be checked during the test operation include the existence of abnormal noise, excessive rise of bearing temperature, leakage and contamination of lubricants, etc. If any abnormality is found during the test operation, it must be stopped immediately and the machine should be inspected. If necessary, the bearing should be dismounted for examination.



Although the bearing temperature can generally be estimated by the temperature of the outside surface of the housing, it is more desirable to directly measure the temperature of the outer ring using oil holes for access.

The bearing temperature should rise gradually to the steady state level within one to two hours after the operation starts. If the bearing or its mounting is improper, the bearing temperature may increase rapidly and become abnormally high. The cause of this abnormal temperature may be an excessive amount of lubricant, insufficient bearing clearance, incorrect mounting, or excessive friction of the seals.

In the case of high speed operation, an incorrect selection of bearing type or lubricating method may also cause an abnormal temperature rise.

The sound of a bearing may be checked with a noise locater or other instruments. Abnormal conditions are indicated by a loud metallic sound, or other irregular noise, and the possible cause may include incorrect lubrication, poor alignment of the shaft and housing, or the entry of foreign matter into the bearing. The possible causes and measures for irregularities are listed in Table 14.2.

Table 14. 2 Causes of and Measures for Operating Irregularities

Irr	egularities	Possible Causes	Measures		
		Abnormal Load	Improve the fit, internal clearance, preload, position of housing shoulder, etc.		
	Loud Metallic Sound (1)	Incorrect mounting	Improve the machining accuracy and alignment of shaft and housing, accuracy of mounting method.		
		Insufficient or improper Lubricant	Replenish the lubricant or select another lubricant.		
		Contact of rotating parts	Modify the labyrinth seal, etc.		
Noise	Louid Dogular	Flaws,corrosion,or scratches on raceways	Replace or clean the bearing, improve the seals, and use clean lubricant.		
	Loud Regular Sound	Brinelling	Replace the bearing and use care when handling bearings.		
		Flaking on raceway	Replace the bearing.		
		Excessive clearance	Improve the fit, clearance and preload.		
	Irregular Sound	Penetration of foreign particles	Replace or clean the bearing, improve the seals, and use clean lubricant.		
		Flaws or flaking on balls	Replace the bearing.		
		Excessive amount of lubricant	Reduce amount of lubricant, select stiffer grease.		
		Insufficient or improper lubricant	Replenish lubricant or select a better one.		
Abnorm	nal Temperature Rise	Abnormal load	Improve the fit, internal clearance, preload, position of housing shoulder.		
	Rise	Incorrect mounting	Improve the machining accuracy and alignment of shaft and housing, accuracy of mounting, or mounting method.		
		Creep on fitted surface, excessive seal friction	Correct the seals, replace the bearing, correct the fitting or mounting.		
		Brinelling	Replace the bearing and use care when handling bearings.		
\	√ibration	Flaking	Replace the bearing.		
	kial runout)	Incorrect mounting	Correct the squareness between the shaft and housing shoulder or side of spacer.		
		Penetration of foreign particles	Replace or clean the bearing, improve the seals.		
Leakage or Discoloration of Lubricant		Too much lubricant, Penetration by foreign matter or abrasion chips	Reduce the amount of lubricant, select a stiffer grease. Replace the bearing or lubricant. Clean the housing and adjacent parts.		

Note (1) Intermittent squeal or high-pitch noise may be heard in medium- to large-sized cylindrical roller bearings or ball bearings that are operating under grease lubrication in low-temperature environments. Under such low-temperature conditions, bearing temperature will not rise resulting in fatigue nor is grease performance affected. Although intermittent squeal or high-pitch noise may occur under these conditions, the bearing is fully functional and can continue to be used. In the event that greater noise reduction or quieter running properties are needed, please contact your nearest NSK branch office.

14.4 Dismounting

A bearing may be removed for periodic inspection or for other reasons. If the removed bearing is to be used again or it is removed only for inspection, it should be dismounted as carefully as when it was mounted. If the bearing has a tight fit, its removal may be difficult. The means for removal should be considered in the original design of the adjacent parts of the machine. When dismounting, the procedure and sequence of removal should first be studied using the machine drawing and considering the type of mounting fit in order to perform the operation properly.

14.4.1 Dismounting of Outer Rings

In order to remove an outer ring that is tightly fitted, first place bolts in the push-out holes in the housing at several locations on its circumference as shown in Fig. 14.10, and remove the outer ring by uniformly tightening the bolts. These bolt holes should always be fitted with blank plugs when not being used for dismounting. In the case of separable bearings, such as tapered roller bearings, some notches should be made at several positions in the housing shoulder, as shown in Fig. 14.11, so the outer ring may be pressed out using a dismounting tool or by tapping it.

14.4.2 Dismounting of Bearings with Cylindrical Bores

If the mounting design allows space to press out the inner ring, this is an easy and fast method. In this case, the withdrawal force should be imposed only on the inner ring (Fig. 14.12). Withdrawal tools like those shown in Figs. 14.13 and 14.14 are often used.

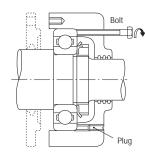


Fig. 14.10 Removal of Outer Ring with Dismounting Bolts

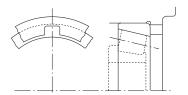


Fig. 14.11 Removal Notches

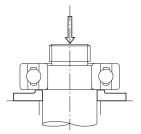


Fig. 14.12 Removal of Inner Ring Using a Press

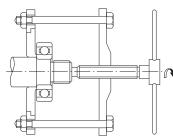


Fig. 14.13 Removal of Inner Ring Using Withdrawal Tool (1)

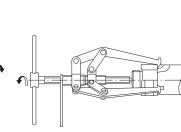


Fig. 14.14 Removal of Inner Ring Using Withdrawal Tool (2)



In both cases, the claws of the tools must substantially engage the face of the inner ring; therefore, it is advisable to consider the size of the shaft shoulder or to cut grooves in the shoulder to accommodate the withdrawal tools (Fig. 14.14).

The oil injection method is usually used for the withdrawal of large bearings. The withdrawal is achieved easily by mean of oil pressure applied through holes in the shaft. In the case of extra wide bearings, the oil injection method is used together with a withdrawal tool.

Induction heating is used to remove the inner rings of NU and NJ types of cylindrical roller bearings. The inner rings are expanded by brief local heating, and then withdrawn (Fig. 14.15). Induction heating is also used to mount several bearings of these types on a shaft.

14.4.3 Dismounting of Bearings with Tapered Bores

When dismounting relatively small bearings with adapters, the inner ring is held by a stop fastened to the shaft and the nut is loosened several turns. This is followed by hammering on the sleeve using a suitable tool as shown in Fig. 14.18. Fig. 14.16 shows one procedure for dismounting a withdrawal sleeve by tightening the removal nut. If this procedure is difficult, it may be possible to drill and tap bolt holes in the nut and withdraw the sleeve by tightening the bolts as shown in Fig. 14.17.

Large bearings may be withdrawn easily using oil pressure. Fig. 14.19 illustrates the removal of a bearing by forcing oil under pressure through a hole and groove in a tapered shaft to expand the inner ring. The bearing may suddenly move axially when the interference is relieved during this procedure so a stop nut is recommended for protection. Fig. 14.20 shows a withdrawal using a hydraulic nut.

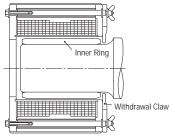


Fig. 14.15 Removal of Inner Ring Using Induction Heater



Fig. 14.16 Removal of Withdrawal Sleeve Using Withdrawal Nut (1)

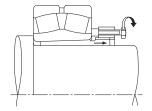


Fig. 14.17 Removal of Withdrawal Sleeve Using Withdrawal Nut (2)

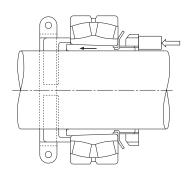


Fig. 14.18 Removal of Adapter with Stop and Axial Pressure

Fig. 14.19 Removal Using Oil Injection Hydraulic Pump

14.5 Inspection of Bearings

14.5.1 Bearing Cleaning

When bearings are inspected, the appearance of the bearings should first be recorded and the amount and condition of the residual lubricant should be checked. After the lubricant has been sampled for examination, the bearings should be cleaned. In general, light oil or kerosene may be used as a cleaning solution.

Dismounted bearings should first be given a preliminary cleaning followed by a finishing rinse. Each bath should be provided with a metal net to support the bearings in the oil without touching the sides or bottom of the tank. If the bearings are rotated with foreign matter in them during preliminary cleaning, the raceways may be damaged. The lubricant and other deposits should be removed in the oil bath during the initial rough cleaning with a brush or other means. After the bearing is relatively clean, it is given the finishing rinse. The finishing rinse should be done carefully with the bearing being rotated while immersed in the rinsing oil. It is necessary to always keep the rinsing oil clean.

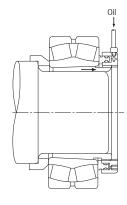


Fig. 14.20 Removal Using Hydraulic Nut

14.5.2 Inspection and Evaluation of Bearings

After being thoroughly cleaned, bearings should be examined for the condition of their raceways and external surfaces, the amount of cage wear, the increase in internal clearance, and degradation of tolerances. These should be carefully checked, in addition to examination for possible damage or other abnormalities, in order to determine the possibility for its reuse.

In the case of small non-separable ball bearings, hold the bearing horizontally in one hand, and then rotate the outer ring to confirm that it turns smoothly.

Separable bearings such as tapered roller bearings may be checked by individually examining their rolling elements and the outer ring raceway.

Large bearings cannot be rotated manually; however, the rolling elements, raceway surfaces, cages, and contact surface of the ribs should be carefully examined visually. The more important a bearing is, the more carefully it should be inspected.

The determination to reuse a bearing should be made only after considering the degree of bearing wear, the function of the machine, the importance of the bearings in the machine, operating conditions, and the time until the next inspection. However, if any of the following defects exist, reuse is impossible and replacement is necessary.

- (a) When there are cracks in the inner or outer rings, rolling elements, or cage.
- (b) When there is flaking of the raceway or rolling elements.
- (c) When there is significant smearing of the raceway surfaces, ribs, or rolling elements.
- (d) When the cage is significantly worn or rivets are loose.
- (e) When there is rust or scoring on the raceway surfaces or rolling elements.
- (f) When there are any significant impact or brinell traces on the raceway surfaces or rolling elements.
- (g) When there is significant evidence of creep on the bore or the periphery of the outer ring.
- (h) When discoloration by heat is evident.
- When significant damage to the seals or shields of grease sealed bearings has occurred.

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14.6 Maintenance and Inspection

14.6.1 Detecting and Correcting Irregularities

In order to maintain the original performance of a bearing for as long as possible, proper maintenance and inspection should be performed. If proper procedures are used, many bearing problems can be avoided and the reliability, productivity, and operating costs of the equipment containing the bearings are all improved. It is suggested that periodic maintenance be done following the procedure specified. This periodic maintenance encompasses the supervision of operating conditions, the supply or replacement of lubricants, and regular periodic inspection. Items that should be regularly checked during operation include bearing noise, vibration, temperature, and lubrication. If an irregularity is found during operation, the cause should be determined and the proper corrective actions should be taken after referring to Table 14.2. If necessary, the bearing should be dismounted and examined in detail. As for the procedure for

NSK BEARING MONITOR (Bearing Abnormality Detector)

Inspection of Bearings.

It is important during operation to detect signs of irregularities early before damage becomes severe. The NSK Bearing Monitor (see Page C5) is an instrument that checks the condition of bearings and gives a warning of any abnormality, or it stops a machine automatically in order to prevent serious trouble. In addition, it helps to improve maintenance and reduce its cost.

dismounting and inspection, refer to Section 14.5,

14.6.2 Bearing Failures and Measures

In general, if rolling bearings are used correctly they will survive to their predicted fatigue life. However, they often fail prematurely due to avoidable mistakes. In contrast to fatigue life, this premature failure is caused by improper mounting, handling, or lubrication, entry of foreign matter, or abnormal heat generation. For instance, the causes of rib scoring, as one example of premature failure, may include insufficient lubrication, use of improper lubricant, faulty lubrication system, entry of foreign matter, bearing mounting error, excessive deflection of the shaft, or any combination of these. Thus, it is difficult to determine the real cause of some premature failures. If all the conditions at the time of failure and previous to the time of failure are known, including the application. the operating conditions, and environment; then by studying the nature of the failure and its probable causes, the possibility of similar future failures can be reduced. The most frequent types of bearing failure, along with their causes and corrective actions, are listed in Table 14.3.

Table 14.3 Causes and Measures for Bearing Failures

Type of Failure	Probable Causes	Measures
Flaking Flaking of one-side of the raceway of radial bearing.	Abnomal axial load.	A loose fit should be used when mounting the outer ring of free-end bearings to allow axial expansion of the shaft.
Flaking of the raceway in symmetrical patterm.	Out-of-roundness of the housing bore.	Correct the faulty housing.
Flaking pattern inclined relative to the raceway in radial ball bearings. Flaking near the edge of the raceway and rolling surfaces in roller bearings.	Improper muonting, deflection of shaft, inadequate tolerances for shaft and housing.	Use care in mounting and centering, select a bearing with a large clearance, and correct the shaft and housing shoulder.
Flaking of raceway with same spacing as rolling elements.	Large shock load during mounting, rusting while bearing is out of operation for prolonged period.	Use care in mounting and apply a rust preventive when machine operation is suspended for a long time.
Premature flaking of raceway and rolling elements.	Insufficient clearance, excessive load, improper lubrication, rust, etc.	Select proper fit, bearing clearance, and lubricant.
Premature flaking of duplex bearings.	Excessive preload.	Adjust the preload.

Type of Failure	Probable Causes	Measures
Scoring Scoring or smearing between raceway and rolling surfaces.	Inadequate initial lubrication, excessively hard grease and high acceleration when starting.	Use a softer grease and avoid rapid acceleration.
Spiral scoring or smearing of raceway surface of thrust ball bearing.	Raceway rings are not parallel and excessive speed.	Correct the mounting, apply a preload, or select another bearing type.
Scoring or smearing between the end face of the rollers and guide rib.	Inadequate lubrication, incorrect mounting and large axial load.	Select proper lubricant and modify the mounting.
Cracks Crack in outer or inner ring.	Excessive shock load, excessive interference in fitting, poor surface cylindricality, improper sleeve taper, large fillet radius, development of thermal cracks and advancement of flaking.	Examine the loading conditions, modify the fit of bearing and sleeve. The fillet radius must be smaller than the bearing chamfer.
Crack in rolling element. Broken rib.	Advancement of flaking, shock applied to the rib during mounting or dropped during handling.	Be carefull in handling and mounting.
Fractured cage.	Abnormal loading of cage due to incorrect mounting and improper lubrication.	Reduce the mounting error and review the lubricating method and lubricant.
Indentations Indentations in raceway in same pattern as rolling elements.	Shock load during mounting or excessive load when not rotating.	Use care in handling.
Indentations in raceway and rolling elements.	Foreign matter such as metallic chips or sand.	Clean the housing, improve the seals, and use a clean lubricant.
Abnormal Wear False brinelling (phenomenon similar to brinelling)	Vibration of the bearing without rotation during shipment or rocking motion of small amplitude.	Secure the shaft and housing, use oil as a lubricant and reduce vibration by applying a preload.
Fretting	Slight wear of the fitting surface.	Increase interference and apply oil.
Wearing of raceway, rolling elements, rib, and cage.	Penentration by foreign matter, incorrect lubrication, and rust.	Improve the seals, clean the housing, and use a clean lubricant.
Creep	Insufficient interference or insufficient tightening of sleeve.	Modify the fit or tighten the sleeve
Seizure Discoloration and melting of raceway, rolling elements, and ribs.	Insufficient clearance, incorrect lubrication, or improper mounting.	Review the internal clearance and bearing fit, supply an adequate amount of the proper lubricant and improve the mounting method and related parts.
Electric Burng Fluting or corrugations.	Melting due to electric arcing.	Install a ground wire to stop the flow of electricity or insulate the beaning.
Corrosion & Rust Rust and corrosion of fitting surfaces and bearing interior.	Condensation of water from the air, or fretting. Penetration by corrosive substance(especially varnish-gas, etc).	Use care in storing and avoid high temperature and high humidity, treatment for rust prevention is necessary when operation is stopped for long time. Selection of varnish and grease.

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DEFINIONS OF SYMBOLS AND THEIR UNITS

Symbols	Nomenclature	Units
a	Contact Ellipse Major Axis	(mm)
b	Contact Ellipse Major Axis	(mm)
$C_{ m r}$	Basic Dynamic Load Rating of Radial Bearings	(N){kgf}
C_{0r}	Basic Static Load Radial of Radial Bearings	(N){kgf}
Ca	Basic Dynamic Load Rating of Thrust Bearings	(N){kgf}
C_{0a}	Basic Static Load Rating of Thrust Bearings	(N){kgf}
d	Shaft Diameter, Nominal Bearing Bore Diameter	(mm)
D	Housing Bore Diameter, Nominal Bearing Outside Diameter	(mm)
D_{e}	Outer Ring Raceway Diameter	(mm)
D_i	Inner Ring Raceway Diameter	(mm)
D_0	Housing Outside Diameter	(mm)
D_{pw}	Rolling Element Pitch Diameter	(mm)
$\dot{D_{ m W}}$	Nominal Rolling Element Diameter	(mm)
e	Contact Position of Tapered Roller End Face with Rib	(mm)
E	Modulus of Longitudinal Elasticity (Bearing Steel) 208 000 MPa{21 200 kgf/mm²}	
E(k)	Complete elliptic integral of the 2nd kind for which the population parameter is $k=\sqrt{1-\left(\frac{b}{a}\right)^2}$	
f_{0}	factor which depends on the geometry of the bearing components and on the applicable stress level	
$f(\varepsilon)$	Function of ϵ	
$F_{\rm a}$	Axial Load, Preload	$(N)\{kgf\}$
$F_{\rm r}$	Radial Load	(N){kgf}
h	$D_{ m e}/D$	
$h_{\scriptscriptstyle 0}$	D/D_0	
\vec{k}	d/D_i	
K	Constant Determined by Internal	
L	Design of Bearing Fatigue Life when Effective Clearance is 0	
$L_{\rm we}$	Effective Leng of Roller	(mm)
$L_{arepsilon}$	Fatigue Life when Effective Clearance is	·/
$m_{\scriptscriptstyle 0}$	Distance between Centers of Curvature of Inner and Outer Rings	
	$r_i + r_e - D_W$	(mm)
1.6		
M $M_{\rm S}$	Frictional Torque Spin Friction	(N·mm){kgf·mm (N·mm){kgf·mm

Units (min ⁻¹) (min ⁻¹) (min ⁻¹) (min ⁻¹) (MP _a){kgf/mm ² } (N){kgf} (N){kgf} (mm) (mm)
(min ⁻¹) (min ⁻¹) (min ⁻¹) (MP _a){kgf/mm ² } (N){kgf} (N){kgf} (mm)
$\begin{array}{c} (min^{\text{-}1}) \\ (min^{\text{-}1}) \\ \\ (MP_a)\{kgf/mm^2\} \\ (N)\{kgf\} \\ (N)\{kgf\} \\ \\ (mm) \end{array}$
(min ⁻¹) (MP _a){kgf/mm ² } (N){kgf} (N){kgf} (N){kgf}
(MP _a){kgf/mm ² } (N){kgf} (N){kgf} (mm)
(N){kgf} (N){kgf} (mm)
(N){kgf} (mm)
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(m/sec)
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(mm)
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()
(mm)
$(MP_a)\{kgf/mm^2\}$

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15. 1 Axial Displacement of Bearings

(1) Contact Angle α and Axial Displacement δ_a of Deep Groove Ball Bearing and Angular Contact Ball Bearings

(2) Axial Load F_a and Axial Displacement δ_a of Tapered Roller Bearings (Fig. 15.4)

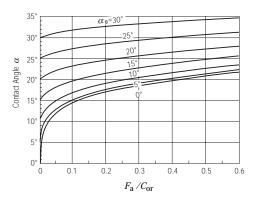


Fig. 15.1 F_a/C_{or} and Contact Angle of Deep Groove and Angular Contact Ball Bearings

Remarks:

Actual axial displacement may vary depending on the shaft/housing thickness, material, and fitting interference with the bearing. Please contact NSK about such factors of axial displacement which are not discussed in detail in this catalog.

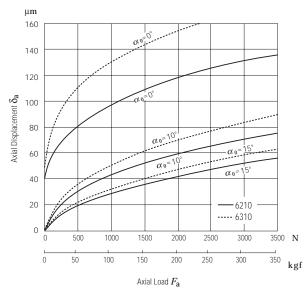


Fig. 15.2 Axial Load and Axial Displacement of Deep Groove Ball Bearings

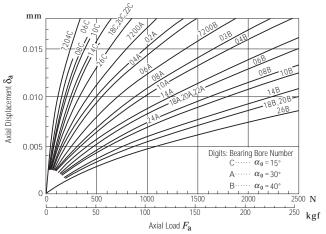


Fig. 15.3 Axial Load and Axial Displacement of Angular Contact Ball Bearings

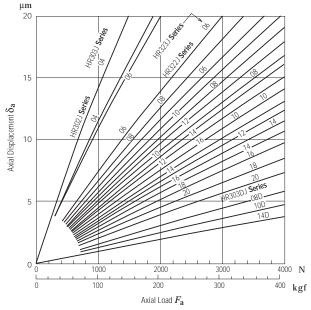


Fig. 15.4 Axial Load and Axial Displacement of Tapered Roller Bearings



15.2 Fits

(1) Surface Pressure $p_{\rm m}$, Maximum Stress $\sigma_{\rm tmax}$ on Fitted Surfaces and Expansion of Inner Ring Raceway Diameter ΔD_i or Contraction of Outer Ring Raceway Diameter ΔD_e (Table 15.1, Figs. 15.5 and 15.6)

- (2) Interferences or Clearances of Shafts and Inner Rings (Table 15.2)
- (3) Interferences or Clearances of Housing Bores and Outer Rings (Table 15.3)

Table. 15. 1 Surface Pressure, Maximum Stress on Fitted Surfaces and Expansion or Contraction

Items	Shaft & Inner Ring	Housing & Bore & Outer Ring
Surface Pressure Pm (MPa) {kgf/mm²}	(In case of sold shaft) $p_{\rm m} = \ \frac{E}{2} \ \frac{\varDelta d}{2} \ \ (1 - \emph{k}^2)$	In case of housing outside dia. $D_0 \neq \infty$ $p_{\rm m} = \frac{E}{2} \frac{\Delta D}{D} \frac{(1 - h^2)(1 - h_0^2)}{1 - h^2 h_0^2}$ In case $D_0 = \infty$ $p_{\rm m} = \frac{E}{2} \frac{\Delta D}{D} (1 - h^2)$
$\begin{array}{c} \text{Maximum stress} \\ \sigma_{\text{t max}} \\ \text{(MPa)} \\ \text{\{kgf/mm}^2\} \end{array}$	Maximum circumferential stress on fitted surface of inner ring bore is $\sigma_{t \max} = p_{\text{m}} \frac{1 + k^2}{1 - k^2}$	Maximum circumferential stress on outer ring bore surface is $\sigma_{\text{t max}} = p_{\text{m}} \frac{2}{1 - h^2}$
Expansion of inner ring raceway dia. \$\Displace D_i \text{ (mm)}\$	In case of solid shaft $\Delta D_i = \Delta d \cdot k$	In case $D_0 \neq \infty$
Contraction of outer ring raceway dia. \$\D_{\text{e}}(\text{mm})\$		In case $D_0 = \infty$

Remarks The modulus of longitudinal elasticity and Poisson's ratio for the shaft and housing material are the same as those for inner and outer rings.

Reference 1 MPa=1 N/mm²=0.102 kgf/mm²

Table 15. 2 Interferences or Clearances

ı	Si	70		Plane											Interf	ferences	or Cleara	nces for		
	Classif	ification Dia						6	٤	g5	g	6	h	15	h	6	j:	s5	j	5
	(m	m)	$\Delta d_{\rm mp}$		Clear	Clearance		Inter- ference	Clearance	Inter- ference	Clearance	Inter- ference	Clearance	Inter- ference	Clearance	Inter- ference	Clearance	Inter- ference		
	over	incl.	high	low	max.	min.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.		
	3 6 10	6 10 18	0 0 0	- 8 - 8 - 8	18 22 27	2 5 8	9 11 14	4 3 2	12 14 17	4 3 2	5 6 8	8 8 8	8 9 11	8 8 8	3 4	— 11 12	_ 2 3	— 12 13		
	18	30	0	-10	33	10	16	3	20	3	9	10	13	10	4.5	14.5	4	15		
	30	50	0	-12	41	13	20	3	25	3	11	12	16	12	5.5	17.5	5	18		
	50	65	0	-15	49	15	23	5	29	5	13	15	19	15	6.5	21.5	7	21		
	65	80	0	-15	49	15	23	5	29	5	13	15	19	15	6.5	21.5	7	21		
	80	100	0	-20	58	16	27	8	34	8	15	20	22	20	7.5	27.5	9	26		
	100	120	0	-20	58	16	27	8	34	8	15	20	22	20	7.5	27.5	9	26		
	120	140	0	- 25	68	18	32	11	39	11	18	25	25	25	9	34	11	32		
	140	160	0	- 25	68	18	32	11	39	11	18	25	25	25	9	34	11	32		
	160	180	0	- 25	68	18	32	11	39	11	18	25	25	25	9	34	11	32		
	180	200	0	-30	79	20	35	15	44	15	20	30	29	30	10	40	13	37		
	200	225	0	-30	79	20	35	15	44	15	20	30	29	30	10	40	13	37		
	225	250	0	-30	79	20	35	15	44	15	20	30	29	30	10	40	13	37		
	250	280	0	- 35	88	21	40	18	49	18	23	35	32	35	11.5	46.5	16	42		
	280	315	0	- 35	88	21	40	18	49	18	23	35	32	35	11.5	46.5	16	42		
	315	355	0	- 40	98	22	43	22	54	22	25	40	36	40	12.5	52.5	18	47		
	355	400	0	- 40	98	22	43	22	54	22	25	40	36	40	12.5	52.5	18	47		
	400	450	0	- 45	108	23	47	25	60	25	27	45	40	45	13.5	58.5	20	52		
	450	500	0	- 45	108	23	47	25	60	25	27	45	40	45	13.5	58.5	20	52		

Remarks 1. The figures for tolerance classes where stress caused by the fitting of the shaft and inner ring becomes excessive are omitted.

2. The tolerance range js is now recommended instead of j.

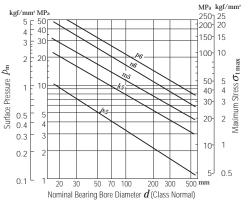


Fig. 15.5 Surface Pressure $p_{\rm m}$ and Maximum Stress $\sigma_{\rm t\,max}$ for Average Fitting Interference

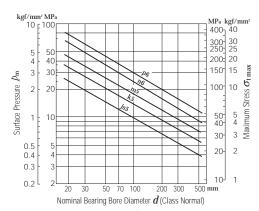


Fig. 15.6 Surface Pressure $p_{\rm m}$ and Maximum Stress $\sigma_{\rm t \ max}$ for Maximum Fitting Interference

of Shafts and Inner Rings

I	Inite	٠	111	n

Each Fit	ting Cla	SS																- Si	70
js	6	j	6	ŀ	k5		k6		m5		m6		16	I	6	r	6	Classif	ication
Clearance	Inter- ference	Clearance	Inter- ference	Interf	erence	Interf	erence	Interf	erence	Interf	erence	Interf	erence	Interf	erence	Interfe	erence	(m	m)
max.	max.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	over	incl.
— 4.5 5.5	— 12.5 13.5	_ 2 3	— 15 16	_	=	_	=	_	=	_	=		=	_	_	_ _ _	_	3 6 10	6 10 18
6.5 8 9.5	16.5 20 24.5	4 5 7	19 23 27	2 2 2	21 25 30	2 2 2	25 30 36	9 11	— 32 39	9 11	— 37 45	_ _ _	_	_ 	_	_ _ _	_	18 30 50	30 50 65
9.5 11 11	24.5 31 31	7 9 9	27 33 33	2 3 3	30 38 38	2 3 3	36 45 45	11 13 13	39 48 48	11 13 13	45 55 55	20 23 23	54 65 65	- 37 37	— 79 79	_ _ _	_	65 80 100	80 100 120
12.5 12.5 12.5	37.5 37.5 37.5	11 11 11	39 39 39	3 3 3	46 46 46	3 3 3	53 53 53	15 15 15	58 58 58	15 15 15	65 65 65	27 27 27	77 77 77	43 43 43	93 93 93	63 65 68	113 115 118	120 140 160	140 160 180
14.5 14.5 14.5	44.5 44.5 44.5	13 13 13	46 46 46	4 4 4	54 54 54	4 4 4	63 63 63	17 17 17	67 67 67	17 17 17	76 76 76	31 31 31	90 90 90	50 50 50	109 109 109	77 80 84	136 139 143	180 200 225	200 225 250
16 16 18	51 51 58	16 16 18	51 51 58	4 4 4	62 62 69	4 4 4	71 71 80	20 20 21	78 78 86	20 20 21	87 87 97	34 34 37	101 101 113	56 56 62	123 123 138	94 98 108	161 165 184	250 280 315	280 315 355
18 20 20	58 65 65	18 20 20	58 65 65	4 5 5	69 77 77	4 5 5	80 90 90	21 23 23	86 95 95	21 23 23	97 108 108	37 40 40	113 125 125	62 68 68	138 153 153	114 126 132	190 211 217	355 400 450	400 450 500

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Table 15. 3 Interferences or

Si	70	Sing	le Plane n O. D.											Interf	erences	or Cleara	ances for
Classification (mm)		Deviation (Normal)		G	7	Н	16	F	I 7	H	H8		J6		JS6		7
(m	m)	$\Delta D_{\rm mp}$		Clear	Clearance		Clearance		Clearance		Clearance		Clearance Inter- ference		Inter- ference	Clearance	Inter- ference
over	incl.	high	low	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.	max.	max.
6 10 18	10 18 30	0 0 0	- 8 - 8 - 9	28 32 37	5 6 7	17 19 22	0 0 0	23 26 30	0 0 0	30 35 42	0 0 0	13 14 17	4 5 5	12.5 13.5 15.5	4.5 5.5 6.5	16 18 21	7 8 9
30 50 80	50 80 120	0 0 0	- 11 - 13 - 15	45 53 62	9 10 12	27 32 37	0 0 0	36 43 50	0 0 0	50 59 69	0 0 0	21 26 31	6 6 6	19 22.5 26	8 9.5 11	25 31 37	11 12 13
120 150 180	150 180 250	0 0 0	- 18 - 25 - 30	72 79 91	14 14 15	43 50 59	0 0 0	58 65 76	0 0 0	81 88 102	0 0 0	36 43 52	7 7 7	30.5 37.5 44.5	12.5 12.5 14.5	44 51 60	14 14 16
250 315 400	315 400 500	0 0 0	- 35 - 40 - 45	104 115 128	17 18 20	67 76 85	0 0 0	87 97 108	0 0 0	116 129 142	0 0 0	60 69 78	7 7 7	51 58 65	16 18 20	71 79 88	16 18 20
500 630 800	630 800 1 000	0 0 0	- 50 - 75 -100	142 179 216	22 24 26	94 125 156	0 0 0	120 155 190	0 0 0	160 200 240	0 0 0	_ _ _	=	72 100 128	22 25 28	_ _ _	_ _ _

Note (*) Indicates the minimum interference

Remarks The tolerance range JS is now recommended instead of J.

15.3 Radial and Axial Internal Clearances

(1) Radial Internal Clearance $\Delta_{\rm r}$ and Axial Internal Clearance $\Delta_{\rm a}$ in Single-Row Deep Groove Ball Bearings (Fig. 15.7)

$$\Delta_{\mathbf{a}} = K \Delta_{\mathbf{r}}^{\frac{1}{2}} \tag{mm}$$

where

$$K=2 (r_{\rm e} + r_i - D_{\rm w})^{\frac{1}{2}}$$

(2) Radial Internal Clearance Δ_r and Axial Internal Clearance Δ_a in Double-Row Angular Contact Ball Bearings (Fig. 15.8)

$$\Delta_{\rm a} = 2\sqrt{m_0^2 - \left(m_0 \cos\alpha_{\rm R} - \frac{\Delta_{\rm r}}{2}\right)^2}$$
$$-2m_0 \sin\alpha_{\rm R} \qquad (mm)$$

Table 15. 4 Constant K

		Value	s of <i>K</i>	
Bore No.	160XX	60XX	62XX	63XX
00		—	0.93	1.14
01	0.80	0.80	0.93	1.06
02	0.80	0.93	0.93	1.06
03	0.80	0.93	0.99	1.11
04	0.90	0.96	1.06	1.07
05	0.90	0.96	1.06	1.20
06	0.96	1.01	1.07	1.19
07	0.96	1.06	1.25	1.37
08	0.96	1.06	1.29	1.45
09	1.01	1.11	1.29	1.57
10	1.01	1.11	1.33	1.64
11	1.06	1.20	1.40	1.70
12	1.06	1.20	1.50	2.09
13	1.06	1.20	1.54	1.82
14	1.16	1.29	1.57	1.88
15	1.16	1.29	1.57	1.95
16	1.20	1.37	1.64	2.01
17	1.20	1.37	1.70	2.06
18	1.29	1.44	1.76	2.11
19	1.29	1.44	1.82	2.16
20	1.29	1.44	1.88	2.25
21	1.37	1.54	1.95	2.32
22	1.40	1.64	2.01	2.40
24	1.40	1.64	2.06	2.40
26	1.54	1.70	2.11	2.49
28	1.54	1.70	2.11	2.59
30	1.57	1.76	2.11	2.59

Clearances of Housing Bores and Outer Rings

Units: µm

Each Fit	ting Cla	SS																c	ize
JS	57	ŀ	6	K	.7	N	16	N	17	N	16	N7		N7 P6		P7		Classification	
Clearance	Inter- ference	Interf	erence	Interf	erence	(mm)													
max.	max.	max.	max.	min.	max.	over	incl.												
15	7	10	7	13	10	5	12	8	15	1	16	4	19	4	21	1	24	6	10
17	9	10	9	14	12	4	15	8	18	1*	20	3	23	7	26	3	29	10	18
19	10	11	11	15	15	5	17	9	21	2*	24	2	28	9	31	5	35	18	30
23	12	14	13	18	18	7	20	11	25	1*	28	3	33	10	37	6	42	30	50
28	15	17	15	22	21	8	24	13	30	1*	33	4	39	13	45	8	51	50	80
32	17	19	18	25	25	9	28	15	35	1*	38	5	45	15	52	9	59	80	120
38	20	22	21	30	28	10	33	18	40	2*	45	6	52	18	61	10	68	120	150
45	20	29	21	37	28	17	33	25	40	5	45	13	52	11	61	3	68	150	180
53	23	35	24	43	33	22	37	30	46	8	51	16	60	11	70	3	79	180	250
61	26	40	27	51	36	26	41	35	52	10	57	21	66	12	79	1	88	250	315
68	28	47	29	57	40	30	46	40	57	14	62	24	73	11	87	1	98	315	400
76	31	53	32	63	45	35	50	45	63	18	67	28	80	10	95	0	108	400	500
85	35	50	44	50	70	24	70	24	96	6	88	6	114	28	122	28	148	500	630
115	40	75	50	75	80	45	80	45	110	25	100	25	130	13	138	13	168	630	800
145	45	100	56	100	90	66	90	66	124	44	112	44	146	0	156	0	190	800	1 000

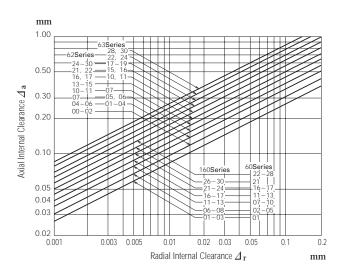


Fig. 15.7 \varDelta_r and \varDelta_a in Single-Row Deep Groove Ball Bearings

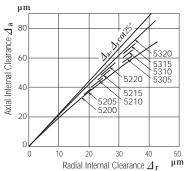


Fig. 15.8 $\varDelta_{\rm T}$ and $\varDelta_{\rm a}$ in Double-Row Angular Contact Ball Bearings (52, 53 Series)



15. 4 Preload and Staring Torque

(1) Axial Load F_a and Starting Torque M of Tapered Roller Bearings (Figs. 15.9 and 15.10)

$$M$$
 = $e \mu_{\rm e} F_{\rm a} \cos \beta$ (N·mm), {kgf·mm} where

 $\mu_{\rm e}$: 0.20

When bearings with the same number are used in opposition, the torque M caused by the preload becomes 2M.

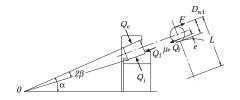


Fig. 15.9 Relation between e and β

(2) Preload F_a and Starting Torque M of Angular Contact Ball Bearings and Double-Direction Angular Contact Thrust Ball Bearings (Figs. 15.11 and 15.12)

$$M = M_{\rm S} \, Z \, {\rm sin} \alpha$$
 (N·mm), {kgf·mm} where $M_{\rm S}$ is spin friction

$$M_{\rm S} = \frac{3}{8} \,\mu_{\rm s} \,Q \,a \,E(k)$$
 (N·mm), {kgf·mm}

where

$$\mu_{\rm s} = 0.15$$

When bearings with the same number are used in opposition, the torque M caused by the preload becomes 2M.

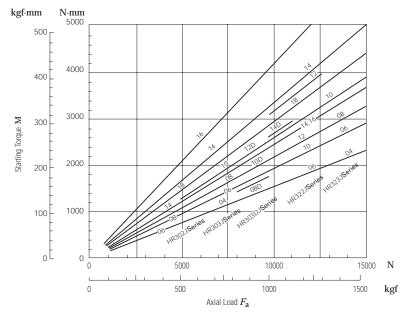


Fig. 15.10 Relation between Axial Load and Starting **Torque of Tapered Roller Bearings**

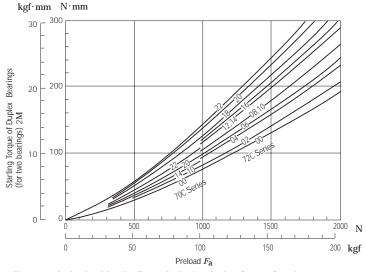


Fig. 15.11 Preload and Starting Torque for Back-to-Back or Face-to-Face Arrangements of Angular Contact Ball Bearings ($\alpha = 15^{\circ}$)

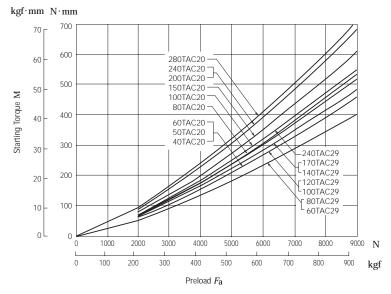


Fig. 15.12 Preload and Starting Torque of Double-Direction **Angular Contact Thrust Ball Bearings**



15.5 Coefficients of Dynamic Friction and Other Bearing Data

(1) Bearing Types and Their Coefficients of Dynamic Friction μ

$$\mu = \frac{M}{P \cdot \frac{d}{2}}$$

Table 15.5 Coefficients of Dynamic Friction

Bearing Types	Approximate values of $\boldsymbol{\mu}$
Deep Groove Ball Bearings	0.0013
Angular Contact Ball Bearings	0.0015
Self-Aligning Ball Bearings	0.0010
Thrust Ball Bearings	0.0011
Cylindrical Roller Bearings	0.0010
Tapered Roller Bearings	0.0022
Spherical Roller Bearings	0.0028
Needle Roller Bearings with Cages	0.0015
Full Complement Needle Roller Bearings	0.0025
Spherical Thrust Roller Bearings	0.0028

(3) Radial Internal Clearance $\Delta_{\rm r}$ and Fatigue Life L(Fig. 15.13)

For the radial internal clearance Δ_r and the function f(ε) of the load factor, the following equations are valid:

For Deep Groove Ball Bearings

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot D_{\rm w}^{\frac{1}{3}}}{0.00044 \left(\frac{F_{\rm r}}{Z}\right)^{\frac{2}{3}}} \tag{N}$$

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot D_{\rm w}^{\frac{1}{3}}}{0.002 \left(\frac{F_{\rm r}}{Z}\right)^{\frac{2}{3}}} \tag{kgf}$$

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot D_{\rm w}^{\frac{1}{3}}}{0.002 \left(\frac{F_{\rm r}}{Z}\right)^{\frac{2}{3}}} \dots \{kgf$$

For Cylindrical Roller Bearings

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot L_{\rm we}^{0.8}}{0.000077 \left(\frac{F_{\rm r}}{Z}\right)^{0.9}}$$
(N)

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot L_{\rm we}^{0.8}}{0.0006 \left(\frac{F_{\rm r}}{Z}\right)^{0.9}} \dots \{\rm kgf\}$$

The relation between the load factor ε and $f(\varepsilon)$ and L_{ε}/L , when the radial internal clearance is Δ_{r} is as shown in Table 15.7.

From the above equations, first obtain $f(\varepsilon)$ and then ε and L_{ε}/L can be obtained.

(2) Circumferential Speeds of Rolling Elements about Their Centers and Bearing Center

Table 15.6 Circumferential Speeds of Rolling Elements about Their Centers and Bearing Center

Items	Rotating inner ring, fixed outer ring	Rotating outer ring, fixed inner ring
Ball rotating speed n _a (min ⁻¹)	$-\left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}}-\frac{\mathrm{cos}^{2}\alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right)\frac{n_{i}}{2}$	$+ \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^{2}\alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{\mathrm{e}}}{2}$
Cicumferential speed around bearing ball's center υ_a (m/sec)	$-\frac{\pi \cdot D_{\mathrm{w}}}{60 \times 10^{3}} \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^{2} \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{i}}{2}$	$+\frac{\pi \cdot D_{\mathrm{w}}}{60 \times 10^{3}} \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^{2} \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{\mathrm{e}}}{2}$
Revolving speed around bearing center n_c (min ⁻¹)	$+ \left(1 - \frac{\cos \alpha}{D_{\rm pw}/D_{\rm w}}\right) \frac{n_i}{2}$	$+ \left(1 - \frac{\cos \alpha}{D_{\rm pw}/D_{\rm w}}\right) \frac{n_{\rm e}}{2}$
Cicumferential speed around bearing center $\upsilon_{c}\left(m/sec\right)$	$-\frac{\pi \cdot D_{\mathrm{pw}}}{60 \times 10^{3}} \left(1 - \frac{\cos \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{i}}{2}$	$+\frac{\pi \cdot D_{\mathrm{pw}}}{60 \times 10^{3}} \left(1 - \frac{\cos \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{\mathrm{e}}}{2}$

1. + sign indicates CW rotation and - sign CCW

Table 15. 7 ϵ and $f(\epsilon)$, L_{ϵ}/L

	Deep Groove	Ball Bearings	Cylindrical Ro	oller Bearings
ε	$f(\varepsilon)$	$\frac{L_{\mathcal{E}}}{L}$	$f(\varepsilon)$	$\frac{L_{\mathcal{E}}}{L}$
0.1	33.713	0.294	51.315	0.220
0.2	10.221	0.546	14.500	0.469
0.3	4.045	0.737	5.539	0.691
0.4	1.408	0.889	1.887	0.870
0.5	0	1.0	0	1.0
0.6	- 0.859	1.069	– 1.133	1.075
0.7	- 1.438	1.098	- 1.897	1.096
0.8	- 1.862	1.094	- 2.455	1.065
0.9	- 2.195	1.041	- 2.929	0.968
1.0	- 2.489	0.948	- 3.453	0.805
1.25	- 3.207	0.605	- 4.934	0.378
1.5	- 3.877	0.371	- 6.387	0.196
1.67	- 4.283	0.276	- 7.335	0.133
1.8	- 4.596	0.221	- 8.082	0.100
2.0	- 5.052	0.159	- 9.187	0.067
2.5	- 6.114	0.078	-11.904	0.029
3	- 7.092	0.043	-14.570	0.015
4	- 8.874	0.017	-19.721	0.005
5	–10.489	0.008	-24.903	0.002
10	–17.148	0.001	-48.395	0.0002

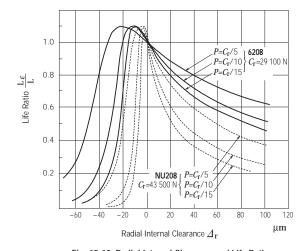


Fig. 15.13 Radial Internal Clearance and Life Ratio

^{2.} The revolving speed and circumferential speed of the rolling elements are the same as those of the



15. 6 BRANDS AND PROPERTIES OF LUBRICATING GREASES

Table 15. 8 Brands of Lubricating Greases

Brands	Thickeners	Base Oils				
ADLEX	Lithium	Mineral oil				
APOLOIL AUTOLEX A	Lithium	Mineral oil				
ARAPEN RB 300	Lithium/Calcium	Mineral oil				
EA2 GREASE	Urea (3)	Poly-α-olefin oil				
EA3 GREASE	Urea (3)	Poly-α-olefin oil				
EA5 GREASE	Urea (3)	Poly-α-olefin oil				
EA7 GREASE	Urea (3)	Poly-α-olefin oil				
ENC GREASE	Urea (3)	Polyol ester oil + Mineral oil (4)				
ENS GREASE	Urea (3)	Polyol ester oil (4)				
ECE GREASE	Lithium	Poly-α-olefin oil				
ISOFLEX NBU 15	Barium Complex	Ester oil + Mineral oil (4)				
ISOFLEX SUPER LDS 18	Lithium	Ester oil (4)				
ISOFLEX TOPAS NB 52	Barium Complex	Poly-α-olefin oil				
DOW CORNING SH 33 L GREASE	Lithium	Silicone oil (5)				
DOW CORNING SH 44 M GREASE	Lithium	Silicone oil (5)				
NS HI-LUBE	Lithium	Polyol ester oil + Diester oil (4)				
NSC GREASE	Lithium	Alkyldiphenyl ether oil + Polyol ester oil (4)				
NSK CLEAN GREASE LG2	Lithium	Poly-α-olefin oil + Mineral oil				
EMALUBE 8030	Urea (3)	Mineral oil				
MA8 GREASE	Urea (3)	Alkyldiphenyl ether oil + Poly- $lpha$ -olefin oil				
KRYTOX GPL-524	PTFE	Perfluoropolyether oil				
KP1 GREASE	PTFE	Perfluoropolyether oil				
COSMO WIDE GREASE WR No.3N	Sodium Terephtalamate	Polyol ester oil + Mineral oil (4)				
G-40M	Lithium	Silicone oil (5)				
SHELL GADUS S2 V220 2	Lithium	Mineral oil				
SHELL ALVANIA GREASE S1	Lithium	Mineral oil				
SHELL ALVANIA GREASE S2	Lithium	Mineral oil				
SHELL ALVANIA GREASE S3	Lithium	Mineral oil				
CASSIDA GREASE RLS 2	Aluminum Complex	Poly-α-olefin oil				
SHELL SUNLIGHT GREASE 2	Lithium	Mineral oil				
WPH GREASE	Urea (3)	Poly-α-olefin oil				
DEMNUM GREASE L-200	PTFE	Perfluoropolyether oil				
NIGACE WR-S	Urea (3)	Synthetic oil				
NIGLUBE RSH	Sodium Complex	Polyalkylene Glycol oil				

Notes (1) If grease will be used at the upper or lower limit sufficient of the temperature range or in a special environment such

and Comparison of Properties

Dropping Point (°C)	Consistency	Working Temperature Range(1)(°C)	Pressure Resistance	Usable Limit Compared to Listed Limiting Speed(2)(%)	
198	300	0 to +110	Good	70	
198	280	-10 to +110	Fair	60	
177	294	-10 to + 80	Fair	70	
≧260	243	-40 to +150	Fair	100	
≧260	230	-40 to +150	Fair	100	
≧260	251	-40 to +160	Good	60	
≧260	243	-40 to +160	Fair	100	
≧260	262	-40 to +160	Fair	70	
≧260	264	-40 to +160	Poor	100	
≧260	235	-10 to +120	Fair	100	
≧260	280	-30 to +120	Poor	100	
195	280	-50 to +110	Poor	100	
≧260	280	-40 to +130	Poor	90	
210	310	-60 to +120	Poor	60	
210	260	-30 to +130	Poor	60	
192	250	-40 to +130	Fair	100	
192	235	-30 to +140	Fair	70	
201	199	-40 to +130	Poor	100	
≧260	280	0 to +130	Good	60	
≧260	283	-30 to +160	Fair	70	
≧260	265	0 to +200	Fair	70	
≧260	280	-30 to +200	Fair	60	
≧230	227	-40 to +130	Poor	100	
223	252	-30 to +130	Poor	60	
187	276	0 to + 80	Good	60	
182	323	-10 to +110	Fair	70	
185	275	-10 to +110	Fair	70	
185	242	-10 to +110	Fair	70	
≧240	280	0 to +120	Fair	70	
200	274	-10 to +110	Fair	70	
259	240	-40 to +150	Fair	70	
≧260	280	-30 to +200	Fair	60	
≧260	230	-30 to +150	Poor	70	
≧260	270	-20 to +120	Fair	60	

(continued on next page)

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as vacuum, it is advisable to consult NSK.
 For short-term operation or when cooling is grease may be used at speeds exceeding the above limits provided the supply of grease is appropriate.
 Urea-based grease causes fluorine-based material to deteriorate.
 Ester-based grease causes acrylic rubber material to swell.
 Silicone-based grease causes silicone-based material to swell.



Brands	Thickeners	Base Oils
PALMAX RBG	Lithium Complex	Mineral oil
BEACON 325	Lithium	Diester oil (4)
MULTEMP PS No.2	Lithium	Poly-α-olefin oil + Diester oil (4)
MOLYKOTE FS-3451 GREASE	PTFE	Fluorosilicone oil (5)
UME GREASE	Urea	Mineral oil
RAREMAX AF-1	Urea	Mineral oil

Ν	lotes	(
I١	OLCS	(

- (1) If grease will be used at the upper or lower limit sufficient of the temperature range or in a special environment such
- (3) Silicone-based grease causes silicone-based material to swell.

Dropping Point (°C)	Consistency	Working Temperature Range(¹)(°C)	Pressure Resistance	Usable Limit Compared to Listed Limiting Speed(2)(%)
216	300	-10 to +130	Good	70
190	274	-50 to +100	Poor	100
190	275	-50 to +110	Poor	100
≧260	285	0 to +180	Fair	70
≧260	268	-10 to +130	Fair	70
≧260	300	-10 to +130	Fair	70

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BEARING TABLES



BEARING TABLE CONTENTS

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MAXIMUM TYPE BALL BEARINGS	25 – 110 mm ·····	_
MAGNETO BEARINGS	4 – 20mm ······	
EXTRA SMALL BALL BEARINGS AND	4 – 2011111	DZ
MINIATURE BALL BEARINGS		B3
Metric Design	1 – 9mm ·····	
Inch Design	1.016 – 9.525 mm ······	
mon bosign	7.070 7.02011111	D 1.
ANGULAR CONTACT BALL BEARINGS		B4
	Bore Dia.	
SINGLE-ROW ANGULAR CONTACT BALL BEARINGS	10 – 200 mm ·····	
MATCHED ANGULAR CONTACT BALL BEARINGS	10 – 200 mm ·····	
DOUBLE-ROW ANGULAR CONTACT BALL BEARINGS	10 – 85 mm ·····	
FOUR-POINT CONTACT BALL BEARINGS	30 – 200 mm ·····	B7.
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JEEL NEIGHING BALL BEARINGS	Bore Dia.	07
SELF-ALIGNING BALL BEARINGS	5 – 110 mm ······	B7
ozz. Azionino sazz bzaminos	· · · · · · · · · · · · · · · · · · ·	5,
CYLINDRICAL ROLLER BEARINGS		B8
	Bore Dia.	
SINGLE-ROW CYLINDRICAL ROLLER BEARINGS L-SHAPED THRUST COLLARS FOR CYLINDRICAL ROLLER	20 – 500 mm ·····	B8
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SPHERICAL ROLLER BEARINGS		R10
31 HERICAL ROLLER DEARINGS	Bore Dia.	DIO
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SINGLE-DIRECTION THRUST BALL BEARINGS	10 – 360 mm ·····	
DOUBLE-DIRECTION THRUST BALL BEARINGS	10 – 190 mm ·····	
CYLINDRICAL ROLLER THRUST BEARINGS	35 – 320 mm ·····	
SPHERICAL THRUST ROLLER BEARINGS	60 – 500 mm ·····	
ANGULAR CONTACT THRUST BALL BEARINGS		
Double-Direction Angular Contact Thrust Ball Bearings	35 – 280mm ·····	
Angular Contact Thrust Ball Bearings for Ball Screws	15 – 60 mm ·····	B24.
Needle Roller Bearings		B24
J .	Bore Dia.	
CAGE & NEEDLE ROLLER ASSEMBLIES	5 – 100 mm ·····	B25
DRAWN CUP NEEDLE ROLLER BEARINGS	4 – 55 mm ·····	B25
SOLID NEEDLE ROLLER BEARINGS	9 – 390mm ·····	B26
THRUST NEEDLE ROLLER BEARINGS	10 – 100 mm ·····	
CAM FOLLOWERS	16 – 90 mm ·····	
ROLLER FOLLOWERS	5 – 50 mm ·····	B27

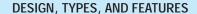
		1 agc
BALL BEARING UNITS		B280
SET SCREW TYPE		
	Shaft Dia.	
Pillow blocks cast housing		
UCP2	12 – 90 mm ·····	B286
Flanged units cast housing		
UCF2	12 – 90 mm ·····	
UCFL2	12 – 90mm ·····	B298
PLUMMER BLOCKS		B304
	Shaft Dia.	
STANDARD TYPE PLUMMER BLOCKS	20 – 140mm ·····	B306
LARGE PLUMMER BLOCKS	150 – 450 mm ·····	B312
DUSTPROOF PLUMMER BLOCKS	50 – 180 mm ·····	B316
STEPPED-SHAFT TYPE PLUMMER BLOCKS	25 – 320mm ·····	B318
CYLINDRICAL ROLLER BEARINGS FOR SHEAVES		B326
	Bore Dia.	
Open Type	50 – 560mm ·····	B328
Prelubricated Type	40 – 400mm ·····	B332
ROLL-NECK BEARINGS		B334
	Bore Dia.	
FOUR-ROW TAPERED ROLLER BEARINGS	100 – 939.800 mm ·····	
FOUR-ROW CYLINDRICAL ROLLER BEARINGS	100 – 920 mm ·····	B340
RAILWAY ROLLING STOCK BEARINGS		B344
ROLLING ELEMENTS		B346
	Basic Dia.	
STEEL BALLS FOR BALL BEARINGS	0.3 – 114.3mm·····	B348
CYLINDRICAL ROLLERS FOR ROLLER BEARINGS	3 – 80 mm ·····	B350
LONG CYLINDRICAL ROLLERS FOR ROLLER BEARINGS	5.5 – 15 mm ·····	B352
NEEDLE ROLLERS FOR ROLLER BEARINGS	1 – 5mm ·····	B354
ACCESSORIES FOR ROLLING BEARINGS		B35 <i>6</i>
	Shaft Dia.	
ADAPTERS FOR ROLLING BEARINGS	17 – 470 mm ·····	B358
WITHDRAWAL SLEEVES FOR ROLLING BEARINGS	35 – 480 mm ·····	B366
NUTS FOR ROLLING BEARINGS		B372
STOPPERS FOR ROLLING BEARINGS		
LOCK-WASHERS FOR ROLLING BEARINGS		B378

DEEP GROOVE BALL BEARINGS

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Open Type, Shielded Type, Sealed Type Bore Diameter 10 – 240mm ···· B8 Open Type Bore Diameter 260 – 800mm ···· B20 MAXIMUM TYPE BALL BEARINGS Bore Diameter 25 – 110mm B26 **MAGNETO BEARINGS** Bore Diameter 4 – 20mm····· B28

Extra Small and Miniature Ball Bearings are described on Pages B30 to B45.



SINGLE-ROW DEEP GROOVE BALL BEARINGS

Single-Row Deep Groove Ball Bearings are classified into the types shown

The proper amount of good quality grease is packed in shielded and sealed ball bearings. A comparison of the features of each type is shown in Table 1.





Open Type





Shielded Type (ZZ Type)



Non-Contact **Rubber Sealed** Type (VV Type)



Contact **Rubber Sealed** Type (DDU Type)

Туре	Shielded Type (ZZ Type)	Non-Contact Rubber Sealed Type (VV Type)	Contact Rubber Sealed Type (DDU Type)
Torque	Low	Low	Higher than ZZ, VV types due to contact seal
Speed capability	Good	Good	Limited by contact seals
Grease sealing effectiveness	Good	Better than ZZ type	A little better than VV type
Dust resistance	Good	Better than ZZ type (usable in moderately dusty environment)	Best (usable even in very dusty environment)
Water resistance	Not suitable	Not suitable	Good (usable even if fluid is splashed on bearing)
Operating temperature (1)	–10 to +110°C	-10 to +110°C	−10 to +100°C

The above temperature range applies to standard bearings. By using cold or heat resistant grease and changing the type of rubber, the operating temperature range can be extended. For such applications, please contact NSK.





For deep groove ball bearings, pressed cages are usually used. For big bearings, machined brass cages are used. (Refer to Table 2)

Machined cages are also used for high speed applications.

Table 2 Standard Cages for Deep Groove Ball Bearings

Series	Pressed Steel Cages	Machined Brass Cages
68	6800 - 6838	6840 - 68/800
69	6900 – 6936	6938 - 69/800
160	16001 - 16026	16028 - 16064
60	6000 - 6040	6044 - 60/670
62	6200 - 6240	6244 – 6272
63	6300 - 6332	6334 - 6356



MAXIMUM TYPE BALL BEARINGS

Maximum Type Ball Bearings contain a larger number of balls than normal deep groove ball bearings because of filling slots in the inner and outer rings. Because of their filling slots, they are not suitable for applications with high axial loads.

BL2 and BL3 types of bearings have boundary dimensions equal to those of single-row deep groove ball bearings of Series 62 and 63 respectively. Besides the open type, ZZ type shielded bearings are also available.

When using these bearings, it is important for the filling slot in the outer ring to be outside of the loaded zone as much as possible.

Their cages are pressed steel.



MAGNETO BEARINGS

The groove in the inner ring is a little shallower than that of deep groove ball bearings and one side of the outer ring is relieved. Consequently, the outer ring is separable, which makes it convenient for mounting.

Pressed cages are standard, but for high speed applications, machined synthetic resin cages are used.

PRECAUTIONS FOR USE OF DEEP GROOVE BALL BEARINGS

For deep groove ball bearings, if the bearing load is too small during operation, slippage occurs between the balls and raceways, which may result in smearing. The higher the weight of balls and cage, the higher this tendency becomes, especially for large bearings. If very small bearing loads are expected, please contact NSK for selection of an appropriate bearing.

TOLERANCES AND RUNNING ACCURACY

SINGLE-ROW DEEP GROOVE BALL						
BEARINGS	Table	8.2	(Pages	A60 1	to A6	3
MAXIMUM TYPE BALL BEARINGS	Table	8.2	(Pages	A60 1	to A6	3
MAGNETO BEARINGS	Table	8.5	(Pages	A70 a	nd A	7

RECOMMENDED FITS

SINGLE-ROW DEEP GROOVE BALL				
BEARINGS	Table	9.2	(Page	A84)
	Table	9.4	(Page	A85)
MAXIMUM TYPE BALL BEARINGS	Table	9.2	(Page	A84)
	Table	9.4	(Page	A85)
MAGNETO BEARINGS	Table	9.2	(Page	A84)
	Table	9.4	(Page	A85)

INTERNAL CLEARANCES

SINGLE-I	ROW DEEP GROOVE BA	LL	
BEARING	S	Tabl	e 9.9 (Page A89)
			, ,
IVIAXIIVIU	M TYPE BALL BEARING	S labi	e 9.9 (Page A89)
MAGNET	O BEARINGS	Tabl	e 9.11 (Page A89)

LIMITING SPEEDS

The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

B6 B7

Shielded Type

ZZ

(N)

 $C_{\rm r}$

1 720

2 700

4 550

5 100

8 100

1 920

2 890

5 100

5 100

6 800

9 700

2 070

4 350

5 600

5 600

7 650

11 400

2 6 3 0

4 600

6 000

6 000

9 550

13 600

4 000

6 400

7 900

9 400

12 800

15 900

9 400

12 900

18 400

Basic Load Ratings

 C_{0r}

840

1 270

1 970

2 390

3 450

1 040

1 460

2 370

2 370

3 050

4 200

1 260

2 260

2 830

2 830

3 750

5 450

1 570

2 550

3 250

4 800

6 650

2 470

3 700

4 450

5 000

6 600

7 900

5 050

6 800

9 250

dimensions of sealed or shielded bearings.

Non-Contact

Sealed Type

VV

{kgf}

 $C_{0\mathrm{r}}$ f_0

86 14.8

129

201

244

350

106

149

241 13.0

241

310 12.3

425

128 15.8

230

289 13.9

289

380

555

160 15.7

260 14.7

330

330 14.4

490

675

252

375 14.7

455

510

670 13.1

805 12.4

515

695

940

(3) Ring types N and NR applicable only to open-type bearings. Please consult NSK about the snap ring groove

 $C_{\rm r}$

175

275

465

520 825

195

295

520

520

695

990

212

440

570

570

780

1 170

268

470

610

610

975

410

650

810

955

1 300

1 620

960

1 320

1 870

Notes (1) For tolerances for the snap ring grooves and snap ring dimensions, refer to Pages A50 to A53.

(2) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.

1 390

Factor

14.0

12.4

13.2

11.2

15.3

14.5

13.0

11.1

14.3

13.9

13.2

12.3

14.4

13.2

12.4

15.5

14.5

13.8

14.0

13.5

12.4

Contact

Sealed Type

 $\mathsf{DD} \cdot \mathsf{DDU}$

Open

Z · ZZ V · VV

24 000

28 000

28 000

22 000

24 000

26 000

24 000

22 000

17 000

15 000

19 000

18 000

18 000

15 000

17 000

14 000

13 000

Limiting Speeds (min⁻¹)

DH

DDU

34 000 24 000 40 000

32 000 22 000 38 000

30 000 22 000 36 000

22 000 17 000 26 000

32 000 20 000 38 000

30 000 20 000 36 000

20 000 16 000 24 000

28 000 17 000 34 000

26 000 17 000 30 000

24 000 15 000 28 000

20 000 14 000 24 000

17 000 13 000 20 000

22 000 13 000 26 000

14 000 10 000 17 000

15 000 30 000

15 000 28 000

13 000 26 000

12 000 20 000

11 000 18 000

12 000 22 000

11 000 20 000

11 000 18 000

11 000 20 000

9 500 16 000

9 500 16 000

— 20 000

— 26 000

18 000 30 000

18 000 32 000

17 000 28 000

— 32 000

— 28 000

Grease

With Snap

Ring Groove

Ν

Oil

Open Z

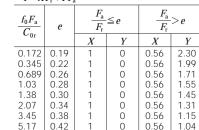
Dynamic Equivalent Load

NSK

0.56

1.00

 $P = XF_r + YF_a$



 $F_{\rm r}$

# D ₁	ϕD_a r_a ϕD_a	ϕD_X	0 0 0 1 1 1 2 3 5 6
<u></u>		Cy	

# P D 1	ϕD_a Γ_a ϕD_a	ϕD_X C_{Y-}
---------	----------------------------------	---------------------

 ϕD_2

With

Snap Ring

NR

VV DD

ZZ VV DDU

ZZ VV DDU

VV DDU

VV DDU

VV DDU

VV DDU

VV DDU

ZZ VV DDU

Bearing Numbers

Open Shielded Sealed

6800 ZZ VV DD

6000 ZZ VV DDU

6300 ZZ VV DDU

6801 ZZ VV DD

6901 ZZ VV DD

ZZ

6802 ZZ VV DD

6902 ZZ VV DD

6002 ZZ VV DDU

6202 ZZ VV DDU

6302 ZZ VV DDU

6803 ZZ VV DD

ZZ

6903 ZZ VV DDU

6303 ZZ VV DDU

6804 ZZ VV DD

6304 ZZ VV DDU

60/22 ZZ VV DDU

63/22 ZZ VV DDU

ZZ

6900 ZZ

6200

16001

6001

6201 ZZ VV DDU

6301

16002

16003

6203

6904

6004 ZZ

6204 ZZ

62/22

16004

## ## ## ## ## ## ## ## ## ## ## ## ##	ϕD_a r_a ϕD_a ϕd_a	ϕD_X $C_{Y^{-1}}$
--	--	-------------------------

ϕD_1	φD_a ϕd_a	φD _x	2.07 3.45 5.17 6.89	0.34 0.38 0.42 0.44	1 1 1 1	0 0 0 0
		$C_{Y^{-1}}$	-	•	=0.6 <i>F</i> _r +	0.5 <i>F</i> _a

With Snap	With Snap	Sna	p Ring G	roove Dim (mm)	ensions	(1)	Snap R Dimen	sions		Abutmen	t and Fille (mm		nsions		Mass (kg)
Ring Groove	Ring	a max.	$m{b}$ min.	$D_{ m 1}$ max.	r_0 max.	$\emph{r}_{ m N}$ min.	$D_{2}^{(111)}$ max.	f max.	min.	$m{d}_{\mathbf{a}}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	$r_{ m a}$ max.	D_{x} min.	$C_{\scriptscriptstyle m Y}$ max.	approx.
N(3) N(4)	— NR(3) NR(4)		 0.8 0.87	 20.8 24.5	0.2 0.2	0.2 0.3	24.8 28.7	 0.7 0.84	12 12 12	12 12.5 13	17 20 24	0.3 0.3 0.3	 25.5 29.4	 1.5 1.9	0.005 0.009 0.018
N N	NR NR	2.06 2.06	1.35 1.35	28.17 33.17	0.4 0.4	0.5 0.5	34.7 39.7	1.12 1.12	14 14	16 16.5	26 31	0.6 0.6	35.5 40.5	2.9 2.9	0.032 0.052
N(3)	 NR(3) 	 1.05 	0.8	22.8 —	0.2	0.2 —	26.8 —	0.7	14 14 14	14 14.5 —	19 22 26	0.3 0.3 0.3	 27.5 	1.5 —	0.006 0.010 0.019
N(4) N N	NR(4) NR NR	1.35 2.06 2.06	0.87 1.35 1.35	26.5 30.15 34.77	0.2 0.4 0.4	0.3 0.5 0.5	30.7 36.7 41.3	0.84 1.12 1.12	14 16 17	15.5 17 18	26 28 32	0.3 0.6 1	31.4 37.5 42	1.9 2.9 2.9	0.022 0.037 0.060
(3)	 NR(3) 	1.3 —	0.95 —	26.7 —	0.25 —	0.3	30.8 —	0.85 —	17 17 17	17 17 —	22 26 30	0.3 0.3 0.3	_ 31.5 _	1.8 —	0.007 0.015 0.027
N N N	NR NR NR	2.06 2.06 2.06	1.35 1.35 1.35	30.15 33.17 39.75	0.4 0.4 0.4	0.3 0.5 0.5	36.7 39.7 46.3	1.12 1.12 1.12	17 19 20	19 20.5 22.5	30 31 37	0.3 0.6 1	37.5 40.5 47	2.9 2.9 2.9	0.031 0.045 0.083
N(3)	NR(3)	1.3	0.95 —	28.7 —	0.25 —	0.3	32.8 —	0.85	19 19 19	19 19.5 —	24 28 33	0.3 0.3 0.3	33.5 —	1.8	0.007 0.017 0.033
N N N	NR NR NR	2.06 2.06 2.46	1.35 1.35 1.35	33.17 38.1 44.6	0.4 0.4 0.4	0.3 0.5 0.5	39.7 44.6 52.7	1.12 1.12 1.12	19 21 22	21.5 23.5 25.5	33 36 42	0.3 0.6 1	40.5 45.5 53.5	2.9 2.9 3.3	0.041 0.067 0.113
N N	NR NR —	1.3 1.7 —	0.95 0.95 —	30.7 35.7 —	0.25 0.25 —	0.3 0.3 —	34.8 39.8 —	0.85 0.85 —	22 22 22	22 24 —	30 35 40	0.3 0.3 0.3	35.5 40.5 —	1.8 2.3 —	0.017 0.037 0.048
N N N	NR NR NR	2.06 2.46 2.46	1.35 1.35 1.35	39.75 44.6 49.73	0.4 0.4 0.4	0.5 0.5 0.5	46.3 52.7 57.9	1.12 1.12 1.12	24 25 26.5	25.5 26.5 28	38 42 45.5	0.6 1 1	47 53.5 58.5	2.9 3.3 3.3	0.068 0.107 0.145
N N N	NR NR NR	2.06 2.46 2.46	1.35 1.35 1.35	41.75 47.6 53.6	0.4 0.4 0.4	0.5 0.5 0.5	48.3 55.7 61.7	1.12 1.12 1.12	26 27 28.5	26.5 29.5 30.5	40 45 49.5	0.6 1 1	49 56.5 62.5	2.9 3.3 3.3	0.074 0.119 0.179

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

⊢-B⊸

Open Type

Boundary Dimensions

(mm)

22 6 0.3

26 8 0.3

30 35 9 0.6

21

24

28 7 0.3

28 8

32 37 10

24 5

28 7

32 8 0.3

32 35

42 13

26

30 7 0.3

35 8

35 10 0.3

40 12

47 14 1

32 7 0.3

42

42 12

47 14

52 15 1.1

44 12 0.6

56 16 1.1

11 0.6

> 5 0.3

6

9 0.3

9 0.3

8 0.3

14 50

11

min.

0.3

0.3

0.6 12

0.3

0.3

0.6

0.3 5

0.3

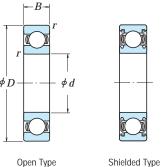
0.6

0.6

1

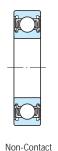
d DBr

10 19 5 0.3 Bore Diameter 25 - 45 mm

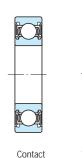




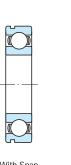
ZZ

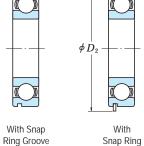


Sealed Type



Sealed Type





				VV VV					DD · DDI		N	ve			IR	
Boun	dary D		sions		Basic Load	0		Factor	Limitino	g Speeds	(min ⁻¹)		Bearing Numbers			
	(m	m)		(1	N)	{k	gf}		Gre	ase	Oil			Ü		
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielde	d Se	ealed	
25	37 42 47	7 9 8	0.3 0.3 0.3	4 500 7 050 8 850	3 150 4 550 5 600	455 715 905	320 460 570	16.1 15.4 15.1	18 000 16 000 15 000	10 000 10 000 —	22 000 19 000 18 000	6805 6905 16005	ZZ ZZ	VV VV	DD DDU	
	47 52 62	12 15 17	0.6 1 1.1	10 100 14 000 20 600	5 850 7 850 11 200	1 030 1 430 2 100	595 800 1 150	14.5 13.9 13.2	15 000 13 000 11 000	9 500 9 000 8 000	18 000 15 000 13 000	6005 6205 6305	ZZ ZZ ZZ	VV VV	DDU DDU DDU	
28	52 58 68	12 16 18	0.6 1 1.1	12 500 16 600 26 700	7 400 9 500 14 000	1 270 1 700 2 730	755 970 1 430	14.5 13.9 12.4	14 000 12 000 10 000	8 500 8 000 7 500	16 000 14 000 13 000	60/28 62/28 63/28	ZZ ZZ ZZ	VV VV	DDU DDU DDU	
30	42 47 55	7 9 9	0.3 0.3 0.3	4 700 7 250 11 200	3 650 5 000 7 350	480 740 1 150	370 510 750	16.4 15.8 15.2	15 000 14 000 13 000	9 000 8 500 —	18 000 17 000 15 000	6806 6906 16006	ZZ ZZ	VV VV	DD DDU —	
	55 62 72	13 16 19	1 1 1.1	13 200 19 500 26 700	8 300 11 300 15 000	1 350 1 980 2 720	845 1 150 1 530	14.7 13.8 13.3	13 000 11 000 9 500	8 000 7 500 6 700	15 000 13 000 12 000	6006 6206 6306	ZZ ZZ ZZ	VV VV	DDU DDU DDU	
32	58 65 75	13 17 20	1 1 1.1	15 100 20 700 29 900	9 150 11 600 17 000	1 530 2 120 3 050	935 1 190 1 730	14.5 13.6 13.2	12 000 10 000 9 000	7 500 7 100 6 300	14 000 12 000 11 000	60/32 62/32 63/32	ZZ ZZ ZZ	VV VV	DDU DDU DDU	
35	47 55 62	7 10 9	0.3 0.6 0.3	4 900 10 600 11 700	4 100 7 250 8 200	500 1 080 1 190	420 740 835	16.7 15.5 15.6	14 000 12 000 11 000	7 500 7 500 —	16 000 15 000 13 000	6807 6907 16007	ZZ ZZ	VV VV	DD DDU	
	62 72 80	14 17 21	1 1.1 1.5	16 000 25 700 33 500	10 300 15 300 19 200	1 630 2 620 3 400	1 050 1 560 1 960	14.8 13.8 13.2	11 000 9 500 8 500	6 700 6 300 6 000	13 000 11 000 10 000	6007 6207 6307	ZZ ZZ ZZ	VV VV	DDU DDU DDU	
40	52 62 68	7 12 9	0.3 0.6 0.3	6 350 13 700 12 600	5 550 10 000 9 650	650 1 390 1 290	565 1 020 985	17.0 15.7 16.0	12 000 11 000 10 000	6 700 6 300 —	14 000 13 000 12 000	6808 6908 16008	ZZ ZZ	VV VV	DD DDU	
	68	15	1	16 800	11 500	1 710	1 180	15.3	10 000	6 000	12 000	6008	ZZ	VV	DDU	

100	25	1.5	53 000	32 000	5 400	3 250	13.1	6 700	4 800	8 000	630
Notes	(1)	For toler	ances for th	e snap ring	grooves and	d snap r	ing dime	ensions, ref	er to Pag	es A50 to	A53.

2 970

4 150

670

1 440

1 520

2 140

3 200

1 820

2 450

1 110

1 160

1 550

2 080

625

14.0

13.2

17.2

15.9

15.9

15.3

14.4

8 500

7 500

11 000

9 500

9 000

9 000

7 500

5 600 10 000

5 300 9 000

6 000 13 000

5 600 12 000

5 300 11 000

5 300 9 000

— 11 000

6208 ZZ VV DDU

6308 ZZ VV DDU

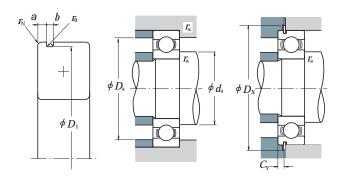
6009 ZZ VV DDU 6209 ZZ VV DDU 6309 ZZ VV DDU

ZZ VV DDU

6809 ZZ VV DD

6909

16009



Dynamic Equivalent Load	
$P = XF_r + YF_a$	

		•						
$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\rm a}}{F_{\rm r}}$	$\leq e$	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}} > e$				
c_{0r}		X	Y	X	Y			
0.172	0.19	1	0	0.56	2.30			
0.345	0.22	1	0	0.56	1.99			
0.689	0.26	1	0	0.56	1.71			
1.03	0.28	1	0	0.56	1.55			
1.38	0.30	1	0	0.56	1.45			
2.07	0.34	1	0	0.56	1.31			
3.45	0.38	1	0	0.56	1.15			
5.17	0.42	1	0	0.56	1.04			
6.89	0.44	1	0	0.56	1.00			

Static Equivalent Load

$\frac{F_{\rm a}}{F_{\rm r}} > 0.8$, $P_0 = 0.6F_{\rm r} + 0.5F_{\rm a}$	
$F_a < 0.8 P_a - F$	

With	With					(1)	Snap R Dimen	sions		Abutmer	nt and Fille (mm		ensions		Mass (kg)
Snap Ring Groove	Snap Ring	а тах.	b min.	$D_{ m 1}$ max.	$r_{ m 0}$ max.	$r_{ m N}$ min.	$D_{\!\scriptscriptstyle 2}^{(mr)}$	f max.	min.	$m{d}_{\mathbf{a}}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	$r_{ m a}$ max.	$D_{\!\scriptscriptstyle m x}$ min.	$C_{\scriptscriptstyle Y}$ max.	арргох.
N N(3)	NR NR(3)	1.3 1.7 —	0.95 0.95 —	35.7 40.7 —	0.25 0.25 —	0.3 0.3 —	39.8 44.8	0.85 0.85 —	27 27 27	27 28.5 —	35 40 45	0.3 0.3 0.3	40.5 45.5 —	1.8 2.3	0.021 0.042 0.059
N	NR	2.06	1.35	44.6	0.4	0.5	52.7	1.12	29	30	43	0.6	53.5	2.9	0.079
N	NR	2.46	1.35	49.73	0.4	0.5	57.9	1.12	30	32	47	1	58.5	3.3	0.129
N	NR	3.28	1.9	59.61	0.6	0.5	67.7	1.7	31.5	36	55.5	1	68.5	4.6	0.235
N	NR	2.06	1.35	49.73	0.4	0.5	57.9	1.12	32	34	48	0.6	58.5	2.9	0.096
N	NR	2.46	1.35	55.6	0.4	0.5	63.7	1.12	33	35.5	53	1	64.5	3.3	0.175
N	NR	3.28	1.9	64.82	0.6	0.5	74.6	1.7	34.5	38	61.5	1	76	4.6	0.287
N N	NR NR	1.3 1.7 —	0.95 0.95 —	40.7 45.7 —	0.25 0.25 —	0.3 0.3 —	44.8 49.8 —	0.85 0.85 —	32 32 32	32 34 —	40 45 53	0.3 0.3 0.3	45.5 50.5 —	1.8 2.3 —	0.024 0.052 0.087
N	NR	2.08	1.35	52.6	0.4	0.5	60.7	1.12	35	36.5	50	1	61.5	2.9	0.116
N	NR	3.28	1.9	59.61	0.6	0.5	67.7	1.7	35	38.5	57	1	68.5	4.6	0.199
N	NR	3.28	1.9	68.81	0.6	0.5	78.6	1.7	36.5	42.5	65.5	1	80	4.6	0.345
N	NR	2.08	1.35	55.6	0.4	0.5	63.7	1.12	37	38.5	53	1	64.5	2.9	0.122
N	NR	3.28	1.9	62.6	0.6	0.5	70.7	1.7	37	40	60	1	71.5	4.6	0.225
N	NR	3.28	1.9	71.83	0.6	0.5	81.6	1.7	38.5	44.5	68.5	1	83	4.6	0.389
N N	NR NR	1.3 1.7 —	0.95 0.95 —	45.7 53.7 —	0.25 0.25 —	0.3 0.5 —	49.8 57.8 —	0.85 0.85 —	37 39 37	37 39 —	45 51 60	0.3 0.6 0.3	50.5 58.5 —	1.8 2.3 —	0.027 0.075 0.107
N	NR	2.08	1.9	59.61	0.6	0.5	67.7	1.7	40	41.5	57	1	68.5	3.4	0.151
N	NR	3.28	1.9	68.81	0.6	0.5	78.6	1.7	41.5	44.5	65.5	1	80	4.6	0.284
N	NR	3.28	1.9	76.81	0.6	0.5	86.6	1.7	43	47	72	1.5	88	4.6	0.464
N N	NR NR	1.3 1.7 —	0.95 0.95 —	50.7 60.7 —	0.25 0.25 —	0.3 0.5 —	54.8 64.8 —	0.85 0.85 —	42 44 42	42 46 —	50 58 66	0.3 0.6 0.3	55.5 65.5 —	1.8 2.3 —	0.031 0.112 0.13
N	NR	2.49	1.9	64.82	0.6	0.5	74.6	1.7	45	47.5	63	1	76	3.8	0.19
N	NR	3.28	1.9	76.81	0.6	0.5	86.6	1.7	46.5	50.5	73.5	1	88	4.6	0.366
N	NR	3.28	2.7	86.79	0.6	0.5	96.5	2.46	48	53	82	1.5	98	5.4	0.636
N N	NR NR	1.3 1.7 —	0.95 0.95 —	56.7 66.7 —	0.25 0.25 —	0.3 0.3(4)	60.8 70.8 —	0.85 0.85 —	47 49 49	47.5 50 —	56 64 71	0.3 0.6 0.6	61.5 72 —	1.8 2.3 —	0.038 0.126 0.167
N	NR	2.49	1.9	71.83	0.6	0.5	81.6	1.7	50	53.5	70	1	83	3.8	0.241
N	NR	3.28	1.9	81.81	0.6	0.5	91.6	1.7	51.5	55.5	78.5	1	93	4.6	0.42
N	NR	3.28	2.7	96.8	0.6	0.5	106.5	2.46	53	61.5	92	1.5	108	5.4	0.829

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

0.6

0.6

29 100

40 500

6 600

14 100

14 900

20 900

31 500

17 900

24 000

6 150

10 900

11 400

15 200

20 400

80 18 1.1

90 23 1.5

58 7 0.3

68 75 12 10

75 16

85 19 1.1

⁽²⁾ When heavy axial loads are applied, increase d_a and decrease D_a from the above values.

⁽³⁾ Ring types N and NR applicable only to open-type bearings. Please consult NSK about the snap ring groove dimensions of sealed or shielded bearings.

 ϕD_a

Snap Ring Groove Dimensions (1)

 ϕD_1

 $\phi d_a \phi D_x$

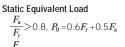
Snap Ring (1)

Dynamic Equivalent Load $P = XF_r + YF_a$

 $\frac{F_{\rm a}}{F_{\rm r}} \leq e$ $\frac{F_{\rm a}}{F_{\rm r}} > e$ f_0F_a $\overline{C_{0r}}$ X X Y0.172 0.19 0 0.56 2.30 0.56 0.345 0.22 0 1.99 0.689 1.03 0.26 0 0.56 0.56 1.71 0.28 0 1.55 1.38 0.30 0 0.56 1.45

NSK

Mass



2.07 0.34 0 0.56 1.31 3.45 0.38 0 0.56 1.15 5.17 0.42 0 0.56 1.04 6.89 0.44 0.56 1.00

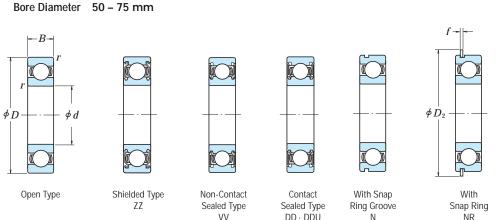
Static Equivalent Load
$\frac{F_{\rm a}}{F_{\rm r}} > 0.8, \ P_0 = 0.6F_{\rm r} + 0.5F_{\rm a}$
$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, \ P_0 = F_{\rm r}$

Abutment and Fillet Dimensions

With	With			(mm)		()	Dimens				(mm)			(kg)
Snap Ring Groov	Ring	а тах.	b min.	$D_{ m 1}$ max.	$r_{ m 0}$ max.	$\emph{r}_{ m N}$ min.	$D_{\scriptscriptstyle 2}^{(mr)}$	f max.	a min.	nax.	$D_{ m a}^{(2)}$ max.	$m{r_{\mathrm{a}}}$ max.	$D_{\!\scriptscriptstyle m x}$ min.	$C_{ m Y}$ max.	approx.
N N	NR NR	1.3 1.7 —	0.95 0.95 —	63.7 70.7 —	0.25 0.25 —	0.3 0.5	67.8 74.8 —	0.85 0.85 —	52 54 54	52.5 55 —	63 68 76	0.3 0.6 0.6	68.5 76 —	1.8 2.3 —	0.050 0.135 0.175
N N N	NR NR NR	2.49 3.28 3.28	1.9 2.7 2.7	76.81 86.79 106.81	0.6 0.6 0.6	0.5 0.5 0.5	86.6 96.5 116.6	1.7 2.46 2.46	55 56.5 59	58.5 60 68	75 83.5 101	1 1 2	88 98 118	3.8 5.4 5.4	0.261 0.459 1.06
N N	NR NR —	1.7 2.1 —	0.95 1.3 —	70.7 77.9 —	0.25 0.4 —	0.3 0.5 —	74.8 84.4 —	0.85 1.12 —	57 60 59	59 61.5 —	70 75 86	0.3 1 0.6	76 86 —	2.3 2.9 —	0.081 0.189 0.257
N N N	NR NR NR	2.87 3.28 4.06	2.7 2.7 3.1	86.79 96.8 115.21	0.6 0.6 0.6	0.5 0.5 0.5	96.5 106.5 129.7	2.46 2.46 2.82	61.5 63 64	64 66.5 72.5	83.5 92 111	1 1.5 2	98 108 131.5	5 5.4 6.5	0.381 0.619 1.37
N N	NR NR —	1.7 2.1 —	1.3 1.3	76.2 82.9 —	0.4 0.4 —	0.3 0.5 —	82.7 89.4 —	1.12 1.12 —	62 65 64	64 66 —	76 80 91	0.3 1 0.6	84 91 —	2.5 2.9 —	0.103 0.192 0.281
N N N	NR NR NR	2.87 3.28 4.06	2.7 2.7 3.1	91.82 106.81 125.22	0.6 0.6 0.6	0.5 0.5 0.5	101.6 116.6 139.7	2.46 2.46 2.82	66.5 68 71	69 74.5 79	88.5 102 119	1 1.5 2	103 118 141.5	5 5.4 6.5	0.412 0.783 1.72
N N	NR NR —	1.7 2.1 —	1.3 1.3	82.9 87.9 —	0.4 0.4 —	0.5 0.5 —	89.4 94.4 —	1.12 1.12 —	69 70 69	69 71.5 —	81 85 96	0.6 1 0.6	91 96 —	2.5 2.9 —	0.128 0.218 0.30
N N N	NR NR NR	2.87 4.06 4.9	2.7 3.1 3.1	96.8 115.21 135.23	0.6 0.6 0.6	0.5 0.5 0.5	106.5 129.7 149.7	2.46 2.82 2.82	71.5 73 76	73 80 85.5	93.5 112 129	1 1.5 2	108 131.5 152	5 6.5 7.3	0.439 1.0 2.11
N N	NR NR —	1.7 2.5 —	1.3 1.3 —	87.9 97.9 —	0.4 0.4 —	0.5 0.5 —	94.4 104.4 —	1.12 1.12 —	74 75 74	74.5 77.5 —	86 95 106	0.6 1 0.6	96 106 —	2.5 3.3 —	0.134 0.349 0.441
N N N	NR NR NR	2.87 4.06 4.9	2.7 3.1 3.1	106.81 120.22 145.24	0.6 0.6 0.6	0.5 0.5 0.5	116.6 134.7 159.7	2.46 2.82 2.82	76.5 78 81	80.5 84 92	103.5 117 139	1 1.5 2	118 136.5 162	5 6.5 7.3	0.608 1.09 2.57
N N	NR NR —	1.7 2.5 —	1.3 1.3 —	92.9 102.6 —	0.4 0.4 —	0.5 0.5 —	99.4 110.7 —	1.12 1.12 —	79 80 79	79.5 82 —	91 100 111	0.6 1 0.6	101 112 —	2.5 3.3 —	0.149 0.364 0.463
N N N	NR NR NR	2.87 4.06 4.9	2.7 3.1 3.1	111.81 125.22 155.22	0.6 0.6 0.6	0.5 0.5 0.5	121.6 139.7 169.7	2.46 2.82 2.82	81.5 83 86	85.5 90 98.5	108.5 122 149	1 1.5 2	123 141.5 172	5 6.5 7.3	0.649 1.19 3.08

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

- 2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
- 3. Please consult NSK about the snap ring groove dimensions of sealed and shielded bearings when the diameter of dimension series 18 and 19 is 50 mm or more.



							VV		טטע י טטע	1	N			IN	R
Bou	ndary E		sions		Basic Load			Factor	Limiting	Speeds	(min ⁻¹)	F	Bearin	ıa Nıır	nbers
	(m	m)		(1)	1)	{kg	ſf}		Grea	ise	Oil		Jean III	ig ivai	IIDCIS
<i>d</i>	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open S	hielded	Se	aled
50	65 72 80	7 12 10	0.3 0.6 0.6	6 400 14 500 15 400	6 200 11 700 12 400	655 1 480 1 570	635 1 200 1 260	17.2 16.1 16.1	9 500 9 000 8 500	5 300 5 300 —	11 000 11 000 10 000	6810 6910 16010	ZZ ZZ	VV VV	DDU DDU
	80 90 110	16 20 27	1 1.1 2	21 800 35 000 62 000	16 600 23 200 38 500	2 220 3 600 6 300	1 700 2 370 3 900	15.6 14.4 13.2	8 500 7 100 6 000	4 800 4 800 4 300	10 000 8 500 7 500	6010 6210 6310	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
55	72 80 90	9 13 11	0.3 1 0.6	8 800 16 000 19 400	8 500 13 300 16 300	900 1 630 1 980	865 1 350 1 660	17.0 16.2 16.2	8 500 8 000 7 500	4 800 4 500 —	10 000 9 500 9 000	6811 6911 16011	ZZ ZZ —	VV VV	DDU DDU —
	90 100 120	18 21 29	1.1 1.5 2	28 300 43 500 71 500	21 200 29 300 44 500	2 880 4 450 7 300	2 170 2 980 4 550	15.3 14.3 13.1	7 500 6 300 5 600	4 500 4 300 4 000	9 000 7 500 6 700	6011 6211 6311	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
60	78 85 95	10 13 11	0.3 1 0.6	11 500 19 400 20 000	10 900 16 300 17 500	1 170 1 980 2 040	1 120 1 660 1 780	16.9 16.2 16.3	8 000 7 500 7 100	4 500 4 300 —	9 500 9 000 8 500	6812 6912 16012	ZZ ZZ	VV VV	DD DDU
	95 110 130	18 22 31	1.1 1.5 2.1	29 500 52 500 82 000	23 200 36 000 52 000	3 000 5 350 8 350	2 370 3 700 5 300	15.6 14.3 13.1	7 100 5 600 5 300	4 000 3 800 3 600	8 500 7 100 6 300	6012 6212 6312	ZZ ZZ ZZ	VV VV	DDU DDU DDU
65	85 90 100	10 13 11	0.6 1 0.6	11 900 17 400 20 500	12 100 16 100 18 700	1 220 1 770 2 090	1 230 1 640 1 910	17.0 16.6 16.5	7 500 7 100 6 700	4 000 4 000 —	8 500 8 500 8 000	6813 6913 16013	ZZ ZZ	VV VV	DD DDU —
	100 120 140	18 23 33	1.1 1.5 2.1	30 500 57 500 92 500	25 200 40 000 60 000	3 100 5 850 9 450	2 570 4 100 6 100	15.8 14.4 13.2	6 700 5 300 4 800	4 000 3 600 3 400	8 000 6 300 6 000	6013 6213 6313	ZZ ZZ ZZ	VV VV	DDU DDU DDU
70	90 100 110	10 16 13	0.6 1 0.6	12 100 23 700 26 800	12 700 21 200 23 600	1 230 2 420 2 730	1 300 2 160 2 410	17.2 16.3 16.3	6 700 6 300 6 000	3 800 3 600 —	8 000 7 500 7 100	6814 6914 16014	ZZ ZZ —	VV VV	DD DDU
	110 125 150	20 24 35	1.1 1.5 2.1	38 000 62 000 104 000	31 000 44 000 68 000	3 900 6 350 10 600	3 150 4 500 6 950	15.6 14.5 13.2	6 000 5 000 4 500	3 600 3 400 3 200	7 100 6 300 5 300	6014 6214 6314	ZZ ZZ ZZ	VV VV	DDU DDU DDU
75	95 105 115	10 16 13	0.6 1 0.6	12 500 24 400 27 600	13 900 22 600 25 300	1 280 2 480 2 820	1 410 2 300 2 580	17.3 16.5 16.4	6 300 6 000 5 600	3 600 3 400 —	7 500 7 100 6 700	6815 6915 16015	ZZ ZZ —	VV VV	DDU DDU
	115 130 160	20 25 37	1.1 1.5 2.1	39 500 66 000 113 000	33 500 49 500 77 000	4 050 6 750 11 600	3 400 5 050 7 850	15.8 14.7 13.2	5 600 4 800 4 300	3 400 3 200 2 800	6 700 5 600 5 000	6015 6215 6315	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU

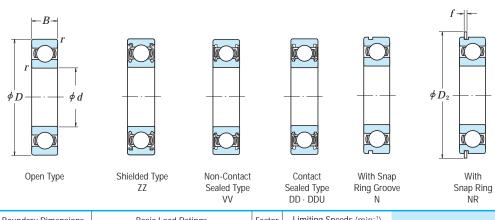
Notes	(1)	For tolerances for the	snap ring grooves an	d snap ring dimensions	refer to Pages A50 to A53.

(2) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.

B 12 B 13

quivalent Load NSK

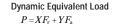
Bore Diameter 80 – 105 mm

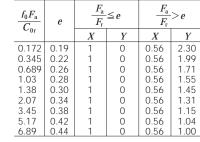


							V V		טטי טטט		IV			IVI	11
Bou	ndary D		sions		Basic Load	9		Factor	Limiting	Speeds (min ⁻¹)	В	earing	Nun	nbers
	(m	m)		1)	۷)	{k	gf}		Grea	se	Oil		J		
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open Sh	ielded	Se	aled
80	100 110 125	10 16 14	0.6 1 0.6	12 700 25 000 32 000	14 500 24 000 29 600	1 290 2 540 3 250	1 470 2 450 3 000	17.4 16.6 16.4	6 000 5 600 5 300	3 400 3 200 —	7 100 6 700 6 300			/V /V	DDU DDU
	125 140 170	22 26 39	1.1 2 2.1	47 500 72 500 123 000	40 000 53 000 86 500	4 850 7 400 12 500	4 050 5 400 8 850	15.6 14.6 13.3	5 300 4 500 4 000	3 200 3 000 2 800	6 300 5 300 4 800	6016 6216	ZZ ۱	/V /V /V	DDU DDU DDU
85	110 120 130	13 18 14	1 1.1 0.6	18 700 32 000 33 000	20 000 29 600 31 500	1 910 3 250 3 350	2 040 3 000 3 200	17.1 16.4 16.5	5 600 5 300 5 000	3 200 3 000 —	6 700 6 300 6 000	6917	ZZ ۱	/V /V	DDU DDU
	130 150 180	22 28 41	1.1 2 3	49 500 84 000 133 000	43 000 62 000 97 000	5 050 8 550 13 500	4 400 6 300 9 850	15.8 14.5 13.3	5 000 4 300 3 800	3 000 2 800 2 600	6 000 5 000 4 500	6217	ZZ ۱	/V /V /V	DDU DDU DDU
90	115 125 140	13 18 16	1 1.1 1	19 000 33 000 41 500	21 000 31 500 39 500	1 940 3 350 4 250	2 140 3 200 4 000	17.2 16.5 16.3	5 300 5 000 4 800	3 000 2 800 —	6 300 6 000 5 600	6918		/V /V	DDU DDU —
	140 160 190	24 30 43	1.5 2 3	58 000 96 000 143 000	50 000 71 500 107 000	5 950 9 800 14 500	5 050 7 300 11 000	15.6 14.5 13.3	4 800 4 000 3 600	2 800 2 600 2 400	5 600 4 800 4 300	6218	ZZ ۱	/V /V /V	DDU DDU DDU
95	120 130 145	13 18 16	1 1.1 1	19 300 33 500 43 000	22 000 33 500 42 000	1 970 3 450 4 350	2 240 3 400 4 250	17.2 16.6 16.4	5 000 4 800 4 500	2 800 2 800 —	6 000 5 600 5 300	6919		/V /V	DD DDU —
	145 170 200	24 32 45	1.5 2.1 3	60 500 109 000 153 000	54 000 82 000 119 000	6 150 11 100 15 600	5 500 8 350 12 100	15.8 14.4 13.3	4 500 3 800 3 000	2 600 2 600 2 400	5 300 4 500 3 600	6219	ZZ ۱	/V /V /V	DDU DDU DDU
100	125 140 150	13 20 16	1 1.1 1	19 600 43 000 42 500	23 000 42 000 42 000	2 000 4 350 4 300	2 340 4 250 4 300	17.3 16.4 16.5	4 800 4 500 4 300	2 800 2 600 —	5 600 5 300 5 300	6920	ZZ ۱	/V /V –	DD DDU
	150 180 215	24 34 47	1.5 2.1 3	60 000 122 000 173 000	54 000 93 000 141 000	6 150 12 500 17 700	5 550 9 500 14 400	15.9 14.4 13.2	4 300 3 600 2 800	2 600 2 400 2 200	5 300 4 300 3 400	6220 6320	ZZ \ ZZ \	/V /V /V	DDU DDU DDU
105	130 145 160	13 20 18	1 1.1 1	19 800 42 500 52 000	23 900 42 000 50 500	2 020 4 300 5 300	2 440 4 300 5 150	17.4 16.5 16.3	4 800 4 300 4 000	2 600 — —	5 600 5 300 4 800	6921 16021	ZZ \	/V /V -	DDU — —
	160 190 225	26 36 49	2 2.1 3	72 500 133 000 184 000	66 000 105 000 154 000	7 400 13 600 18 700	6 700 10 700 15 700	15.8 14.4 13.2	4 000 3 400 2 600	2 400 2 200 2 000	4 800 4 000 3 200	6221	ZZ ۱	/V /V –	DDU DDU DDU

Notes (1) For tolerances for the snap ring grooves and snap ring dimensions, refer to Pages A50 to A53.

(2) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.





Static Equivalent Load

 $\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$ $\frac{F_a}{F_r} \le 0.8, P_0 = F_r$

	With Snap	Snap	Ring G	Groove Dim (mm)	ensions	(1)	Snap R Dimen (mr	sions		Abutmer	nt and Fill (mm		ensions		Mass (kg)
	Ring	a max.	b min.	$D_{\scriptscriptstyle 1}$ max.	$oldsymbol{r_0}{ ext{max.}}$	$\emph{r}_{ m N}$ min.	$D_{\scriptscriptstyle 2}^{\scriptscriptstyle (1111)}$ max.	f max.	min.	$I_{\rm a}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	D_{x} min.	$C_{\scriptscriptstyle m Y}$ max.	approx
	NR NR	1.7 2.5 —	1.3 1.3	97.9 107.6 —	0.4 0.4 —	0.5 0.5 —	104.4 115.7 —	1.12 1.12 —	84 85 84	84.5 87.5 —	96 105 121	0.6 1 0.6	106 117 —	2.5 3.3 —	0.1! 0.39 0.62
N I	NR	2.87	3.1	120.22	0.6	0.5	134.7	2.82	86.5	91	118.5	1	136.5	5.3	0.8
	NR	4.9	3.1	135.23	0.6	0.5	149.7	2.82	89	95.5	131	2	152	7.3	1.42
	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.1	91	104.5	159	2	185	8.4	3.6
N I	NR	2.1	1.3	107.6	0.4	0.5	115.7	1.12	90	90.5	105	1	117	2.9	0.20
	NR	3.3	1.3	117.6	0.4	0.5	125.7	1.12	91.5	94.5	113.5	1	127	4.1	0.5
	—	—	—	—	—	—	—	—	89	—	126	0.6	—	—	0.6
N I	NR	2.87	3.1	125.22	0.6	0.5	139.7	2.82	91.5	96	123.5	1	141.5	5.3	0.9
	NR	4.9	3.1	145.24	0.6	0.5	159.7	2.82	94	102	141	2	162	7.3	1.7
	NR	5.69	3.5	173.66	0.6	0.5	192.9	3.1	98	110.5	167	2.5	195	8.4	4.2
N I	NR	2.1	1.3	112.6	0.4	0.5	120.7	1.12	95	95.5	110	1	122	2.9	0.2
	NR	3.3	1.3	122.6	0.4	0.5	130.7	1.12	96.5	98.5	118.5	1	132	4.1	0.5
	—	—	—	—	—	—	—	—	95	—	135	1	—	—	0.8
N I	NR	3.71	3.1	135.23	0.6	0.5	149.7	2.82	98	103	132	1.5	152	6.1	1.1
	NR	4.9	3.1	155.22	0.6	0.5	169.7	2.82	99	107.5	151	2	172	7.3	2.1
	NR	5.69	3.5	183.64	0.6	0.5	202.9	3.1	103	117	177	2.5	205	8.4	4.9
N I	NR	2.1	1.3	117.6	0.4	0.5	125.7	1.12	100	101.5	115	1	127	2.9	0.2
	NR	3.3	1.3	127.6	0.4	0.5	135.7	1.12	101.5	103.5	123.5	1	137	4.1	0.6
	—	—	—	—	—	—	—	—	100	—	140	1	—	—	0.9
N I	NR	3.71	3.1	140.23	0.6	0.5	154.7	2.82	103	108.5	137	1.5	157	6.1	1.2
	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.1	106	114	159	2	185	8.4	2.6
	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.1	108	123.5	187	2.5	215	8.4	5.7
N I	NR	2.1	1.3	122.6	0.4	0.5	130.7	1.12	105	105.5	120	1	132	2.9	0.3
	NR	3.3	1.9	137.6	0.6	0.5	145.7	1.7	106.5	111	133.5	1	147	4.7	0.8
	—	—	—	—	—	—	—	—	105	—	145	1	—	—	0.9
N I	NR NR —	3.71 5.69 —	3.1 3.5 —	145.24 173.66 —	0.6 0.6	0.5 0.5 —	159.7 192.9 —	2.82 3.1 —	108 111 113	112.5 121.5 133	142 169 202	1.5 2 2.5	162 195 —	6.1 8.4 —	1.2 3.1 7.0
N I	NR NR —	2.1 3.3 —	1.3 1.9	127.6 142.6 —	0.4 0.6 —	0.5 0.5 —	135.7 150.7 —	1.12 1.7 —	110 111.5 110	110.5 116 —	125 138.5 155	1 1 1	137 152 —	2.9 4.7 —	0.3 0.8 1.2
	NR NR	3.71 5.69	3.1 3.5 —	155.22 183.64 —	0.6 0.6	0.5 0.5 —	169.7 202.9	2.82 3.1 —	114 116 118	120 127.5 138	151 179 212	2 2 2.5	172 205 —	6.1 8.4 —	1.5 3.7 8.0

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

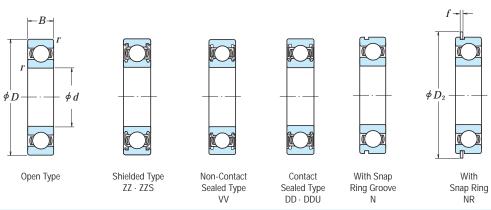
 $\phi d_a \phi D_X$

 ϕD_a

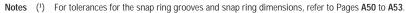
 ϕD_1

- 2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
- Please consult NSK about the snap ring groove dimensions of sealed and shielded bearings when the diameter of dimension series 18 and 19 is 50 mm or more.

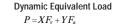
Bore Diameter 110 - 160 mm

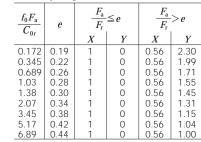


							VV		טטע י טטע	1	N		ı	VK .
Bou	ndary [sions		Basic Load	l Ratings		Factor	Limiting	Speeds (min ⁻¹)		Bearing Nu	mhers
	(m	m)		1)	۷)	{k	gf}		Grea	ise	Oil		Dearing ive	ITIDOIS
<u>d</u>	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded S	ealed
110	140 150 170	16 20 19	1 1.1 1	28 100 43 500 57 500	32 500 44 500 56 500	2 860 4 450 5 850	3 350 4 550 5 800	17.1 16.6 16.3	4 300 4 300 3 800	2 400 2 400 —	5 300 5 000 4 500	6822 6922 16022	ZZ VV ZZ VV	DDU DDU
	170 200 240	28 38 50	2 2.1 3	85 000 144 000 205 000	73 000 117 000 179 000	8 650 14 700 20 900	7 450 11 900 18 300	15.5 14.3 13.2	3 800 2 800 2 400	2 200 2 200 —	4 500 3 400 3 000	6022 6222 6322	ZZ VV ZZ VV ZZ —	DDU DDU
120	150 165 180	16 22 19	1 1.1 1	28 900 53 000 56 500	35 500 54 000 57 500	2 950 5 400 5 800	3 650 5 500 5 850	17.3 16.5 16.5	4 000 3 800 3 600	2 200 — —	4 800 4 500 4 300	6824 6924 16024	ZZ VV ZZ — — —	DD — —
	180 215 260	28 40 55	2 2.1 3	88 000 155 000 207 000	80 000 131 000 185 000	9 000 15 800 21 100	8 150 13 400 18 800	15.7 14.4 13.5	3 600 2 600 2 200	2 200 2 000 1 800	4 300 3 200 2 800	6024 6224 6324	ZZ VV ZZ VV ZZS —	DDU DDU DDU
130	165 180 200	18 24 22	1.1 1.5 1.1	37 000 65 000 75 500	44 000 67 500 77 500	3 750 6 650 7 700	4 450 6 850 7 900	17.1 16.5 16.4	3 600 3 400 3 000	2 000	4 300 4 000 3 600	6826 6926 16026	ZZS VV ZZ — — —	DD — —
	200 230 280	33 40 58	2 3 4	106 000 167 000 229 000	101 000 146 000 214 000	10 800 17 000 23 400	10 300 14 900 21 800	15.8 14.5 13.6	3 000 2 400 2 200	1 900 — —	3 600 3 000 2 600	6026 6226 6326	ZZ — ZZ — ZZS —	DDU — —
140	175 190 210	18 24 22	1.1 1.5 1.1	38 500 66 500 77 500	48 000 72 000 82 500	3 900 6 800 7 900	4 850 7 300 8 400	17.3 16.6 16.5	3 400 3 200 2 800	1 900 — —	4 000 3 800 3 400	6828 6928 16028	ZZ VV ZZS VV — —	DDU — —
	210 250 300	33 42 62	2 3 4	110 000 166 000 253 000	109 000 150 000 246 000	11 200 17 000 25 800	11 100 15 300 25 100	16.0 14.9 13.6	2 800 2 200 2 000	1 800 1 700 —	3 400 2 800 2 400	6028 6228 6328	ZZ — ZZS — ZZS —	DDU DDU
150	190 210 225	20 28 24	1.1 2 1.1	47 500 85 000 84 000	58 500 90 500 91 000	4 850 8 650 8 550	5 950 9 200 9 250	17.1 16.5 16.6	3 200 2 600 2 600	1 800 1 700 —	3 800 3 200 3 000	6830 6930 16030	ZZ VV ZZS — — —	DDU DDU
	225 270 320	35 45 65	2.1 3 4	126 000 176 000 274 000	126 000 168 000 284 000	12 800 18 000 28 000	12 800 17 100 28 900	15.9 15.1 13.9	2 600 2 000 1 800	1 700 — —	3 000 2 600 2 200	6030 6230 6330	ZZ VV ZZS — ZZS —	DDU — —
160	200 220 240	20 28 25	1.1 2 1.5	48 500 87 000 99 000	61 000 96 000 108 000	4 950 8 850 10 100	6 250 9 800 11 000	17.2 16.6 16.5	2 600 2 600 2 400	1 700 1 600 —	3 200 3 000 2 800	6832 6932 16032	ZZS VV ZZS — — —	DDU DDU
	240 290 340	38 48 68	2.1 3 4	137 000 185 000 278 000	135 000 186 000 287 000	13 900 18 900 28 300	13 800 19 000 29 200	15.9 15.4 13.9	2 400 1 900 1 700	1 600 — —	2 800 2 400 2 000	6032 6232 6332	ZZ — ZZS — ZZS —	DDU — —



⁽²⁾ When heavy axial loads are applied, increase d_a and decrease D_a from the above values.





Static Equivalent Load

 $\frac{F_a}{F_r}$ >0.8, P_0 =0.6 F_r +0.5 F_a

 $\frac{F_{\rm a}}{F_{\rm r}} \le 0.8$, $P_0 = F_{\rm i}$

With		Snaj	p Ring (Groove Dim (mm)	ensions	s (1)	Snap R Dimen	sions		Abutmer	nt and Fille (mm		ensions		Mass (kg)
Snap Ring Groov	Ring	а max.	b min.	$D_{\scriptscriptstyle 1}$ max.	$r_{ m 0}$ max.	$r_{ m N}$ min.	$D_{\scriptscriptstyle 2}^{({ m mr}}$	f max.	min.	$I_{\rm a}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	$r_{ m a}$ max.	$D_{\!\scriptscriptstyle m x}$ min.	$C_{\scriptscriptstyle m Y}$ max.	approx.
N N	NR NR	2.5 3.3	1.9 1.9 —	137.6 147.6 —	0.6 0.6	0.5 0.5 —	145.7 155.7 —	1.7 1.7 —	115 116.5 115	117 121 —	135 143.5 165	1 1 1	147 157 —	3.9 4.7	0.497 0.893 1.51
N N	NR NR	3.71 5.69 —	3.5 3.5 —	163.65 193.65 —	0.6 0.6	0.5 0.5 —	182.9 212.9 —	3.1 3.1	119 121 123	124.5 134 147	161 189 227	2 2 2.5	185 215 —	6.4 8.4	1.94 4.45 9.51
N N	NR NR	2.5 3.7	1.9 1.9	147.6 161.8 —	0.6 0.6	0.5 0.5 —	155.7 171.5 —	1.7 1.7	125 126.5 125	127 132 —	145 158.5 175	1 1 1	157 173 —	3.9 5.1	0.537 1.21 1.6
N 	NR —	3.71 — —	3.5	173.66 — —	0.6	0.5 — —	192.9 — —	3.1 	129 131 133	134.5 146 161	171 204 247	2 2 2.5	195 — —	6.4	2.08 5.29 12.5
N N	NR NR	3.3 3.7 —	1.9 1.9 —	161.8 176.8 —	0.6 0.6	0.5 0.5 —	171.5 186.5 —	1.7 1.7 —	136.5 138 136.5	138 144 —	158.5 172 193.5	1 1.5 1	173 188 —	4.7 5.1	0.758 1.57 2.4
N _	NR —	5.69 —	3.5 — —	193.65 — —	0.6	0.5 —	212.9 — —	3.1 	139 143 146	148.5 157 175	191 217 264	2 2.5 3	215 — —	8.4	3.26 5.96 15.2
N N	NR NR	3.3 3.7 —	1.9 1.9 —	171.8 186.8 —	0.6 0.6	0.5 0.5 —	181.5 196.5 —	1.7 1.7 —	146.5 148 146.5	148.5 153.5	168.5 182 203.5	1 1.5 1	183 198 —	4.7 5.1	0.832 1.67 2.84
_	_	_ _ _	_	_ _ _	_	_	_ _ _	_ _	149 153 156	158.5 171.5 187	201 237 284	2 2.5 3	_	_	3.48 7.68 18.5
N 	NR —	3.3	1.9 	186.8 — —	0.6	0.5	196.5 — —	1.7 —	156.5 159 156.5	160 166 —	183.5 201 218.5	1 2 1	198 — —	4.7 —	1.15 3.01 3.62
_	_	_ _ _	_	_ _ _	_	_	_ _ _		161 163 166	170 186 203	214 257 304	2 2.5 3	_ _ _	_	4.24 10 22.7
N 	NR —	3.3	1.9 	196.8 — —	0.6	0.5 — —	206.5 — —	1.7 —	166.5 169 168	170.5 176	193.5 211 232	1 2 1.5	208 — —	4.7 —	1.23 2.71 4.2
_ _ _	_	_ _ _	_	_	_	_	_ _ _	_	171 173 176	181.5 202 215.5	229 277 324	2 2.5 3	_	_	5.15 12.8 26.2

 ϕD_a

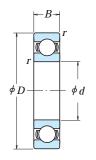
 ϕD_1

 $\phi d_a \phi D_X$

Remarks 1. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

2. Please consult NSK about the snap ring groove dimensions of sealed and shielded bearings when the diameter of dimension series 18 and 19 is 50 mm or more.

Bore Diameter 170 - 240 mm







Shielded Type ZZS Open Type

Non-Contact Sealed Type VV

Boundary Dimensions Basic Load Ratings									V V			
Bou	ndary E		sions	/-			. 0	Factor	Limiting	Speeds (min ⁻¹)	Bearing Numbers
	(111)	111)		(1	N)	{K	gf}		Grea	ise	Oil	
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open Shielded Sealed
170	215 230 260	22 28 28	1.1 2 1.5	60 000 86 000 114 000	75 000 97 000 126 000	6 100 8 750 11 700	7 650 9 850 12 900	17.1 16.7 16.5	2 600 2 400 2 200	1 600 — —	3 000 2 800 2 600	6834 ZZS VV DDU 6934 ZZS — — 16034 — — —
	260 310 360	42 52 72	2.1 4 4	161 000 212 000 325 000	161 000 224 000 355 000	16 400 21 700 33 500	16 400 22 800 36 000	15.8 15.3 13.6	2 200 1 800 1 600	_	2 600 2 200 2 000	6034 ZZS VV — 6234 ZZS — — 6334 — — —
180	225 250 280	22 33 31	1.1 2 2	60 500 119 000 145 000	78 500 128 000 157 000	6 200 12 100 14 700	8 000 13 100 16 000	17.2 16.4 16.3	2 400 2 200 2 000	_	2 800 2 600 2 400	6836 — VV — 6936 ZZS — — 16036 — — —
	280 320 380	46 52 75	2.1 4 4	180 000 227 000 355 000	185 000 241 000 405 000	18 400 23 200 36 000	18 800 24 600 41 500	15.6 15.1 13.9	2 000 1 700 1 500	_ _ _	2 400 2 000 1 800	6036 ZZS VV — 6236 ZZS — — 6336 — — —
190	240 260 290	24 33 31	1.5 2 2	73 000 113 000 149 000	93 500 127 000 168 000	7 450 11 500 15 200	9 550 13 000 17 100	17.1 16.6 16.4	2 200 2 200 2 000		2 600 2 600 2 400	6838 — VV — 6938 — — — 16038 — — —
	290 340 400	46 55 78	2.1 4 5	188 000 255 000 355 000	201 000 282 000 415 000	19 200 26 000 36 000	20 500 28 700 42 500	15.8 15.0 14.1	2 000 1 600 1 400		2 400 2 000 1 700	6038 ZZS — — 6238 ZZS — — 6338 — — —
200	250 280 310	24 38 34	1.5 2.1 2	74 000 143 000 161 000	98 000 158 000 180 000	7 550 14 600 16 400	10 000 16 100 18 300	17.2 16.4 16.4	2 200 2 000 1 900	_ _ _	2 600 2 400 2 200	6840 — — — 6940 ZZS — — 16040 — — —
	310 360 420	51 58 80	2.1 4 5	207 000 269 000 380 000	226 000 310 000 445 000	21 100 27 400 38 500	23 000 31 500 45 500	15.6 15.2 13.8	1 900 1 500 1 300	_	2 200 1 800 1 600	6040 ZZS — — 6240 ZZS — — 6340 — — —
220	270 300 340	24 38 37	1.5 2.1 2.1	76 500 146 000 180 000	107 000 169 000 217 000	7 800 14 900 18 400	10 900 17 300 22 100	17.4 16.6 16.5	1 900 1 800 1 600	_	2 400 2 200 2 000	6844 ZZS — — 6944 ZZS — — 16044 — — —
	340 400 460	56 65 88	3 4 5	235 000 310 000 410 000	271 000 375 000 520 000	24 000 31 500 42 000	27 600 38 500 53 000	15.6 15.1 14.3	1 700 1 300 1 200	_	2 000 1 600 1 500	6044 ZZS — — 6244 — — — 6344 — — —
240	300 320 360	28 38 37	2 2.1 2.1	98 500 154 000 196 000	137 000 190 000 243 000	10 000 15 700 19 900	14 000 19 400 24 700	17.3 16.8 16.5	1 700 1 700 1 500	_	2 000 2 000 1 900	6848 — — — 6948 ZZS — — 16048 — — —
	360 440 500	56 72 95	3 4 5	244 000 340 000 470 000	296 000 430 000 625 000	24 900 34 500 48 000	30 000 44 000 63 500	15.9 15.2 14.2	1 500 1 200 1 100	_ _ _	1 900 1 500 1 300	6048 — — — 6248 — — — 6348 — — —

Note (1) When heavy axial loads are applied, increase d_a and decrease D_a from the above values. **Remarks** When using bearings with rotating outer rings, contact NSK if they are sealed or shielded.



 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}}$	>e
$\mathcal{C}_{0\mathrm{r}}$		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00



Static Equivalent Load
$$\frac{F_a}{F_r} > 0.8, \ P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, \ P_0 = F_r$$

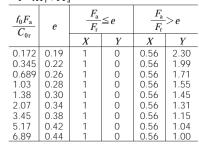
$$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, \ P_0 = F_{\rm r}$$

 ϕD_a

Bore Diameter 260 - 360 mm

Dynamic Equivalent Load



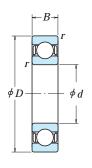


NSK



$$\frac{F_a}{F_r} > 0.8$$
, $P_0 = 0.6F_r + 0.5F_a$

$$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, \ P_0 = F_{\rm r}$$



Open Type

Во	oundary [(m	Dimensio m)	ons	A)	Basic Load	I Ratings {kg	gf}	Factor	Limiting :		Bearing Numbers
d	D	В	$r \atop { m min.}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	Open
260	320	28	2	101 000	148 000	10 300	15 100	17.4	1 600	1 900	6852
	360	46	2.1	204 000	255 000	20 800	26 000	16.5	1 500	1 800	6952
	400	44	3	237 000	310 000	24 100	31 500	16.4	1 400	1 700	16052
	400	65	4	291 000	375 000	29 700	38 500	15.8	1 400	1 700	6052
	480	80	5	400 000	540 000	41 000	55 000	15.1	1 100	1 300	6252
	540	102	6	505 000	710 000	51 500	72 500	14.6	1 000	1 200	6352
280	350	33	2	133 000	191 000	13 600	19 500	17.3	1 500	1 700	6856
	380	46	2.1	209 000	272 000	21 300	27 700	16.6	1 400	1 700	6956
	420	44	3	243 000	330 000	24 700	33 500	16.5	1 300	1 600	16056
	420	65	4	300 000	410 000	31 000	41 500	16.0	1 300	1 600	6056
	500	80	5	400 000	550 000	41 000	56 000	15.2	1 000	1 300	6256
	580	108	6	570 000	840 000	58 000	86 000	14.5	900	1 100	6356
300	380	38	2.1	166 000	233 000	17 000	23 800	17.1	1 300	1 600	6860
	420	56	3	269 000	370 000	27 400	38 000	16.4	1 300	1 500	6960
	460	50	4	285 000	405 000	29 000	41 000	16.4	1 200	1 400	16060
	460	74	4	355 000	500 000	36 500	51 000	15.8	1 200	1 400	6060
	540	85	5	465 000	670 000	47 500	68 500	15.1	950	1 200	6260
320	400	38	2.1	168 000	244 000	17 200	24 900	17.2	1 300	1 500	6864
	440	56	3	266 000	375 000	27 100	38 000	16.5	1 200	1 400	6964
	480	50	4	293 000	430 000	29 800	44 000	16.5	1 100	1 300	16064
	480	74	4	390 000	570 000	40 000	58 000	15.7	1 100	1 300	6064
	580	92	5	530 000	805 000	54 500	82 500	15.0	850	1 100	6264
340	420	38	2.1	175 000	265 000	17 800	27 100	17.3	1 200	1 400	6868
	460	56	3	273 000	400 000	27 800	40 500	16.6	1 100	1 300	6968
	520	82	5	440 000	660 000	45 000	67 500	15.6	1 000	1 200	6068
	620	92	6	530 000	820 000	54 000	83 500	15.3	800	1 000	6268
360	440	38	2.1	192 000	290 000	19 600	29 600	17.3	1 100	1 300	6872
	480	56	3	280 000	425 000	28 500	43 000	16.7	1 100	1 300	6972
	540	82	5	460 000	720 000	47 000	73 500	15.7	950	1 200	6072
	650	95	6	555 000	905 000	57 000	92 000	15.4	750	950	6272

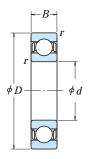
	ment and F ensions (m		Mass (kg)
$d_{\!\scriptscriptstyle a}^{\!\scriptscriptstyle (1)}$ min.	$D_{\!\scriptscriptstyle a}^{\scriptscriptstyle (1)}$ max.	$r_{ m a}$ max.	approx.
269	311	2	4.84
271	349	2	14
273	387	2.5	21.1
276	384	3	29.4
280	460	4	67
286	514	5	118
289	341	2	7.2
291	369	2	15.1
293	407	2.5	22.7
296	404	3	31.2
300	480	4	70.4
306	554	5	144
311	369	2	10.3
313	407	2.5	23.9
316	444	3	31.5
316	444	3	44.2
320	520	4	87.8
331	389	2	10.8
333	427	2.5	25.3
336	464	3	33.2
336	464	3	46.5
340	560	4	111
351	409	2	11.5
353	447	2.5	26.6
360	500	4	62.3
366	594	5	129
371	429	2	11.8
373	467	2.5	27.9
380	520	4	65.3
386	624	5	145

 ϕD_a

Note (1) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.



Bore Diameter 380 - 600 mm



Open Type

Во	oundary [(m	Dimension)	ons	1)	Basic Load		gf}	Factor	Limiting :		Bearing Numbers
d	D	B	$r \atop { m min.}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	Open
380	480	46	2.1	238 000	375 000	24 200	38 000	17.1	1 000	1 200	6876
	520	65	4	325 000	510 000	33 000	52 000	16.6	950	1 200	6976
	560	82	5	455 000	725 000	46 500	74 000	15.9	900	1 100	6076
400	500	46	2.1	241 000	390 000	24 600	40 000	17.2	950	1 200	6880
	540	65	4	335 000	540 000	34 000	55 000	16.7	900	1 100	6980
	600	90	5	510 000	825 000	52 000	84 000	15.7	850	1 000	6080
420	520	46	2.1	245 000	410 000	25 000	41 500	17.3	900	1 100	6884
	560	65	4	340 000	570 000	35 000	58 500	16.8	900	1 100	6984
	620	90	5	530 000	895 000	54 000	91 000	15.8	800	1 000	6084
440	540	46	2.1	248 000	425 000	25 300	43 500	17.4	900	1 100	6888
	600	74	4	395 000	680 000	40 500	69 000	16.6	800	1 000	6988
	650	94	6	550 000	965 000	56 000	98 500	16.0	750	900	6088
460	580	56	3	310 000	550 000	31 500	56 000	17.1	800	1 000	6892
	620	74	4	405 000	720 000	41 500	73 500	16.7	800	950	6992
	680	100	6	605 000	1 080 000	62 000	110 000	15.8	710	850	6092
480	600	56	3	315 000	575 000	32 000	58 500	17.2	800	950	6896
	650	78	5	450 000	815 000	45 500	83 000	16.6	750	900	6996
	700	100	6	605 000	1 090 000	61 500	111 000	15.9	710	850	6096
500	620	56	3	320 000	600 000	33 000	61 000	17.3	750	900	68/500
	670	78	5	460 000	865 000	47 000	88 000	16.7	710	850	69/500
	720	100	6	630 000	1 170 000	64 000	120 000	16.0	670	800	60/500
530	650	56	3	325 000	625 000	33 000	63 500	17.4	710	850	68/530
	710	82	5	455 000	870 000	46 500	88 500	16.8	670	800	69/530
	780	112	6	680 000	1 300 000	69 500	133 000	16.0	600	750	60/530
560	680	56	3	330 000	650 000	33 500	66 500	17.4	670	800	68/560
	750	85	5	525 000	1 040 000	53 500	106 000	16.7	600	750	69/560
	820	115	6	735 000	1 500 000	75 000	153 000	16.2	560	670	60/560
600	730	60	3	355 000	735 000	36 000	75 000	17.5	600	710	68/600
	800	90	5	550 000	1 160 000	56 500	118 000	16.9	560	670	69/600
	870	118	6	790 000	1 640 000	80 500	168 000	16.1	530	630	60/600

Note (1) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.



 $P = XF_r + YF_a$

	a									
$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\rm a}}{F_{ m r}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}} > e$						
$\mathcal{O}_{0\mathrm{r}}$		X	Y	X	Y					
0.172	0.19	1	0	0.56	2.30					
0.345	0.22	1	0	0.56	1.99					
0.689	0.26	1	0	0.56	1.71					
1.03	0.28	1	0	0.56	1.55					
1.38	0.30	1	0	0.56	1.45					
2.07	0.34	1	0	0.56	1.31					
3.45	0.38	1	0	0.56	1.15					
5.17	0.42	1	0	0.56	1.04					
6.89	0.44	1	0	0.56	1.00					

Static Equivalent Load

$$\frac{F_{\rm a}}{F_{\rm r}}$$
>0.8, P_0 =0.6 $F_{\rm r}$ +0.5 $F_{\rm a}$

$$\frac{F_{\rm a}}{F_{\rm r}} \le 0.8$$
, $P_0 = F_{\rm r}$



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 ϕD_a

 $d_{\!
m a}^{(1)}$ min.

Abutment and Fillet Dimensions (mm)

 $D_{\!\scriptscriptstyle a}^{\scriptscriptstyle (1)}$ max.

793.5

 $r_{\rm a}$

2.5

2.5

2.5

2.5

2.5

2.5 (kg)

approx.

19.5

20.5 88.4

21.4

43.6 92.2

22.3 60.2

34.3 62.6

35.4 73.5

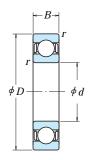
37.2

> 39.8 89.8

41.5

50.9

Bore Diameter 630 - 800 mm



Open Type

В	Boundary Dimensions (mm)			Basic Load Ratings (N) {kgf}			Factor	Limiting S (min		Bearing Numbers	
d	D	B	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	Open
630	780	69	4	420 000	890 000	43 000	90 500	17.3	560	670	68/630
	850	100	6	625 000	1 350 000	64 000	138 000	16.7	530	630	69/630
	920	128	7.5	750 000	1 620 000	76 500	165 000	16.4	480	600	60/630
670	820	69	4	435 000	965 000	44 500	98 000	17.4	500	630	68/670
	900	103	6	675 000	1 460 000	68 500	149 000	16.7	480	560	69/670
	980	136	7.5	765 000	1 730 000	78 000	177 000	16.6	450	530	60/670
710	870	74	4	480 000	1 100 000	49 000	113 000	17.4	480	560	68/710
	950	106	6	715 000	1 640 000	72 500	167 000	16.8	450	530	69/710
750	920	78	5	525 000	1 260 000	53 500	128 000	17.4	430	530	68/750
	1 000	112	6	785 000	1 840 000	80 000	188 000	16.7	400	500	69/750
800	980	82	5	530 000	1 310 000	54 000	133 000	17.5	400	480	68/800
	1 060	115	6	825 000	2 050 000	84 500	209 000	16.8	380	450	69/800

Note (1) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.



 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\rm a}}{F_{ m r}}$	$\leq e$	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}} > e$		
O _{0r}		X	Y	X	Y	
0.172	0.19	1	0	0.56	2.30	
0.345	0.22	1	0	0.56	1.99	
0.689	0.26	1	0	0.56	1.71	
1.03	0.28	1	0	0.56	1.55	
1.38	0.30	1	0	0.56	1.45	
2.07	0.34	1	0	0.56	1.31	
3.45	0.38	1	0	0.56	1.15	
5.17	0.42	1	0	0.56	1.04	
6.89	0.44	1	0	0.56	1.00	

Static Equivalent Load

$$\frac{F_{\rm a}}{F_{\rm r}} > 0.8, \ P_0 = 0.6F_{\rm r} + 0.5F_{\rm a}$$

$$\frac{F_{\rm a}}{F_{\rm r}} \le 0.8, \ P_0 = F_{\rm r}$$

$$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, P_0 = F_{\rm r}$$



 ϕD_a

 $d_{\!\scriptscriptstyle a}^{\scriptscriptstyle (1)}$ min.

646 656 662

686 696 702

726 736

770 776

820 826

Abutment and Fillet Dimensions (mm)

 $D_{\!\scriptscriptstyle
m a}^{\scriptscriptstyle (1)}$

764 824 888

804 874

948

854 924

900 974

960 1 034

 $r_{\rm a}$ max.

3 5 6

4 5

4 5

Mass (kg)

approx.

71.3 163 285

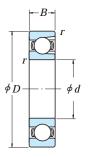
75.4 181 351

92.6 208

110 245

132 275

Bore Diameter 25 – 110 mm





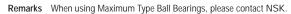


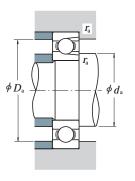
Open Type

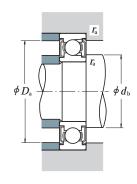
Shielded Type (One Shield) Z

Shielded Type (Two Shields) ZZ

В	Soundary D		ns	,	Basic Loa	d Ratings	gf}	Limiting		
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	(mii Grease Open Z · ZZ	Oil Open Z	Open
25	52	15	1	14 400	10 500	1 470	1 070	12 000	15 000	BL 205
	62	17	1.1	21 500	15 500	2 200	1 580	11 000	13 000	BL 305
30	62	16	1	21 000	16 300	2 150	1 660	10 000	12 000	BL 206
	72	19	1.1	27 900	20 700	2 840	2 110	9 000	11 000	BL 306
35	72	17	1.1	27 800	22 100	2 830	2 250	9 000	11 000	BL 207
	80	21	1.5	37 000	29 100	3 800	2 970	8 000	9 500	BL 307
40	80	18	1.1	35 500	28 800	3 600	2 940	8 000	9 500	BL 208
	90	23	1.5	46 500	36 000	4 750	3 650	7 500	9 000	BL 308
45	85	19	1.1	37 000	32 000	3 800	3 250	7 500	9 000	BL 209
	100	25	1.5	55 500	44 000	5 650	4 500	6 300	8 000	BL 309
50	90	20	1.1	39 000	35 000	3 950	3 550	6 700	8 500	BL 210
	110	27	2	65 000	52 500	6 600	5 350	6 000	7 100	BL 310
55	100	21	1.5	48 000	44 000	4 900	4 500	6 300	7 500	BL 211
	120	29	2	75 000	61 500	7 650	6 250	5 600	6 700	BL 311
60	110	22	1.5	58 000	54 000	5 950	5 550	5 600	6 700	BL 212
	130	31	2.1	85 500	71 500	8 700	7 300	5 000	6 000	BL 312
65	120	23	1.5	63 500	60 000	6 450	6 150	5 300	6 300	BL 213
	140	33	2.1	103 000	89 500	10 500	9 150	4 800	5 600	BL 313
70	125	24	1.5	69 000	66 000	7 050	6 750	5 000	6 000	BL 214
	150	35	2.1	115 000	102 000	11 800	10 400	4 300	5 300	BL 314
75	130	25	1.5	72 000	72 000	7 350	7 300	4 500	5 600	BL 215
	160	37	2.1	126 000	116 000	12 800	11 800	4 000	5 000	BL 315
80	140	26	2	84 000	85 000	8 600	8 650	4 300	5 300	BL 216
	170	39	2.1	136 000	130 000	13 900	13 300	3 800	4 500	BL 316
85	150 180	28 41	2	93 000 147 000	93 000 145 000	9 500 15 000	9 450 14 800	4 000 3 600	5 000 4 300	BL 217 BL 317
90	160 190	30 43	2	107 000 158 000	107 000 161 000	10 900 16 100	10 900 16 400	3 800 3 400	4 500 4 000	BL 218 BL 318
95	170	32	2.1	121 000	123 000	12 300	12 500	3 600	4 300	BL 219
	200	45	3	169 000	178 000	17 300	18 100	2 800	3 600	BL 319
100	180	34	2.1	136 000	140 000	13 800	14 200	3 400	4 000	BL 220
105	190	36	2.1	148 000	157 000	15 000	16 000	3 200	3 800	BL 221
110	200	38	2.1	160 000	176 000	16 300	17 900	2 800	3 400	BL 222





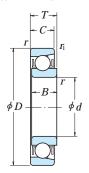


Bearing Number	-S	Abut	ment and Fill (mm		ns	Mass (kg)
With One Shielded	With Two Shields	$d_{\scriptscriptstyle m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{max}.$	approx.
BL 205 Z	BL 205 ZZ	30	32	47	1	0.133
BL 305 Z	BL 305 ZZ	31.5	36	55.5	1	0.246
BL 206 Z	BL 206 ZZ	35	38.5	57	1	0.215
BL 306 Z	BL 306 ZZ	36.5	42	65.5	1	0.364
BL 207 Z	BL 207 ZZ	41.5	44.5	65.5	1	0.307
BL 307 Z	BL 307 ZZ	43	44.5	72	1.5	0.486
BL 208 Z	BL 208 ZZ	46.5	50	73.5	1	0.394
BL 308 Z	BL 308 ZZ	48	52.5	82	1.5	0.685
BL 209 Z	BL 209 ZZ	51.5	55.5	78.5	1	0.449
BL 309 Z	BL 309 ZZ	53	61.5	92	1.5	0.883
BL 210 Z	BL 210 ZZ	56.5	60	83.5	1	0.504
BL 310 Z	BL 310 ZZ	59	68	101	2	1.16
BL 211 Z	BL 211 ZZ	63	66.5	92	1.5	0.667
BL 311 Z	BL 311 ZZ	64	72.5	111	2	1.49
BL 212 Z	BL 212 ZZ	68	74.5	102	1.5	0.856
BL 312 Z	BL 312 ZZ	71	79	119	2	1.88
BL 213 Z	BL 213 ZZ	73	80	112	1.5	1.09
BL 313 Z	BL 313 ZZ	76	85.5	129	2	2.36
BL 214 Z	BL 214 ZZ	78	84	117	1.5	1.19
BL 314 Z	BL 314 ZZ	81	92	139	2	2.87
BL 215 Z	BL 215 ZZ	83	90	122	1.5	1.29
BL 315 Z	BL 315 ZZ	86	98.5	149	2	3.43
BL 216 Z BL 316 Z	BL 216 ZZ BL 316 ZZ	89 91	95.5 104.5	131 159	2	1.61 4.08
BL 217 Z	BL 217 ZZ	94	102	141	2	1.97
BL 317 Z	BL 317 ZZ	98	110.5	167	2.5	4.77
BL 218 Z	BL 218 ZZ	99	107.5	151	2	2.43
BL 318 Z	BL 318 ZZ	103	117	177	2.5	5.45
BL 219 Z	BL 219 ZZ	106	114	159	2	2.95
BL 319 Z	BL 319 ZZ	108	124	187	2.5	6.4
BL 220 Z BL 221 Z	BL 220 ZZ BL 221 ZZ	111 116	121.5 127.5	169 179	2 2 2	3.54 4.23
_	_	121	_	189	2	

B 26 B 27



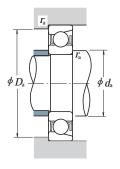
Bore Diameter 4 – 20 mm



Outside Diameter Tolerance (Class N)

Units : μm Single Plane Mean Outside

Nominai Outside Diameter		Diameter ΔD_{mp}					
	Dameter D (mm)		E Se	eries	EN Series		
	Over	Incl.	High	Low	High	Low	
		10	+ 8	0	0	- 8	
	10	18	+ 8	0	0	- 8	
	18	30	+ 9	0	0	- 9	
	30	50	+11	Ω	1 0	_11	



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$		
X	Y	X	Y	e
1	0	0.5	2.5	0.2

	Bound	dary Dim (mm)	ensions		1)	Basic Loa	d Ratings {kg	ιf}	Limiting (mir		Bearing	Numbers
d	D	<i>B, C, T</i>	$r \atop ext{min.}$	$r_1 \atop ext{min.}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	E Series	EN Series
4	16	5	0.15	0.1	1 650	288	168	29	34 000	40 000	E 4	EN 4
5	16	5	0.15	0.1	1 650	288	168	29	34 000	40 000	E 5	EN 5
6	21	7	0.3	0.15	2 490	445	254	46	30 000	36 000	E 6	EN 6
7	22	7	0.3	0.15	2 490	445	254	46	30 000	36 000	E 7	EN 7
8	24	7	0.3	0.15	3 450	650	350	66	28 000	34 000	E 8	EN 8
9	28	8	0.3	0.15	4 550	880	465	90	24 000	30 000	E 9	EN 9
10	28	8	0.3	0.15	4 550	880	465	90	24 000	30 000	E 10	EN 10
11	32	7	0.3	0.15	4 400	845	450	86	22 000	26 000	E 11	EN 11
12	32	7	0.3	0.15	4 400	845	450	86	22 000	26 000	E 12	EN 12
13	30	7	0.3	0.15	4 400	845	450	86	22 000	26 000	E 13	EN 13
14	35	8	0.3	0.15	5 800	1 150	590	117	19 000	22 000	—	EN 14
15 16	35 40 38	8 10 10	0.3 0.6 0.6	0.15 0.3 0.2	5 800 7 400 6 900	1 150 1 500 1 380	590 750 705	117 153 141	19 000 17 000 17 000	22 000 20 000 22 000	E 15 BO 15 —	EN 15 — EN 16
17	40 44 44	10 11 11	0.6 0.6 0.6	0.3 0.3 0.3	7 400 7 350 7 350	1 500 1 500 1 500	750 750 750	153 153 153	17 000 16 000 16 000	20 000 19 000 19 000	L 17 BO 17	EN 17 —
18 19	40 40	9	0.6 0.6	0.2 0.2	5 050 5 050	1 030 1 030	515 515	105 105	17 000 17 000	20 000 20 000	E 19	EN 18 EN 19
20	47	12	1	0.6	11 000	2 380	1 120	243	14 000	17 000	E 20	EN 20
	47	14	1	0.6	11 000	2 380	1 120	243	14 000	17 000	L 20	—

Remarks 1. The outside diameters of Magneto Bearings Series E always have plus tolerances.

2. When using Magneto Bearings other than E, please contact NSK.

	ment and I ensions (n		Mass (kg)
$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	approx.
5.2	14.8	0.15	0.005
6.2	14.8	0.15	0.004
8	19	0.3	0.011
9	20	0.3	0.013
10	22	0.3	0.014
11	26	0.3	0.022
12	26	0.3	0.021
13	30	0.3	0.029
14	30	0.3	0.028
15	28	0.3	0.021
16	33	0.3	0.035
17	33	0.3	0.034
19	36	0.6	0.055
20	34	0.6	0.049
21	36	0.6	0.051
21	40	0.6	0.080
21	40	0.6	0.080
22	36	0.6	0.051
23	36	0.6	0.049
25	42	1	0.089
25	42	1	0.101

B 28 B 29

EXTRA SMALL BALL BEARINGS AND MINIATURE BALL **BEARINGS**

EXTRA SMALL BALL BEARINGS · MINIATURE BALL BEARINGS

Metric Design	Bore Diameter 1 – 9mm·····	B34
With Flange	Bore Diameter 1 – 9mm·····	B38
Inch Design	Bore Diameter 1.016 – 9.525mm·····	B42
With Flange	Bore Diameter 1.191 – 9.525mm·····	B44

DESIGN AND TYPES

The size ranges of extra small and miniature ball bearings are shown in Table 1. The design, types, and type symbols are shown in Table 2. Those types among them that are listed in the bearing tables are indicated by the shading in Table 2.

Table 1 Size Ranges of Bearings

Units: mm

Design	Extra Small Ba	II Bearings	Miniature Ball Bearings
Metric	Outside diameter Bore diameter		Outside diameter $D < 9$
Inch	Outside diameter Bore diameter		Outside diameter $D < 9.525$

Please refer to NSK Miniature Ball Bearings (CAT. No. E126) for details.



ZZ



ZZS



DD



B 30 B 31

Table 2 Design, Types, and Type Symbols

			Type S	ymbols		
0	Design · Types	Metric	Inch	Spe	ecial	Remarks
	1	Wictific	IIICII	Metric	Inch	
		600	R	MR	_	Shielded · sealed bearings are available.
	Thin section	_	-	SMT	_	
Ball Bearings	With flange	F6 0 0	FR	MF	_	Shielded · sealed bearings are available.
Single-Row Deep Groove Ball Bearings	Extended inner ring	_	_	_	RW	Shielded bearings are available.
Sin	With flange and extended inner ring	_	_	_	FRW	Shielded bearings are available.
	For synchro motors	_	_	_	SR00X00	Shielded bearings are available.
Pivot Ball Bearings		_	_	BCF	_	
Thrust Ball Bearings		_	_	F	_	

Remarks Single-row angular contact ball bearings are available besides those shown above.

TOLERANCES AND RUNNING ACCURACY

METRIC DESIGN BEARINGS Table 8.2(Pages A60 to A63)

The flange tolerances for metric design bearings are listed in Table 3.

Table 3 Flange Tolerances for Metric Flanged Bearings

(1) Tolerand	ces of Flange	e Outside Diame							
Nomina	l Flange		Deviation of Flang	e Outside Diamet	er				
Outside I	Diameter		Δ	D_{1S}					
D_1 (r	nm)	(1)		2)				
over	incl.	high	low	high	low				
	10	+220	-36	0	-36				
10	18	+270	-43	0	-43				
18	30	+330	-52	0	-52				

Remarks ②is applied when the flange outside diameter is used for positioning.

(2) Flange Width Tolerances and Running Accuracies Related to Flange

Units: µm

	Nominal Bearing Outside Diameter D (mm)	Outside eter	Flange	ation of e Width C1s	Variation of Flange Width $\Delta _{C_{18}}$				Outside Genera	on of Bea e Surface strix Incli ange Bac S_{D1}	e nation	Flange Backface Runout with Raceway $S_{ m ea1}$		
		11)	Normal and	Classes 6,5,4,2	Normal and class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
	over	incl.	high	low		max.		IX.		max.		max.		
	2.5(1)	6	Use the $\Delta B_{\rm S}$	tolerance for d	Use the $\Delta \it{V}_{ m BS}$	5	2.5	1.5	8	4	1.5	11	7	3
-	6 18	18	of the same bearing of the to		tolerance for d of	5	2.5	1.5	8	4	1.5	11	7	3
Ξ	18	18 30 same class	the same bearing of the same class	5	2.5	1.5	8	4	1.5	11	7	3		

Notes (1) 2.5 mm is included

INCH DESIGN BEARINGS Table 8.2 (Pages A60 to A63)

The flange tolerances for inch design flanged bearings are listed in Table 8.8(2) (Pages A76 and A77).

INSTRUMENT BALL BEARINGS Table 8.8 (Pages A76 to A77)

RECOMMENDED FITS

Please refer to NSK Miniature Ball Bearings (CAT.No.E126).

INTERNAL CLEARANCES......Table 9.10 (Page A89)

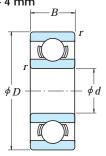
LIMITING SPEEDS

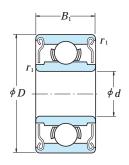
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing toad conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information



Metric Design

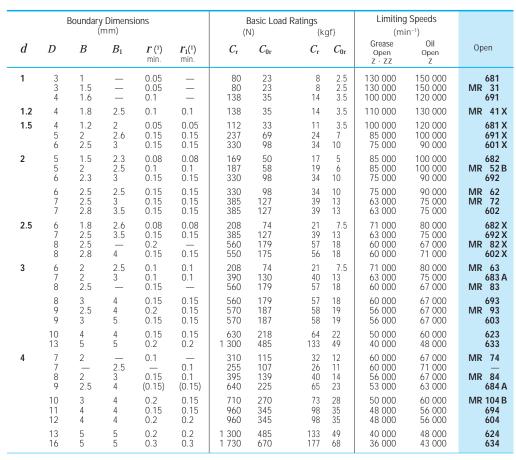
Bore Diameter 1 – 4 mm





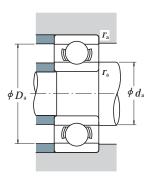
Open Type

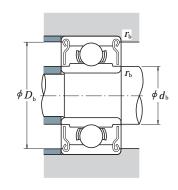
Shielded Type ZZ · ZZ1





Remarks When using bearings with a rotating outer ring, please contact NSK if they are shielded.



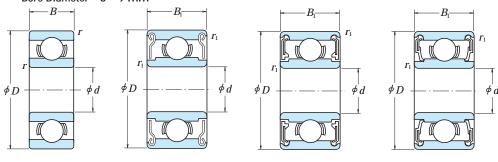


Bearing Numbers			Abutn	nent and F (m		nsions		Ma (g	
Shielded	Sealed	$d_{ m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$D_{ m b}$ min.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$\emph{\emph{r}}_{b}$ max.	app Open	rox. Shielded
_ _ _		1.4 1.4 1.8	_	2.6 2.6 3.2	_	0.05 0.05 0.1	_ _ _	0.03 0.04 0.09	_
MR 41 XZZ		2.0	1.9	3.2	3.5	0.1	0.1	0.10	0.14
681 XZZ		1.9	2.1	3.6	3.6	0.05	0.05	0.07	0.11
691 XZZ		2.7	2.5	3.8	4.3	0.15	0.15	0.17	0.20
601 XZZ		2.7	3.0	4.8	5.4	0.15	0.15	0.33	0.38
682 ZZ	= =	2.6	2.7	4.4	4.2	0.08	0.08	0.12	0.17
MR 52 BZZ		2.8	2.7	4.2	4.4	0.1	0.1	0.16	0.23
692 ZZ		3.2	3.0	4.8	5.4	0.15	0.15	0.28	0.38
MR 62 ZZ		3.2	3.0	4.8	5.2	0.15	0.15	0.30	0.29
MR 72 ZZ		3.2	3.8	5.8	6.2	0.15	0.15	0.45	0.49
602 ZZ		3.2	3.8	5.8	6.2	0.15	0.15	0.51	0.58
682 XZZ		3.1	3.7	5.4	5.4	0.08	0.08	0.23	0.29
692 XZZ		3.7	3.8	5.8	6.2	0.15	0.15	0.41	0.55
—		4.1	—	6.4	—	0.2	—	0.56	—
602 XZZ		3.7	4.1	6.8	7.0	0.15	0.15	0.63	0.83
MR 63 ZZ 683 AZZ		3.8 3.8 4.2	3.7 4.0	5.2 6.2 6.8	5.4 6.4	0.13 0.1 0.1 0.15	0.13 0.1 0.1	0.20 0.32 0.54	0.27 0.45
693 ZZ	= =	4.2	4.3	6.8	7.3	0.15	0.15	0.61	0.83
MR 93 ZZ		4.6	4.3	7.4	7.9	0.2	0.15	0.73	1.18
603 ZZ		4.2	4.3	7.8	7.9	0.15	0.15	0.87	1.45
623 ZZ		4.2	4.3	8.8	8.0	0.15	0.15	1.65	1.66
633 ZZ		4.6	6.0	11.4	11.3	0.2	0.2	3.38	3.33
MR 74 ZZ MR 84 ZZ 684 AZZ		4.8 — 5.2 4.8	4.8 5.0 5.2	6.2 — 6.8 8.2	6.3 7.4 8.1	0.1 0.15 0.1	0.1 0.1 0.1	0.22 0.36 0.63	0.29 0.56 1.01
MR 104 BZZ		5.6	5.9	8.4	8.8	0.2	0.15	1.04	1.42
694 ZZ		5.2	5.6	9.8	9.9	0.15	0.15	1.7	1.75
604 ZZ		5.6	5.6	10.4	9.9	0.2	0.2	2.25	2.29
624 ZZ	= =	5.6	6.0	11.4	11.3	0.2	0.2	3.03	3.04
634 ZZ1		6.0	7.5	14.0	13.8	0.3	0.3	5.24	5.21

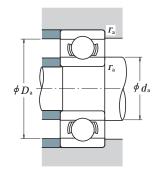


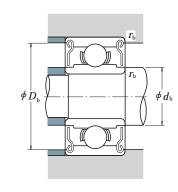
Metric Design

Bore Diameter 5 – 9 mm



	Open	Туре			Shielded ZZ · Z				Non-Co Sealed V	Туре		Conta Sealed 1 DD	
	Boundary Dimensions (mm)						Basic Loa N)	d Ratings {kg	gf}	Limitir Grea	ng Speeds (se	min ⁻¹) Oil	
d	D	В	B_1	r (1) min.	$m{r_1}(^1)$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Open Z · ZZ V · VV	D · DD	Open Z	Open
5	8 9 10 11 11 13	2 	2.5 3 4 4 5 4 5	0.1 0.15 0.15 0.15 0.2 0.2	0.1 0.15 0.15 0.15 0.15 0.2 0.2	310 278 430 430 715 715 1 080 1 330	120 131 168 168 276 281 430 505	31 28 44 44 73 73 110	12 13 17 17 28 29 44 52	53 000 53 000 50 000 50 000 48 000 45 000 43 000 40 000	 40 000 38 000	63 000 63 000 60 000 60 000 56 000 53 000 50 000	MR 85 MR 95 MR 105 — 685 695 605
6	16 19 10 12 13 15 17	5 6 2.5 3 3.5 5 6	5 6 3 4 5 5 6 6	0.3 0.3 0.15 0.2 0.15 0.2 0.3	0.3 0.3 0.1 0.15 0.15 0.2 0.3 0.3	1 730 2 340 495 715 1 080 1 730 2 260 2 340	670 885 218 292 440 670 835 885	177 238 51 73 110 177 231 238	68 90 22 30 45 68 85 90	36 000 32 000 45 000 43 000 40 000 38 000 32 000	32 000 30 000 40 000 38 000 36 000 34 000 30 000	43 000 40 000 53 000 50 000 50 000 45 000 45 000 40 000	625 635 MR 106 MR 126 686 A 696 606 626
7	22 11 13 14 17 19 22 26	7 2.5 3 3.5 5 6 7	7 3 4 5 5 6 7	0.3 0.15 0.2 0.15 0.3 0.3 0.3	0.3 0.1 0.15 0.15 0.3 0.3 0.3	3 300 455 540 1 170 1 610 2 340 3 300 4 550	1 370 201 276 510 710 885 1 370 1 970	335 47 55 120 164 238 335 465	140 21 28 52 73 90 140 201	30 000 43 000 40 000 40 000 36 000 36 000 30 000 28 000	28 000 — 34 000 28 000 32 000 28 000 22 000	36 000 50 000 48 000 45 000 43 000 36 000 34 000	636 MR 117 MR 137 687 697 607 627 637
9	12 14 16 19 22 24 28 17 20	2.5 3.5 4 6 7 8 9 4	3.5 4 5 6 7 8 9 5	0.15 0.2 0.2 0.3 0.3 0.3 0.3 0.2	0.1 0.15 0.2 0.3 0.3 0.3 0.3 0.2	545 820 1 610 2 240 3 300 3 350 4 550 1 330 1 720	274 385 710 910 1 370 1 430 1 970 665 840	56 83 164 228 335 340 465 136	28 39 73 93 140 146 201 68 86	40 000 38 000 36 000 36 000 34 000 28 000 28 000 36 000 34 000	32 000 28 000 28 000 28 000 24 000 24 000 24 000 24 000	48 000 45 000 43 000 43 000 40 000 34 000 43 000 40 000	MR 128 MR 148 688 A 698 608 628 638 689 699
	24 26 30	7 8 10	7 8 10	0.3 (0.6) 0.6	0.3 (0.6) 0.6	3 350 4 550 5 100	1 430 1 970 2 390	340 465 520	146 201 244	32 000 28 000 24 000	24 000 22 000 —	38 000 34 000 30 000	609 629 639





Bearing Numbers	,		fillet Dimension nm)	าร	Ma (g	
Shielded Sealed		$d_{ m b}$ $D_{ m a}$ max.		$m{r_a}$ $m{r_b}$ ax. max.	appi Open	rox. Shielded
MR 85 ZZ — — — — — — — — — — — — — — — — — —	6.2 6 6.2 6 6.2 6	7.2 5.8 — 6.0 7.8 6.0 8.8 6.3 — 6.2 9.8	- 0.7.4 - 8.2 0.7.8.4 0.7.9.8 - 9.9 0.7.	- 0.1 15 0.15 15 0.15 - 0.15 15 0.15	0.26 — 0.50 0.95 — 1.2	
695 ZZ VV DD 605 ZZ — DD 625 ZZ1 VV DD	6.6 7.0	6.6 11.4 6.9 12.4 7.5 14.0	11.2 0.3 12.2 0.3 13.8 0.3	2 0.2 3 0.3	2.45 3.54 4.95	2.5 3.48 4.86
635 ZZ1 VV DD MR 106 ZZ1 — — MR 126 ZZ — DD 686 AZZ VV DD	7.2 7.6	3.5 17.0 7.0 8.8 7.2 10.4 7.4 11.8	16.5 0.3 9.3 0.3 10.9 0.3 11.7 0.3	15 0.1 2 0.15	8.56 0.56 1.27 1.91	8.34 0.68 1.74 2.69
696 ZZ1 VV DD 606 ZZ VV DD 626 ZZ1 VV DD 636 ZZ VV DD	8.0 8.0	7.9 13.4 3.2 15.0 3.5 17.0 0.5 20.0	13.3 0.3 14.8 0.3 16.5 0.3 19.0 0.3	3 0.3 3 0.3	3.88 5.97 8.15 14	3.72 6.08 7.94 14
MR 117 ZZ — — MR 137 ZZ — — 687 ZZ1 VV DD	8.6 8.2	3.0 9.8 9.0 11.4 3.5 12.8	10.5 0.1 11.6 0.1 12.7 0.1	2 0.15 15 0.15	0.62 1.58 2.13	0.72 2.02 2.97
697 ZZ1 VV DD 607 ZZ1 VV DD 627 ZZ VV DD 637 ZZ1 VV DD	9.0 9.0 10	0.2 15.0 9.1 17.0 0.5 20.0 2.8 24.0	14.8 0.3 16.5 0.3 19.0 0.3 22.8 0.3	3 0.3 3 0.3	5.26 7.67 12.7 24	5.12 7.51 12.9 25
MR 128 ZZ1 — — MR 148 ZZ VV DD 688 AZZ1 VV DD	9.6 9.6 10	9.0 10.8 9.2 12.4 0.2 14.4	11.3 0.1 12.8 0.1 14.2 0.1	2 0.15 2 0.2	0.71 1.86 3.12	0.97 2.16 4.02
698 ZZ VV DD 608 ZZ VV DD 628 ZZ VV DD 638 ZZ1 VV DD	10.0 10 10.0 12	0.0 17.0 0.5 20.0 2.0 22.0 2.8 26.0	16.5 0.3 19.0 0.3 20.5 0.3 22.8 0.3	3 0.3 3 0.3	7.23 12.1 17.2 28.3	7.18 12.2 17.4 28.6
689 ZZ1 VV DD 699 ZZ1 VV DD 609 ZZ VV DD 629 ZZ VV DD 639 ZZ VV —	11.0 12 11.0 12 11.0 12	1.5 15.4 2.0 18.0 2.0 22.8 2.8 24.0 5.1 26.0	15.2 0.1 17.2 0.1 20.5 0.1 22.8 0.1 25.6 0.1	3 0.3 3 0.3 3 0.3	3.53 8.45 14.5 19.5 36.5	4.43 8.33 14.7 19.3 36

B 36 B 37

Note (1) The values in parentheses are not based on ISO 15.

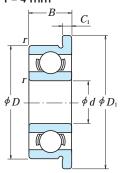
Remarks 1. When using bearings with a rotating outer ring, please contact NSK if they are sealed or shielded.

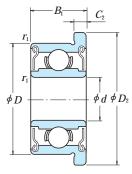
^{2.} Bearings with snap rings are also available, please contact NSK.



Metric Design With Flange

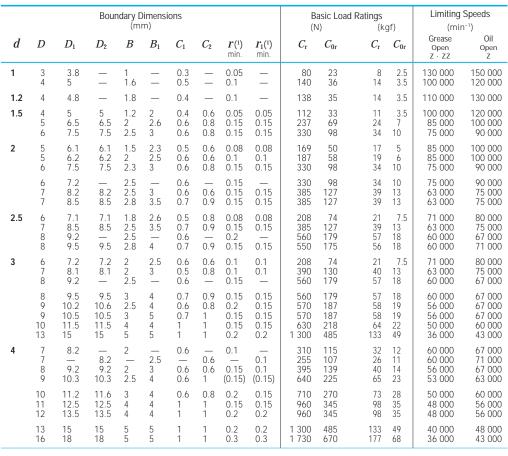
Bore Diameter 1 – 4 mm

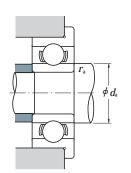


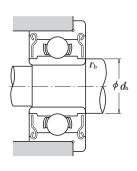


Open Type

Shielded Type ZZ · ZZ1







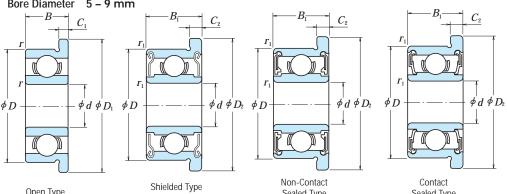
	Bearing Numbers		Abut	ment and (r	Fillet Dim mm)	nensions		ass (g)
Open	Shielded	Sealed	$d_{\scriptscriptstyle a}$ min		$oldsymbol{r_{\mathrm{a}}}{max}.$	$r_{ m b}$ max.		orox. Shielded
F 681 F 691		= =	· 1.4 · 1.8		0.05 0.1	_	0.04 0.14	_
MF 41 X	_		2.0) —	0.1	_	0.12	_
F 681 X F 691 X F 601 X	F 681 XZZ F 691 XZZ F 601 XZZ		2.7	7 2.5	0.05 0.15 0.15	0.05 0.15 0.15	0.09 0.23 0.42	0.14 0.28 0.52
F 682 MF 52 B F 692	F 682 ZZ MF 52 BZZ F 692 ZZ	= =	2.8	3 2.7	0.08 0.1 0.15	0.08 0.1 0.15	0.16 0.21 0.35	0.22 0.27 0.48
MF 62 MF 72 F 602	MF 72 ZZ F 602 ZZ	= =		3.8	0.15 0.15 0.15	0.15 0.15	0.36 0.52 0.60	0.56 0.71
F 682 X F 692 X MF 82 X F 602 X	F 682 XZZ F 692 XZZ — F 602 XZZ		3.7	7 3.8 I —	0.08 0.15 0.2 0.15	0.08 0.15 — 0.15	0.25 0.51 0.62 0.74	0.36 0.68 — 0.98
MF 63 F 683 A MF 83	MF 63 ZZ F 683 AZZ	= =	3.8	3 4.0	0.1 0.1 0.15	0.1 0.1 —	0.27 0.37 0.56	0.33 0.53 —
F 693 MF 93 F 603 F 623 F 633	F 693 ZZ MF 93 ZZ F 603 ZZ F 623 ZZ F 633 ZZ		4.2	4.3 2 4.3 2 4.3	0.15 0.2 0.15 0.15 0.2	0.15 0.15 0.15 0.15 0.2	0.70 0.81 1.0 1.85 3.73	0.97 1.34 1.63 1.86 3.59
MF 74 MF 84 F 684	MF 74 ZZ MF 84 ZZ F 684 ZZ		5.2	4.8 2 5.0	0.1 - 0.15 0.1	0.1 0.1 0.1	0.29 — 0.44 0.70	0.35 0.63 1.14
MF 104 B F 694 F 604	MF 104 BZZ F 694 ZZ F 604 ZZ	= =	5.2	5.6	0.2 0.15 0.2	0.15 0.15 0.2	1.13 1.91 2.53	1.59 1.96 2.53
F 624 F 634	F 624 ZZ F 634 ZZ1	= =	5.6		0.2 0.3	0.2	3.38 5.73	3.53 5.62

Note (1) The values in parentheses are not based on ISO 15.

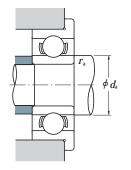
Remarks When using bearings with a rotating outer ring, please contact NSK if they are shielded.

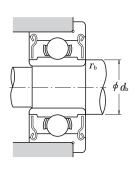






	Ор	en Type					Z · ZZ1				Sealed T VV	ype		Š	Sealed Type DD	;
			Bour	dary D (mr		ons				Ba (N	ısic Load 1)	Ratings {kc	ıf}	Limitino Grea	g Speeds (n se	nin ⁻¹) Oil
d	D	D_1	D_2	В	B_1	C_1	C_2	r min.	$r_{\scriptscriptstyle 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Open Z · ZZ V · VV	D · DD	Open Z
5	8 8 9 10	9.2 — 10.2 11.2	9.2 10.2 11.6	2 — 2.5 3		0.6 0.6 0.6	0.6 0.6 0.8	0.1 0.15 0.15	0.1 0.15 0.15	310 278 430 430	120 131 168 168	31 28 44 44	12 13 17 17	53 000 53 000 50 000 50 000	_ _ _	63 000 63 000 60 000 60 000
	11 13 14	12.5 15 16	12.5 15 16	3 4 5	5 4 5	0.8 1 1	1 1 1	0.15 0.2 0.2	0.15 0.2 0.2	715 1 080 1 330	281 430 505	73 110 135	29 44 52	45 000 43 000 40 000	40 000 38 000	53 000 50 000 50 000
	16 19	18 22	18 22	5 6	5 6	1 1.5	1 1.5	0.3 0.3	0.3 0.3	1 730 2 340	670 885	177 238	68 90	36 000 32 000	32 000 30 000	43 000 40 000
6	10 12 13	11.2 13.2 15	11.2 13.6 15	2.5 3 3.5	3 4 5	0.6 0.6 1	0.6 0.8 1.1	0.15 0.2 0.15	0.1 0.15 0.15	495 715 1 080	218 292 440	51 73 110	22 30 45	45 000 43 000 40 000	40 000 38 000	53 000 50 000 50 000
	15 17 19 22	17 19 22 25	17 19 22 25	5 6 6 7	5 6 6 7	1.2 1.2 1.5 1.5	1.2 1.2 1.5 1.5	0.2 0.3 0.3 0.3	0.2 0.3 0.3 0.3	1 730 2 260 2 340 3 300	670 835 885 1 370	177 231 238 335	68 85 90 140	40 000 38 000 32 000 30 000	36 000 34 000 30 000 28 000	45 000 45 000 40 000 36 000
7	11 13 14	12.2 14.2 16	12.2 14.6 16	2.5 3 3.5	3 4 5	0.6 0.6 1	0.6 0.8 1.1	0.15 0.2 0.15	0.1 0.15 0.15	455 540 1 170	201 276 510	47 55 120	21 28 52	43 000 40 000 40 000	<u> </u>	50 000 48 000 45 000
	17 19 22	19 22 25	19 22 25	5 6 7	5 6 7	1.2 1.5 1.5	1.2 1.5 1.5	0.3 0.3 0.3	0.3 0.3 0.3	1 610 2 340 3 300	715 885 1 370	164 238 335	73 90 140	36 000 36 000 30 000	28 000 32 000 28 000	43 000 43 000 36 000
8	12 14 16	13.2 15.6 18	13.6 15.6 18	2.5 3.5 4	3.5 4 5	0.6 0.8 1	0.8 0.8 1.1	0.15 0.2 0.2	0.1 0.15 0.2	545 820 1 610	274 385 710	56 83 164	28 39 73	40 000 38 000 36 000	32 000 30 000	48 000 45 000 43 000
	19 22	22 25	22 25	6 7	6 7	1.5 1.5	1.5 1.5	0.3 0.3	0.3 0.3	2 240 3 300	910 1 370	228 335	93 140	36 000 34 000	28 000 28 000	43 000 40 000
9	17 20	19 23	19 23	4 6	5 6	1 1.5	1.1 1.5	0.2 0.3	0.2 0.3	1 330 1 720	665 840	136 175	68 86	36 000 34 000	24 000 24 000	43 000 40 000





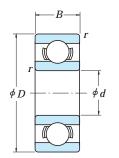
Bearing Numbers			butment)imensio			Ma (g	
Open Shielded	Sealed	$d_{ m a}$ min.	$d_{ m b}$ max.	$r_{ m a}$ max.	$r_{ m b}$ max.	app Open	rox. Shielded
MF 85 — MF 85 ZZ MF 95 MF 95 ZZ1 MF 105 MF 105 ZZ	= =	5.8 — 6.2 6.2	5.8 6.0 6.0	0.1 0.15 0.15	 0.1 0.15 0.15	0.33 — 0.59 1.05	 0.41 0.66 1.46
F 685 F 685 ZZ		6.2	6.2	0.15	0.15	1.37	2.18
F 695 F 695 ZZ	VV DD	6.6	6.6	0.2	0.2	2.79	2.84
F 605 F 605 ZZ	_ DD	6.6	6.9	0.2	0.2	3.9	3.85
F 625 F 625 ZZ1	VV DD	7.0	7.5	0.3	0.3	5.37	5.27
F 635 F 635 ZZ1	VV DD	7.0	8.5	0.3	0.3	9.49	9.49
MF 106 MF 106 ZZ1 MF 126 MF 126 ZZ F 686 A F 686 AZZ	DD VV DD	7.2 7.6 7.2	7.0 7.2 7.4	0.15 0.2 0.15	0.1 0.15 0.15	0.65 1.38 2.25	0.77 1.94 3.04
F 696 F 696 ZZ1	VV DD	7.6	7.9	0.2	0.2	4.34	4.26
F 606 F 606 ZZ	VV DD	8.0	8.2	0.3	0.3	6.58	6.61
F 626 F 626 ZZ1	VV DD	8.0	8.5	0.3	0.3	9.09	9.09
F 636 F 636 ZZ	VV DD	8.0	10.5	0.3	0.3	14.6	14.7
MF 117 MF 117 ZZ		8.2	8.0	0.15	0.1	0.72	0.82
MF 137 MF 137 ZZ		8.6	9.0	0.2	0.15	1.7	2.23
F 687 F 687 ZZ1	VV DD	8.2	8.5	0.15	0.15	2.48	3.37
F 697 F 697 ZZ1	VV DD	9.0	10.2	0.3	0.3	5.65	5.65
F 607 F 607 ZZ1	VV DD	9.0	9.1	0.3	0.3	8.66	8.66
F 627 F 627 ZZ	VV DD	9.0	10.5	0.3	0.3	14.2	14.2
MF 128 MF 128 ZZ1	VV DD	9.2	9.0	0.15	0.1	0.82	1.15
MF 148 MF 148 ZZ		9.6	9.2	0.2	0.15	2.09	2.39
F 688 A F 688 AZZ		9.6	10.2	0.2	0.2	3.54	4.47
F 698 F 698 ZZ	VV DD	10.0	10.0	0.3	0.3	8.35	8.3
F 608 F 608 ZZ	VV DD	10.0	10.5	0.3	0.3	13.4	13.5
F 689 F 689 ZZ1	VV DD	10.6	11.5	0.2	0.2	3.97	4.91
F 699 F 699 ZZ1	VV DD	11.0	12.0	0.3	0.3	9.51	9.51

Remarks When using bearings with a rotating outer ring, please contact NSK if they are shielded.

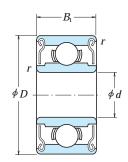


Inch Design

Bore Diameter 1.016 – 9.525 mm

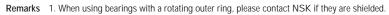




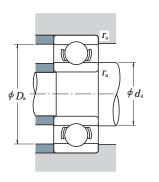


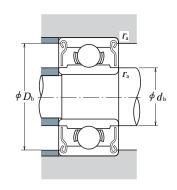
Shielded Type ZZ · ZZS

	Bound	ary Dimens (mm)	ions			Basic Lo V)	ad Ratings {k	gf}	Limiting (mi	•	Bearing
d	D	В	B_1	<i>r</i> min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease Open Z · ZZ	Oil Open Z	Open
1.016	3.175	1.191	_	0.1	80	23	8	2.5	130 000	150 000	R 09
1.191	3.967	1.588	2.380	0.1	138	35	14	3.5	110 000	130 000	R 0
1.397	4.762	1.984	2.779	0.1	231	66	24	6.5	90 000	110 000	R 1
1.984	6.350	2.380	3.571	0.1	310	108	32	11	67 000	80 000	R 1-4
2.380	4.762 4.762 7.938	1.588 — 2.779	2.380 3.571	0.1 0.1 0.15	188 143 550	60 52 175	19 15 56	6 5.5 18	80 000 80 000 60 000	95 000 95 000 71 000	R 133 R 1-5
3.175	6.350 7.938 9.525	2.380 2.779 2.779	2.779 3.571 3.571	0.1 0.1 0.15	283 560 640	95 179 225	29 57 65	9.5 18 23	67 000 60 000 53 000	80 000 67 000 63 000	R 144 R 2-5 R 2-6
	9.525 12.700	3.967 4.366	3.967 4.366	0.3 0.3	630 640	218 225	64 65	22 23	56 000 53 000	67 000 63 000	R 2 R 2A
3.967	7.938	2.779	3.175	0.1	360	149	37	15	53 000	63 000	R 155
4.762	7.938 9.525 12.700	2.779 3.175 3.967	3.175 3.175 4.978	0.1 0.1 0.3	360 710 1 300	149 270 485	37 73 133	15 28 49	53 000 50 000 43 000	63 000 60 000 53 000	R 156 R 166 R 3
6.350	9.525 12.700	3.175 3.175	3.175 4.762	0.1 0.15	420 1 080	204 440	43 110	21 45	48 000 40 000	56 000 50 000	R 168B R 188
	15.875 19.050	4.978 5.558	4.978 7.142	0.3 0.4	1 610 2 620	660 1 060	164 267	68 108	38 000 36 000	45 000 43 000	R 4B R 4AA
7.938	12.700	3.967	3.967	0.15	540	276	55	28	40 000	48 000	R 1810
9.525	22.225	5.558	7.142	0.4	3 350	1 410	340	144	32 000	38 000	R 6



^{2.} Bearings with double shields (ZZ, ZZS) are also available with single shields (Z, ZS).



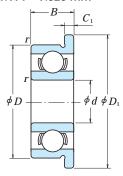


Numbers	А	butment a	nd Fillet D (mm)	imension	S		lass (g)
Shielded	$d_{ m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	ap Open	prox. Shielded
_	1.9	_	2.3	_	0.1	0.04	_
R 0 ZZ	2.0	1.9	3.1	3.5	0.1	0.09	0.11
R 1 ZZ	2.2	2.3	3.9	4.1	0.1	0.15	0.19
R 1-4 ZZ	2.8	3.9	5.5	5.9	0.1	0.35	0.50
R 133 ZZS R 1-5 ZZ	3.2 — 3.6	3.0 4.1	3.9 - 6.7	 4.2 7.0	0.1 0.1 0.15	0.10 0.60	0.13 0.72
R 144 ZZ R 2-5 ZZ R 2-6 ZZS	4.0 4.0 4.4	3.9 4.3 4.6	5.5 7.1 8.3	5.9 7.3 8.2	0.1 0.1 0.15	0.25 0.55 0.96	0.27 0.72 1.13
R 2 ZZ R 2A ZZ	5.2 5.2	4.8 4.6	7.5 10.7	8.0 8.2	0.3 0.3	1.36 3.3	1.39 3.23
R 155 ZZS	4.8	5.5	7.1	7.3	0.1	0.51	0.56
R 156 ZZS R 166 ZZ R 3 ZZ	5.6 5.6 6.8	5.5 5.9 6.5	7.1 8.7 10.7	7.3 8.8 11.2	0.1 0.1 0.3	0.39 0.81 2.21	0.42 0.85 2.79
R 168 BZZ R 188 ZZ	7.2 7.6	7.0 7.4	8.7 11.5	8.9 11.6	0.1 0.15	0.58 1.53	0.62 2.21
R 4B ZZ R 4AA ZZ	8.4 9.4	8.4 9.0	13.8 16.0	13.8 16.6	0.3 0.4	4.5 7.48	4.43 9.17
R 1810 ZZ	9.2	9.0	11.5	11.6	0.15	1.56	1.48
R 6 ZZ	12.6	11.9	19.2	20.0	0.4	9.02	11

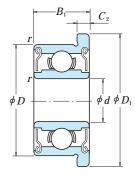


Inch Design With Flange

Bore Diameter 1.191 – 9.525 mm

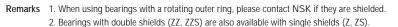


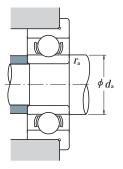
Open Type

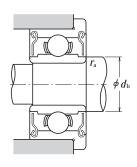


Shielded Type ZZ · ZZS

		Е	Boundary Di							oad Ratings	
			(mn	n)				(1	N)	{k	:gf}
d	D	D_1	В	B_1	C_1	C_2	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$
1.191	3.967	5.156	1.588	2.380	0.330	0.790	0.1	138	35	14	3.5
1.397	4.762	5.944	1.984	2.779	0.580	0.790	0.1	231	66	24	6.5
1.984	6.350	7.518	2.380	3.571	0.580	0.790	0.1	310	108	32	11
2.380	4.762 4.762 7.938	5.944 5.944 9.119	1.588 — 2.779	 2.380 3.571	0.460 0.580	— 0.790 0.790	0.1 0.1 0.15	188 143 550	60 52 175	19 15 56	6 5.5 18
3.175	6.350 7.938 9.525 9.525	7.518 9.119 10.719 11.176	2.380 2.779 2.779 3.967	2.779 3.571 3.571 3.967	0.580 0.580 0.580 0.760	0.790 0.790 0.790 0.760	0.1 0.1 0.15 0.3	283 560 640 630	95 179 225 218	29 57 65 64	9.5 18 23 22
3.967	7.938	9.119	2.779	3.175	0.580	0.910	0.1	360	149	37	15
4.762	7.938 9.525 12.700	9.119 10.719 14.351	2.779 3.175 4.978	3.175 3.175 4.978	0.580 0.580 1.070	0.910 0.790 1.070	0.1 0.1 0.3	360 710 1 300	149 270 485	37 73 133	15 28 49
6.350	9.525 12.700 15.875	10.719 13.894 17.526	3.175 3.175 4.978	3.175 4.762 4.978	0.580 0.580 1.070	0.910 1.140 1.070	0.1 0.15 0.3	420 1 080 1 610	204 440 660	43 110 164	21 45 68
7.938	12.700	13.894	3.967	3.967	0.790	0.790	0.15	540	276	55	28
9.525	22.225	24.613	7.142	7.142	1.570	1.570	0.4	3 350	1 410	340	144







Limiting S	Speeds	Beari	ng Numbers		ment and			ISS
(min-	-1)			Dime	ensions (n	nm)	((g)
Grease Open Z · ZZ	Oil Open Z	Open	Shielded	$d_{ m a}$ min.	$d_{ m b}$ max.	$oldsymbol{r_{a}}{max.}$	app Open	rox. Shielded
110 000	130 000	FR 0	FR 0 ZZ	2.0	1.9	0.1	0.11	0.16
90 000	110 000	FR 1	FR 1 ZZ	2.2	2.3	0.1	0.20	0.25
67 000	80 000	FR 1-4	FR 1-4 ZZ	2.8	3.9	0.1	0.41	0.58
80 000 80 000 60 000	95 000 95 000 71 000	FR 133 FR 1-5	 FR 133 ZZS FR 1-5 ZZ	3.2 — 3.6	3.0 4.1	0.1 0.1 0.15	0.13 — 0.68	0.19 0.82
67 000 60 000 53 000 56 000	80 000 67 000 63 000 67 000	FR 144 FR 2-5 FR 2-6 FR 2	FR 144 ZZ FR 2-5 ZZ FR 2-6 ZZS FR 2 ZZ	4.0 4.0 4.4 5.2	3.9 4.3 4.6 4.8	0.1 0.1 0.15 0.3	0.31 0.62 1.04 1.51	0.35 0.81 1.25 1.55
53 000	63 000	FR 155	FR 155 ZZS	4.8	5.5	0.1	0.59	0.67
53 000 50 000 43 000	63 000 60 000 53 000	FR 156 FR 166 FR 3	FR 156 ZZS FR 166 ZZ FR 3 ZZ	5.6 5.6 6.8	5.5 5.9 6.5	0.1 0.1 0.3	0.47 0.90 2.97	0.53 0.98 3.09
48 000 40 000 38 000	56 000 50 000 45 000	FR 168B FR 188 FR 4B	FR 168 BZZ FR 188 ZZ FR 4B ZZ	7.2 7.6 8.4	7.0 7.4 8.4	0.1 0.15 0.3	0.66 1.64 4.78	0.75 2.49 4.78
40 000	48 000	FR 1810	FR 1810 ZZ	9.2	9.0	0.15	1.71	1.63
32 000	38 000	FR 6	FR 6 ZZ	12.6	11.9	0.4	10.1	12.1

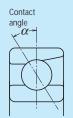
ANGULAR CONTACT BALL BEARINGS

SINGLE-ROW AND MATCHED ANGULAR CONTACT BALL BEARINGS

	Bore Diameter	10 - 65mm·····	B50					
	Bore Diameter	70 – 120 mm ······	B60					
	Bore Diameter	130 – 200 mm ······	B66					
OUBLE-ROW ANGULAR CONTACT	Bore Diameter	10 – 85 mm ·····	B70					
LL BEARINGS								
UR-POINT CONTACT BALL BEARINGS								
	Bore Diameter	30 – 200mm·····	B72					

DESIGN, TYPES, AND FEATURES

SINGLE-ROW ANGULAR CONTACT BALL BEARINGS



DC BA FO

Since these bearings have a contact angle, they can sustain significant axial loads in one direction together with radial loads. Because of their design, when a radial load is applied, an axial force component is produced; therefore, two opposed bearings or a combination of more than two must be used.

"Since the rigidity of single-row angular contact ball bearings can be increased by preloading, they are often used in the main spindles of machine tools, for which high running accuracy is required. (Refer to Chapter 10, Preload, Page A96).

Usually, the cages for angular contact ball bearings with a contact angle of 30° (Symbol A) or 40° (Symbol B) are in accordance with Table 1,but depending on the application, machined synthetic resin cages or molded polyamide resin cages are also used. The basic load ratings given in the bearing tables are based on the cage classification listed in Table 1.

Though the figures in the bearing tables (Pages B50 to B65; bearing bore diameters of 10 to 120) show bearings with single-shoulder-type inner rings, both-shoulder-type bearings are also available. Please consult NSK for more detailed information.

Table 1 Standard Cages for Angular Contact Ball Bearings

Series	Pressed Steel Cages	Machined Brass Cages
79A5, C	_	7900 – 7940
70A	7000 – 7018	7019 – 7040
70C	_	7000 – 7022
72A, B	7200 – 7222	7224 – 7240
72C	_	7200 – 7240
73A, B	7300 – 7320	7321 – 7340

In addition, for bearings with the same serial number, if the type of cages are different, the number of balls may also be different. In such a case, the load rating will differ from the one listed in the bearing tables.

Angular Contact Ball Bearings with contact angles of 15° (Symbol C) and 25° (Symbol A5) are primarily for high precision or high speed applications, and machined brass or synthetic resin cages or molded polyamide cages are used.

The maximum operating temperature of molded polyamide cages is 120°C.





MATCHED ANGULAR CONTACT BALL BEARINGS

The types and features of matched angular contact ball bearings are shown in Table 2.

Table 2 Types and Features of Matched Angular Contact Ball Bearings

Figure	Arrangement	Features			
a ₀	Back-to-back (DB) (Example) 7208 A DB	Radial loads and axial loads in both directions can be sustained. Since the distance between the effective load centers \boldsymbol{a}_0 is big, this type is suitable if moments are applied.			
-a0-	Face-to-face (DF) (Example) 7208 B DF	Radial loads and axial loads in both directions can be sustained. Compared with the DB Type, the distance between the effective load centers is small, so the capacity to sustain moments is inferior to the DB Type.			
	Tandem (DT) (Example) 7208 A DT	Radial loads and axial loads in one direction can be sustained. Since two bearings share the axial load, this arrangement is used when the load in one direction is heavy.			

NSKHPS ANGULAR CONTACT BALL BEARINGS

In comparison with standard angular contact ball bearings, these bearings have high capacity, high limiting speed, and highly accurate universal matching as the features. The molded polyamide cages are standard specification for the HPS type.



DOUBLE-ROW ANGULAR CONTACT BALL BEARINGS

This is basically a back-to-back mounting of two single-row angular contact ball bearings, but their inner and outer rings are each integrated into one. Axial loads in both directions can be sustained, and the capacity to sustain moments is good. This type is used as fixed-end bearings.

Their cages are pressed steel.



FOUR-POINT CONTACT BALL BEARINGS

The inner ring is split radially into two pieces. Their design allows one bearing to sustain significant axial loads in either direction.

The contact angle is 35°, so the axial load capacity is high. This type is suitable for carrying pure axial loads or combined loads where the axial loads are high.

The cages are made of machined brass.

PRECAUTIONS FOR USE OF ANGULAR CONTACT BALL BEARINGS

Under severe operating conditions where the speed and temperature are close to their limits, lubrication is marginal, vibration and moment loads are heavy, they may not be suitable, particularly for certain types of cages. In such a case, please consult with NSK beforehand.

And if the load on angular contact ball bearings becomes too small, or if the ratio of the axial and radial loads for matched bearings exceeds 'e' (e is listed in the bearings tables) during operation, slippage occurs between the balls and raceways, which may result in smearing. Especially with large bearings since the weight of the balls and cage is high. If such load conditions are expected, please consult with NSK for selection of the bearings.

TOLERANCES AND RUNNING ACCURACY

	SINGLE-ROW ANGULAR CONTACT	T.I. 0.0	(D. A.(O.)	۸ (۵)
	BALL BEARINGS	· Table 8.2	(Pages A60 to	A63)
	NSKHPS ANGULAR CONTACT BALL BEARINGS			
	Tolerance for Dimensions: Class 6,	T.I.I. 0.0	(D A (O) .	۸ (۵)
	Running Accuracy: Class 5	· lable 8.2	(Pages A60 to	A63)
	MATCHED ANGULAR CONTACT	T.I. 0.0	(D. 1.10.)	۸ (۵)
	BALL BEARINGS	· Table 8.2	(Pages A60 to	A63)
	DOUBLE-ROW ANGULAR CONTACT		/a	
	BALL BEARINGS	· lable 8.2	(Pages A60 to	A63)
	FOUR-POINT CONTACT BALL		/a	
	BEARINGS	· lable 8.2	(Pages A60 to	A63)
REC	OMMENDED FITS			
	SINGLE-ROW ANGULAR CONTACT BALL			
	BEARINGS AND HPS ANGULAR CONTACT			
	BALL BEARINGS	·Table 9.2	(Page A84)	
		Table 9.4	(Page A85)	
	MATCHED ANGULAR CONTACT BALL BEARINGS	·Table 9.2	(Page A84)	
		Table 9.4	(Page A85)	
	DOUBLE-ROW ANGULAR CONTACT BALL			
	BEARINGS	·Table 9.2	(Page A84)	
		Table 9 4	(Page A85)	
	FOUR-POINT CONTACT BALL BEARINGS	·Table 9.2	(Page A84)	
		Table 9.4	(Page A85)	

INTERNAL CLEARANCES

MATCHED ANGULAR CONTACT BALL BEARINGS..... Table 9. 17 (Page A94)

Matched angular contact ball bearings with precision better than P5 are primarily used in the main spindles of machine tools, so they are used with a preload for rigidity. For convenience of selection, internal clearances are adjusted to produce Very Light, Light, Medium, and Heavy Preloads. Their fitting is also special. Concerning these matters, please refer to Tables 10.1 and 10.2 (Pages A98 and A99).

The clearance (or preload) of matched bearings is obtained by axially tightening a pair of bearings till the side faces of their inner or outer rings are pressed against each other

NSKHPS ANGULAR CONTACT BALL BEARINGS

Axial Internal Clearance (Measured Clearances) Units : μm											
Nominal Bo	re Diameter		Axial Internal Clearance								
<i>d</i> (n	nm)	CN	ΝB	GA							
over	incl.	min.	max.	min.	max.						
12	18	17	25								
18	30	20	28	-2	6						
30	50	24	32								
50	80	29	41	-3	9						

DOUBLE-ROW ANGULAR CONTACT BALL BEARINGS

For the clearance in double-row angular contact ball bearings, please consult with NSK.

FOUR-POINT CONTACT BALL BEARINGS.....Table 9.18 (Page A94)
LIMITING SPEEDS

In cases of single-row and matched angular contact ball bearings, the Limiting speeds listed in the bearing table are for bearings with machined cage. For those with pressed cages, the listed speeds must be reduced by 20%.

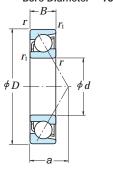
The limiting speeds of bearings with contact angles of 15° (Symbol **C**) and 25° (Symbol **A5**) are for bearings with precision of P5 and better (with machined synthetic-resin cages or molded polyamide cages).

The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

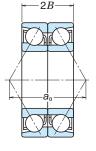
B 48 B 49

SINGLE/MATCHED MOUNTINGS

Bore Diameter 10 - 15 mm

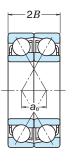


Single



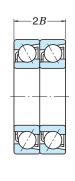
Back-to-Back

DB



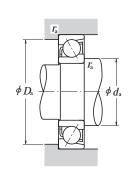
Face-to-Face

DF



Tandem

DT

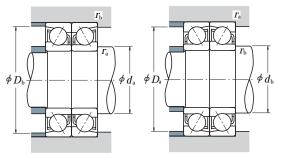


0.086

0.084

36

36





	Cambant	$if_0F_a^*$		Single, DT				DB c	r DF		
	Contact		e	$F_a/F_r \leq e$		F_a/I	$F_a/F_r > e$		$F_a/F_r \leq e$		r > e
	Angle	Cor		X	Y	X	Y	X	Y	X	Y
		0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
		0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28
		0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11
	15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00
	15.	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
		2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82
		3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66
		5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63
	25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41
	30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24
	40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

ontact	Singl	e, DT	DB c	r DF					
Angle	X 0	Y_0	X 0	Y 0	Single or DT				
15°	0.5	0.46	1	0.92	mounting When				
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$				
30°	0.5	0.33	1	0.66	use $P_0 = F_r$				
40°	0.5	0.26	1	0.52					

Bearing	Numbe	ers (²)	Basic (1	: Load Ratings N)	. ,	gf}	Speeds (1)	iting (Matched) in-1)	Load (Spacing: <i>A</i>	s (mm)		ent and nsions (r	
Single	Du	ıplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	Γ _b (³) max.
7900 A5 7900 C 7000 A	DB I		4 700 4 900 8 750	2 900 3 050 5 200	475 500 890	296 310 530	32 000 38 000 24 000	43 000 53 000 34 000	13.5 10.3 18.4	1.5 1.7 2.4	_ _ 11.2	20.8 20.8 24.8	0.15 0.15 0.15
7000 C 7200 A 7200 B	DB I	DF DT DF DT DF DT	8 650 8 800 8 100	5 000 5 400 5 000	880 900 825	510 555 510	36 000 22 000 16 000	50 000 30 000 22 000	12.8 20.5 25.8	3.2 2.5 7.8	— 12.5 12.5	24.8 27.5 27.5	0.15 0.3 0.3
7200 C 7300 A 7300 B	DB I	DF DT DF DT DF DT	8 800 15 100 14 200	5 200 8 600 8 100	895 1 540 1 450	530 880 825	32 000 16 000 14 000	45 000 22 000 20 000	14.4 24.0 29.9	3.6 2.0 7.9	— 12.5 12.5	27.5 32.5 32.5	0.3 0.3 0.3
7901 A5 7901 C 7001 A	DB I	DF DT DF DT DF DT	5 200 5 450 9 400	3 550 3 700 5 950	530 555 955	360 380 610	30 000 36 000 22 000	43 000 50 000 30 000	14.4 10.8 19.5	2.4 1.2 3.5	_ 13.2	22.8 22.8 26.8	0.15 0.15 0.15
7001 C 7201 A 7201 B	DB I	DF DT DF DT DF DT	9 400 13 000 12 100	5 800 8 050 7 500	960 1 330 1 230	590 820 765	32 000 20 000 15 000	45 000 28 000 20 000	13.4 22.7 28.5	2.6 2.7 8.5	— 14.5 14.5	26.8 29.5 29.5	0.15 0.3 0.3
*7201 BE 7201 C 7301 A	DB I	DF DT DF DT	12 800 15 400	7 700 9 000	1 310 1 570	— 785 915	16 000 30 000 15 000	24 000 40 000 20 000	28.5 15.9 26.1	8.5 4.1 2.1	14.5 — 17	29.5 29.5 32	0.3 0.3 0.6
7301 B *7301 BE	DB I A	DF DT	14 400 —	8 400 —	1 460 —	855 —	13 000 15 000	18 000 22 000	32.6 32.6	8.6 8.6	17 17	32 32	0.6 0.6
7902 A5 7902 C 7002 A	DB I DB I		7 400 7 750 9 950	5 050 5 300 6 850	755 790 1 010	515 540 700	26 000 30 000 19 000	34 000 43 000 26 000	17.0 12.8 22.6	3.0 1.2 4.6	_ _ 16.2	26.8 26.8 30.8	0.15 0.15 0.15
7002 C 7202 A 7202 B		DF DT DF DT DF DT	10 100 14 000 12 900	6 750 9 300 8 600	1 030 1 430 1 310	690 950 875	28 000 18 000 13 000	38 000 24 000 18 000	15.3 25.4 32.0	2.7 3.4 10.0	— 17.5 17.5	30.8 32.5 32.5	0.15 0.3 0.3
*7202 BE 7202 C 7302 A		DF DT DF DT	— 14 100 21 800	9 050 14 200	1 440 2 220	925 1 440	14 000 26 000 13 000	20 000 36 000 17 000	32.0 17.7 29.5	10.0 4.3 3.5	17.5 — 20	32.5 32.5 37	0.3 0.3 0.6
7302 B *7302 BE		DF DT	20 200 —	13 200 —	2 060 —	1 340 —	11 000 13 000	15 000 18 000	36.9 36.9	10.9 10.9	20 20	37 37	0.6 0.6

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min) and r_a (max) respectively.

Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

Limiting Basic Load Ratings (Single) Factor Eff.Load | Abutment and Fillet | Mass **Boundary Dimensions** Speeds (1) Centers Dimensions (mm) (mm) (kg) (N) {kgf} (min⁻¹) (mm) Oil. Grease $d D B r r_1$ $C_{\rm r}$ C_{0r} $C_{\rm r}$ C_{0r} f_0 $D_{\rm a}$ r_{a} а min. min. min. max. max. approx. 22 2 880 294 148 40 000 56 000 10 6 0.3 0.15 1 450 12.5 19.5 0.3 0.009 6.7 305 155 63 000 12.5 19.5 0.3 0.009 22 6 0.3 0.15 3 000 1 520 14.1 48 000 5.1 26 8 0.3 0.15 5 350 2 600 550 266 32 000 43 000 9.2 12.5 23.5 0.3 0.019 26 8 0.3 0.15 2 490 540 45 000 0.3 0.021 5 300 254 12.6 63 000 12.5 23.5 6.4 15 15 30 30 9 0.6 0.3 555 276 38 000 10.3 12.9 25 25 5 400 2 710 28 000 0.6 | 0.032 _ 9 0.6 0.3 2 500 255 510 28 000 5 000 20 000 0.6 | 0.032 30 9 0.6 0.3 5 400 2 610 550 266 13.2 40 000 56 000 15 25 0.6 0.036 7.2 35 35 11 0.6 0.3 9 300 4 300 950 440 20 000 26 000 12.0 15 15 30 30 0.6 0.053 _ 11 0.6 0.3 8 750 4 050 890 410 18 000 24 000 14.9 0.6 0.054 12 24 6 0.3 0.15 3 200 1 770 325 181 38 000 21.5 0.3 0.011 53 000 14.5 24 28 340 189 14.7 45 000 63 000 5.4 14.5 21.5 0.3 0.011 25.5 0.3 0.021 6 0.3 0.15 3 350 1 860 590 305 8 0.3 0.15 5 800 2 980 28 000 9.8 14.5 38 000 40 000 25.5 0.3 0.024 28 8 0.3 0.15 5 800 2 900 590 296 13.2 56 000 6.7 14.5 10 0.6 0.3 10 0.6 0.3 32 32 8 000 4 050 815 410 26 000 34 000 11.4 17 27 27 0.6 0.037 _ 3 750 760 380 14.2 17 7 450 18 000 26 000 0.6 32 10 0.6 0.3 8 150 3 750 830 380 20 000 30 000 27 0.6 0.036 14.2 32 37 10 0.6 0.3 7 900 3 850 805 395 12.5 36 000 50 000 7.9 17 27 31 0.6 0.041 12 1 0.6 9 450 4 500 965 460 18 000 24 000 13.1 18 0.060 37 12 8 850 4 200 900 425 16 000 22 000 18 31 0.062 1 0.6 16.3 37 12 1 0.6 11 100 4 950 1 130 505 _ 18 000 26 000 16.3 18 31 0.061 28 465 15 7 0.3 0.15 4 550 2 5 3 0 258 32 000 43 000 25.5 0.3 0.015 28 7 0.3 0.15 4 750 2 640 485 270 14.5 38 000 53 000 17.5 25.5 0.3 0.015 6.4 32 9 0.3 0.15 6 100 3 450 625 350 24 000 32 000 11.3 17.5 29.5 0.3 0.030 9 0.3 0.15 32 35 6 250 3 400 635 345 14.1 34 000 48 000 7.6 17.5 29.5 0.3 0.034 11 0.6 0.3 8 650 880 475 22 000 30 000 12.7 20 30 0.6 0.045 4 650 35 11 0.6 0.3 7 950 4 300 810 440 16 000 22 000 16.0 20 30 0.6 0.046 35 11 0.6 0.3 9 800 4 800 995 490 18 000 26 000 16.0 20 30 0.6 0.044 35 885 30 0.6 0.052 11 0.6 0.3 8 650 4 550 460 | 13.2 | 32 000 45 000 8.8 20 42 13 1 0.6 13 400 7 100 1 370 720 _ 16 000 22 000 14.7 21 36 0.084

6 900 **Notes** (1) For applications operating near the limiting speed, refer to Page **B49**.

6 600

12 500

14 300

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

1 270

1 460

670

705

_

14 000

16 000

19 000

22 000

18.5 21

18.5 21

42 13

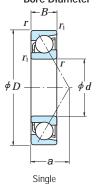
42 13

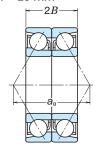
1 0.6

1 0.6

SINGLE/MATCHED MOUNTINGS

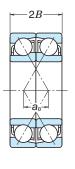
Bore Diameter 17 - 25 mm





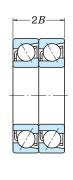
Back-to-Back

DB



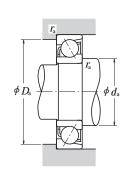
Face-to-Face

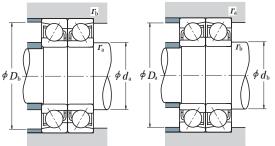
DF

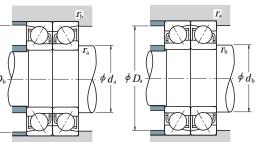


Tandem

DT







Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$			Singl	e, DT		DB or DF			
		e	$F_a/F_r \leq e$		$F_a/F_r > e$		$F_a/F_r \leq e$		$F_a/F_r > e$	
Angle	Cor		X	Y	X	Y	X	Y	X	Y
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00
15.	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Contact	Singl	e, DT	DB c	r DF	_			
Angle	<i>X</i> ₀	Y 0	X 0	Y 0	Single or DT			
15°	0.5	0.46	1	0.92	mounting When			
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$			
30°	0.5	0.33	1	0.66	use $P_0 = F_r$			
40°	0.5	0.26	1	0.52				

Bearing Numbers (2)		ic Load Ratings (Matched) (N) {kgf}		Limiting Speeds (1) (Matched) (min ⁻¹)		Load (Spacing	s (mm)		ent and nsions (r		
Single Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	Γ _b (3) max.
7903 A5 DB DF D	T 8 150	5 600	790	570	24 000	32 000	18.0	4.0	—	28.8	0.15
7903 C DB DF D		5 850	830	600	28 000	38 000	13.3	0.7	—	28.8	0.15
7003 A DB DF D		7 650	1 060	780	17 000	24 000	25.0	5.0	18.2	33.8	0.15
7003 C DB DF C	T 17 600	7 600	1 100	775	26 000	34 000	17.0	3.0	—	33.8	0.15
7203 A DB DF C		12 000	1 790	1 220	16 000	22 000	28.5	4.5	19.5	37.5	0.3
7203 B DB DF C		11 000	1 650	1 130	11 000	15 000	35.9	11.9	19.5	37.5	0.3
*7203 BEA 7203 C DB DF D 7303 A DB DF D		11 700 17 300	1 800 2 640	1 190 1 760	13 000 22 000 11 000	18 000 32 000 15 000	36.3 19.6 32.5	12.3 4.4 4.5	19.5 — 22	37.5 37.5 42	0.3 0.3 0.6
7303 B DB DF D	T 24 000	16 000	2 450	1 640	10 000	14 000	40.9	12.9	22	42	0.6
*7303 BEA	—	—	—	—	11 000	16 000	40.9	12.9	22	42	0.6
7904 A5 DB DF D	T 11 300	8 100	1 090	825	19 000	26 000	22.3	4.3	_	35.8	0.15
7904 C DB DF D		8 500	1 150	865	22 000	32 000	16.6	1.4		35.8	0.15
7004 A DB DF D		13 200	1 800	1 340	15 000	20 000	29.9	5.9	22.5	39.5	0.3
7004 C DB DF C	T 23 500	13 100	1 840	1 330	20 000	30 000	20.3	3.7		39.5	0.3
7204 A DB DF C		16 600	2 400	1 690	13 000	19 000	33.3	5.3	25	42	0.6
7204 B DB DF C		15 300	2 210	1 560	9 500	13 000	42.1	14.1	25	42	0.6
*7204 BEA 7204 C DB DF D 7304 A DB DF D		16 100 20 800	2 410 3 100	1 650 2 130	11 000 19 000 10 000	16 000 26 000 13 000	42.1 23.0 35.8	14.1 5.0 5.8	25 — 25	42 42 47	0.6 0.6 0.6
7304 B DB DF D	T 28 200	19 300	2 870	1 970	9 000	12 000	45.2	15.2	25	47	0.6
*7304 BEA	—	—	—	—	10 000	14 000	45.2	15.2	25	47	0.6
7905 A5 DB DF D		10 300	1 230	1 050	16 000	22 000	24.6	6.6	_	40.8	0.15
7905 C DB DF D		10 800	1 300	1 110	19 000	26 000	18.0	0.0	_	40.8	0.15
7005 A DB DF D		14 800	1 870	1 510	13 000	17 000	32.8	8.8	27.5	44.5	0.3
7005 C DB DF D		14 800	1 940	1 510	18 000	26 000	21.6	2.4		44.5	0.3
7205 A DB DF D		20 500	2 690	2 090	12 000	16 000	37.2	7.2	30	47	0.6
7205 B DB DF D		18 800	2 450	1 920	8 500	11 000	47.3	17.3	30	47	0.6
*7205 BEA 7205 C DB DF D 7305 A DB DF D		20 400 31 500	2 750 4 400	2 080 3 250	9 500 17 000 8 500	14 000 24 000 11 000	47.3 25.3 42.1	17.3 4.7 8.1	30 — 30	47 47 57	0.6 0.6 0.6

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min) and r_a (max) respectively.

Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

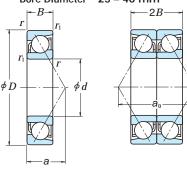
Limiting Basic Load Ratings (Single) Factor Eff.Load | Abutment and Fillet | Mass **Boundary Dimensions** Speeds (1) Centers Dimensions (mm) (mm) (kg) (N) {kgf} (min⁻¹) (mm) Oil Grease $d D B r r_1$ $C_{\rm r}$ C_{0r} $C_{\rm r}$ $C_{0\mathrm{r}}$ f_0 $D_{\rm a}$ $r_{\rm a}$ а min. min min. max. max. approx. 17 30 4 750 2 800 485 286 30 000 40 000 9.0 19.5 7 0.3 0.15 27.5 0.3 0.017 2 940 299 34 000 48 000 19.5 30 7 0.3 0.15 5 000 510 14.8 6.6 27.5 0.3 0.017 35 10 0.3 0.15 6 400 3 800 655 390 22 000 30 000 12.5 19.5 32.5 0.3 0.040 35 10 0.3 0.15 3 800 675 390 32 000 32.5 0.3 0.044 6 600 14.5 43 000 8.5 19.5 35 35 40 12 0.6 0.3 28 000 14.2 22 22 10 800 6 000 1 100 610 20 000 0.6 0.067 40 12 0.6 0.3 565 14 000 19 000 18.0 9 950 5 500 1 010 0.6 0.068 40 12 0.6 0.3 11 600 6 100 1 180 625 16 000 22 000 18.2 22 35 0.6 0.065 40 12 0.6 0.3 10 900 5 850 1 110 595 13.3 28 000 38 000 9.8 22 23 35 41 0.6 0.075 47 14 1 0.6 15 900 8 650 1 630 880 14 000 19 000 16.2 0.116 47 0.6 14 800 8 000 1 510 820 13 000 20.4 23 0.118 14 17 000 14 1 0.6 16 800 8 300 1 720 850 14 000 20 000 20.4 23 47 0.113 _ 37 9 0.3 0.15 6 600 4 050 675 24 000 32 000 11.1 22.5 22.5 34.5 0.3 0.036 37 9 0.3 0.15 6 950 4 250 710 430 14.9 28 000 38 000 8.3 34.5 0.3 0.036 42 12 0.6 0.3 10 800 6 600 1 110 670 18 000 24 000 14.9 25 37 0.6 0.068 _ 42 12 0.6 0.3 11 100 6 550 665 14.0 26 000 36 000 0.6 0.076 47 14 14 500 8 300 1 480 845 17 000 22 000 26 41 1 0.6 16.7 0.106 14 1 0.6 47 13 300 7 650 1 360 780 _ 12 000 16 000 21.1 26 41 0.109 47 14 15 600 8 150 1 590 13 000 19 000 21.1 26 0.103 825 13.3 24 000 34 000 47 14 14 600 1 480 26 41 1 0.6 8 050 11.5 0.118 52 15 1.1 0.6 18 700 10 400 1 910 1 060 13 000 17 000 17.9 27 45 0.146 _ 52 0.15 15 1.1 0.6 17 300 9 650 1 770 985 11 000 15 000 22.6 52 15 1.1 0.6 19 800 10 500 2 020 1 070 13 000 18 000 22.6 27 45 0.149 _ 25 42 9 0.3 0.15 7 450 5 150 760 525 20 000 28 000 12.3 27.5 39.5 0.3 0.043 9 0.3 0.15 42 7 850 5 400 800 555 15.5 24 000 34 000 9.0 27.5 39.5 0.3 0.042 750 42 47 12 0.6 0.3 11 300 7 400 1 150 16 000 22 000 30 0.6 0.079 16.4 _ 47 12 0.6 0.3 11 700 7 400 1 190 755 14.7 22 000 30 000 10.8 30 42 0.6 0.089 52 15 1 0.6 16 200 10 300 1 650 1 050 15 000 20 000 18.6 31 46 0.13 52 15 1 0.6 14 800 9 400 1 510 960 10 000 14 000 23.7 31 46 0.133 52 52 15 0.6 17 600 10 200 12 000 17 000 23.7 0.127 15 1 0.6 16 600 10 200 1 690 1 040 | 14.0 | 22 000 | 28 000 | 12.7 31 46 1 0.143 62 17 1.1 0.6 26 400 15 800 2 690 1 610 32 55 0.235

Notes (1) For applications operating near the limiting speed, refer to Page B49.

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

SINGLE/MATCHED MOUNTINGS

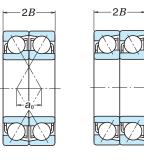
Bore Diameter 25 – 40 mm



Back-to-Back

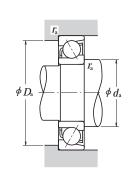
DB

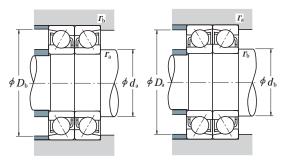
Single



Tandem

DT







*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Dynamic Equivalent Load $P = XF_r + YF_a$

ontact	Singl	e, DT	DB c		
Angle	X 0	Y_0	X 0	Y_0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r}$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

_	Single or DT
-	mounting
-	When
_	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$
_	use $P_0 = F_{ m r}$

Во	undar	y Dim mm)	ensio	ons	Basi (N		ngs (Single) {kg	gf}	Factor	Limiting Speeds (¹) (min-¹)		Eff.Load Centers		ent and sions (r		Mass (kg)
d	D	В	$m{r}$ min.	r_1 min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{r}_{ m a}$ max.	арргох.
25	62 62	17 17	1.1 1.1	0.6 0.6	24 400 27 200	14 600 14 900	2 490 2 770	1 490 1 520	_	9 000 10 000	13 000 15 000	26.7 26.8	32 32	55 55	1 1	0.241 0.229
30	47 47 55	9 9 13	0.3 0.3 1	0.15 0.15 0.6	7 850 8 300 14 500	5 950 6 250 10 100	800 845 1 480	605 640 1 030	 15.9 	18 000 22 000 13 000	24 000 28 000 18 000	13.5 9.7 18.8	32.5 32.5 36	44.5 44.5 49	0.3 0.3 1	0.049 0.049 0.116
	55 62 62	13 16 16	1 1 1	0.6 0.6 0.6	15 100 22 500 20 500	10 300 14 800 13 500	1 540 2 300 2 090	1 050 1 510 1 380	14.9 — —	19 000 12 000 8 500	26 000 17 000 12 000	12.2 21.3 27.3	36 36 36	49 56 56	1 1 1	0.134 0.197 0.202
	62 62 72	16 16 19	1 1 1.1	0.6 0.6 0.6	23 700 23 000 33 500	14 300 14 700 20 900	2 420 2 350 3 450	1 460 1 500 2 130	13.9 —	10 000 18 000 9 000	14 000 24 000 12 000	27.3 14.2 24.2	36 36 37	56 56 65	1 1 1	0.194 0.222 0.346
	72 72	19 19	1.1 1.1	0.6 0.6	31 000 36 500	19 300 20 600	3 150 3 700	1 960 2 100	_	8 000 9 000	11 000 13 000	30.9 30.9	37 37	65 65	1 1	0.354 0.336
35	55 55 62	10 10 14	0.6 0.6 1	0.3 0.3 0.6	11 400 12 100 18 300	8 700 9 150 13 400	1 170 1 230 1 870	885 930 1 370	_ 15.7 _	15 000 18 000 12 000	20 000 24 000 16 000	15.5 11.0 21.0	40 40 41	50 50 56	0.6 0.6 1	0.074 0.074 0.153
	62 72 72	14 17 17	1 1.1 1.1	0.6 0.6 0.6	19 100 29 700 27 100	13 700 20 100 18 400	1 950 3 050 2 760	1 390 2 050 1 870	15.0 — —	17 000 10 000 7 500	22 000 14 000 10 000	13.5 23.9 30.9	41 42 42	56 65 65	1 1 1	0.173 0.287 0.294
	72 72 80	17 17 21	1.1 1.1 1.5	0.6 0.6 1	32 500 30 500 40 000	19 600 19 900 26 300	3 300 3 100 4 050	1 990 2 030 2 680	13.9 —	8 500 15 000 8 000	12 000 20 000 10 000	30.9 15.7 27.1	42 42 44	65 65 71	1 1 1.5	0.271 0.32 0.464
	80 80	21 21	1.5 1.5	1	36 500 40 500	24 200 24 400	3 750 4 100	2 460 2 490	_	7 100 8 000	9 500 11 000	34.6 34.6	44 44	71 71	1.5 1.5	0.474 0.451
40	62 62 68	12 12 15	0.6 0.6 1	0.3 0.3 0.6	14 300 15 100 19 500	11 200 11 700 15 400	1 460 1 540 1 990	1 140 1 200 1 570	_ 15.7 _	14 000 16 000 10 000	18 000 22 000 14 000	17.9 12.8 23.1	45 45 46	57 57 62	0.6 0.6 1	0.11 0.109 0.19
	68 80 80	15 18 18	1 1.1 1.1	0.6 0.6 0.6	20 600 35 500 32 000	15 900 25 100 23 000	2 100 3 600 3 250	1 620 2 560 2 340	15.4 —	15 000 9 500 6 700	20 000 13 000 9 000	14.7 26.3 34.2	46 47 47	62 73 73	1 1 1	0.213 0.375 0.383

Face-to-Face

Notes	(1)	For applications operating near the li	imiting speed, refer to Page B49.
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(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

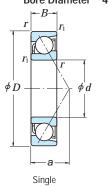
Bearing	Numl	bers (²)	Basi (1	c Load Ratings	s (Matched) {kg		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (r	
Single	[Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	in ⁻¹) Oil	а 	O DF	d _b (³) min.	$D_{ m b}$ max.	Г _b (³) max.
7305 B *7305 BE		DF D	T 39 500	29 300 —	4 050	2 980 —	7 500 8 500	10 000 12 000	53.5 53.5	19.5 19.5	30 30	57 57	0.6 0.6
7906 A5 7906 C 7006 A	DB DB DB	DF D DF D	T 13 500	11 900 12 500 20 200	1 300 1 380 2 410	1 210 1 280 2 060	14 000 17 000 11 000	19 000 24 000 15 000	27.0 19.3 37.5	9.0 1.3 11.5	_ _ 35	45.8 45.8 50	0.15 0.15 0.6
7006 C 7206 A 7206 B	DB DB DB	DF D DF D	T 36 500	20 500 29 500 27 000	2 510 3 750 3 400	2 090 3 000 2 760	15 000 10 000 7 100	22 000 13 000 9 500	24.4 42.6 54.6	1.6 10.6 22.6	— 35 35	50 57 57	0.6 0.6 0.6
*7206 BE 7206 C 7306 A	A DB DB	DF D		29 300 41 500	3 800 5 600	2 990 4 250	8 000 14 000 7 100	11 000 20 000 9 500	54.6 28.3 48.4	22.6 3.7 10.4	35 — 35	57 57 67	0.6 0.6 0.6
7306 B *7306 BE		DF D	T 50 500	38 500 —	5 150 —	3 950 —	6 300 7 100	8 500 10 000	61.8 61.8	23.8 23.8	35 35	67 67	0.6 0.6
7907 A5 7907 C 7007 A	DB DB DB	DF D DF D	T 19 600	17 400 18 300 26 800	1 890 2 000 3 050	1 770 1 860 2 740	12 000 14 000 9 500	17 000 20 000 13 000	31.0 22.1 42.0	11.0 2.1 14.0	_ _ 40	52.5 52.5 57	0.3 0.3 0.6
7007 C 7207 A 7207 B	DB DB DB	DF D DF D	T 48 500	27 300 40 000 36 500	3 150 4 900 4 500	2 790 4 100 3 750	13 000 8 500 6 000	19 000 12 000 8 000	27.0 47.9 61.9	1.0 13.9 27.9	- 40 40	57 67 67	0.6 0.6 0.6
*7207BE/ 7207 C 7307 A	DB DB	DF D		40 000 52 500	5 050 6 600	4 050 5 350	6 700 12 000 6 300	9 500 17 000 8 500	61.9 31.3 54.2	27.9 2.7 12.2	40 — 41	67 67 74	0.6 0.6 1
7307 B *7307 BE		DF D	T 59 500	48 500 —	6 100 —	4 950 —	5 600 6 300	7 500 9 000	69.2 69.2	27.2 27.2	41 41	74 74	1 1
7908 A5 7908 C 7008 A	DB DB DB	DF D DF D	T 24 600	22 300 23 500 31 000	2 370 2 510 3 250	2 270 2 390 3 150	11 000 13 000 8 500	15 000 18 000 11 000	35.8 25.7 46.2	11.8 1.7 16.2	_ _ 45	59.5 59.5 63	0.3 0.3 0.6
7008 C 7208 A 7208 B	DB DB DB	DF D DF D	T 57 500	32 000 50 500 46 000	3 400 5 850 5 300	3 250 5 150 4 700	12 000 7 500 5 300	17 000 10 000 7 500	29.5 52.6 68.3	0.5 16.6 32.3	— 45 45	63 75 75	0.6 0.6 0.6
Note	(3)	For box	rings marked	in the colum	on for d	l and n	for abofta	oro d (m	in \ and =	· (may)	roopooth	, alv	

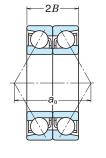
Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively. Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing

Numbers indicates the universal matching.

SINGLE/MATCHED MOUNTINGS

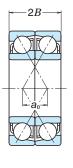
Bore Diameter 40 – 55 mm



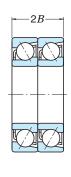


Back-to-Back

DB

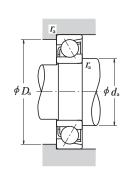


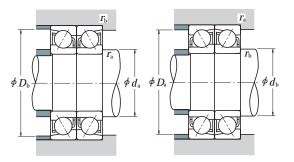
Face-to-Face



Tandem

DT





Dynamic Equivalent Load $P = XF_r + YF_a$

Control	if ₀ F _a *			Singl	e, DT		DB or DF				
Contact		e	F _a /F	$r \leq e$	F_a/I	r > e	F_a/F	r≤e	$F_a/F_r > e$		
Angle	Cor		X	Y	X	Y	X	Y	X	Y	
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39	
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28	
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11	
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00	
15	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93	
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82	
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66	
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63	
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41	
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24	
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93	

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Contact	Singl	e, DT	DB c	r DF	
Angle	<i>X</i> ₀	Y_0	X 0	Y 0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r} +$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

_	Single or DT
-	mounting
_	When
_	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$
_	use $P_0 = F_{ m r}$
_	

Вс	oundar	y Dim (mm)		ons	Basi (N		ngs (Single) {kg	f}	Factor	Limiting Speeds (1)		Eff.Load Centers	Abutment and Fillet Dimensions (mm)			Mass (kg)
d	D	В	r min.	$r_{ m 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	(min ⁻¹) Grease Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	арргох.	
40	80 80 90	18 18 23	1.1 1.1 1.5	0.6 0.6 1	38 500 36 500 49 000	24 500 25 200 33 000	3 900 3 700 5 000	2 500 2 570 3 350	_ 14.1 _	7 500 14 000 7 100	11 000 19 000 9 000	34.2 17.0 30.3	47 47 49	73 73 81	1 1 1.5	0.357 0.418 0.633
	90 90	23 23	1.5 1.5	1	45 000 53 000	30 500 33 000	4 550 5 400	3 100 3 350	_ _	6 300 7 100	8 500 10 000	38.8 38.8	49 49	81 81	1.5 1.5	0.648 0.619
45	68 68 75	12 12 16	0.6 0.6 1	0.3 0.3 0.6	15 100 16 000 23 100	12 700 13 400 18 700	1 540 1 630 2 360	1 290 1 360 1 910	16.0 —	12 000 14 000 9 500	17 000 20 000 13 000	19.2 13.6 25.3	50 50 51	63 63 69	0.6 0.6 1	0.13 0.129 0.25
	75 85 85	16 19 19	1 1.1 1.1	0.6 0.6 0.6	24 400 39 500 36 000	19 300 28 700 26 200	2 490 4 050 3 650	1 960 2 930 2 680	15.4 —	14 000 8 500 6 300	19 000 12 000 8 500	16.0 28.3 36.8	51 52 52	69 78 78	1 1 1	0.274 0.411 0.421
	85 85 100	19 19 25	1.1 1.1 1.5	0.6 0.6 1	40 500 41 000 63 500	27 100 28 800 43 500	4 100 4 150 6 450	2 760 2 940 4 450	14.2 —	7 100 12 000 6 300	10 000 17 000 8 500	36.8 18.2 33.4	52 52 54	78 78 91	1 1 1.5	0.40 0.468 0.848
	100 100	25 25	1.5 1.5	1 1	58 500 62 500	40 000 39 500	5 950 6 400	4 100 4 050	_ _	5 600 6 300	7 500 9 000	42.9 42.9	54 54	91 91	1.5 1.5	0.869 0.823
50	72 72 80	12 12 16	0.6 0.6 1	0.3 0.3 0.6	15 900 16 900 24 500	14 200 15 000 21 100	1 630 1 720 2 500	1 450 1 530 2 150	16.2 —	11 000 13 000 8 500	15 000 18 000 12 000	20.2 14.2 26.8	55 55 56	67 67 74	0.6 0.6 1	0.132 0.13 0.263
	80 90 90	16 20 20	1 1.1 1.1	0.6 0.6 0.6	26 000 41 500 37 500	21 900 31 500 28 600	2 650 4 200 3 800	2 230 3 200 2 920	15.7 —	12 000 8 000 5 600	17 000 11 000 8 000	16.7 30.2 39.4	56 57 57	74 83 83	1 1 1	0.293 0.466 0.477
	90 90 110	20 20 27	1.1 1.1 2	0.6 0.6 1	42 000 43 000 74 000	29 700 31 500 52 000	4 300 4 350 7 550	3 050 3 250 5 300	14.5 —	6 300 12 000 5 600	9 500 16 000 7 500	39.4 19.4 36.6	57 57 60	83 83 100	1 1 2	0.453 0.528 1.1
	110 110	27 27	2	1 1	68 000 78 000	48 000 50 500	6 950 7 950	4 900 5 150	_ _	5 000 5 600	6 700 8 000	47.1 47.1	60 60	100 100	2	1.12 1.07
55	80 80 90	13 13 18	1 1 1.1	0.6 0.6 0.6	18 100 19 100 32 500	16 800 17 700 27 700	1 840 1 950 3 300	1 710 1 810 2 830	16.3 —	10 000 12 000 7 500	14 000 16 000 11 000	22.2 15.5 29.9	61 61 62	74 74 83	1 1 1	0.184 0.182 0.391

Notes	(1)	For applications	operating near	the limiting speed,	refer to Page B49 .
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(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

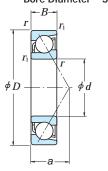
Bearing Numbers ((2)	Basi (N	c Load Ratings	s (Matched {kg		Limiting Speeds (1) (Matched) (min-1)		Load Center Spacings (mm)		Abutment and Fillet Dimensions (mm)		
Single Duple:	х	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	Γ _b (³) max.
*7208 BEA 7208 C DB DF 7308 A DB DF	DT DT	59 000 79 500	50 500 66 000	6 000 8 100	5 150 6 700	6 000 11 000 5 600	8 500 15 000 7 500	68.3 34.1 60.5	32.3 1.9 14.5	45 — 46	75 75 84	0.6 0.6 1
7308 B DB DF	DT	73 000	60 500	7 400	6 200	5 000	6 700	77.5	31.5	46	84	1
*7308 BEA		—	—	—	—	5 600	8 000	77.5	31.5	46	84	1
7909 A5 DB DF	DT	24 600	25 400	2 510	2 590	9 500	13 000	38.4	14.4	—	65.5	0.3
7909 C DB DF	DT	26 000	26 800	2 660	2 730	12 000	16 000	27.1	3.1	—	65.5	0.3
7009 A DB DF	DT	37 500	37 500	3 850	3 800	7 500	10 000	50.6	18.6	50	70	0.6
7009 C DB DF	DT	39 500	38 500	4 050	3 950	11 000	15 000	32.1	0.1	—	70	0.6
7209 A DB DF	DT	64 500	57 500	6 550	5 850	7 100	9 500	56.5	18.5	50	80	0.6
7209 B DB DF	DT	58 500	52 500	5 950	5 350	5 000	6 700	73.5	35.5	50	80	0.6
*7209 BEA 7209 C DB DF 7309 A DB DF	DT DT	66 500 103 000	57 500 87 000	6 750 10 500	5 850 8 900	5 600 10 000 5 000	8 000 14 000 6 700	73.5 36.4 66.9	35.5 1.6 16.9	50 — 51	80 80 94	0.6 0.6 1
7309 B DB DF	DT	95 000	80 500	9 650	8 200	4 500	6 000	85.8	35.8	51	94	1
*7309 BEA		—	—	—	—	5 000	7 100	85.8	35.8	51	94	1
7910 A5 DB DF	DT	25 900	28 400	2 640	2 900	9 000	12 000	40.5	16.5	—	69.5	0.3
7910 C DB DF	DT	27 400	30 000	2 800	3 050	11 000	15 000	28.3	4.3	—	69.5	0.3
7010 A DB DF	DT	40 000	42 000	4 050	4 300	7 100	9 500	53.5	21.5	55	75	0.6
7010 C DB DF	DT	42 000	44 000	4 300	4 450	10 000	14 000	33.4	1.4	<u> </u>	75	0.6
7210 A DB DF	DT	67 000	63 000	6 850	6 400	6 300	9 000	60.4	20.4		85	0.6
7210 B DB DF	DT	60 500	57 000	6 200	5 850	4 500	6 300	78.7	38.7		85	0.6
*7210 BEA 7210 C DB DF 7310 A DB DF	DT DT	69 500 121 000	63 500 104 000	7 100 12 300	6 450 10 600	5 000 9 500 4 500	7 500 13 000 6 000	78.7 38.7 73.2	38.7 1.3 19.2	55 — 56	85 85 104	0.6 0.6 1
7310 B DB DF *7310 BEA	DT	111 000 —	96 000 —	11 300 —	9 800 —	4 000 4 500	5 600 6 700	94.1 94.1	40.1 40.1	56 56	104 104	1
7911 A5 DB DF	DT	29 300	33 500	2 990	3 400	8 000	11 000	44.5	18.5	—	75	0.6
7911 C DB DF	DT	31 000	35 500	3 150	3 600	9 500	13 000	31.1	5.1	—	75	0.6
7011 A DB DF	DT	52 500	55 500	5 350	5 650	6 300	8 500	59.9	23.9	60	85	0.6

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

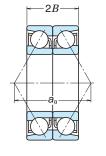
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

SINGLE/MATCHED MOUNTINGS

Bore Diameter 55 – 65 mm

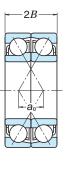


Single

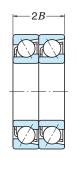


Back-to-Back

DB

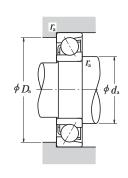


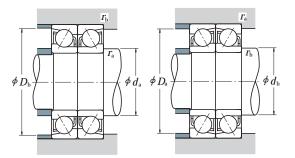
Face-to-Face



Tandem

DT





Dynamic Equivalent Load = r + a												
nic Equ	ivalen	t Load	=	r +	a							
*			Singl	e, DT		DB or DF						
		a/ _r≦		a/	a/ r>		a/ r≦		_r>			
Cor												
0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39			
0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28			
0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11			
1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00			
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93			
2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82			
3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66			
5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63			
_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41			
_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24			
_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93			
	0.178 0.357 0.714 1.07 1.43 2.14 3.57	0.48 0.178 0.178 0.178 0.357 0.40 0.714 0.43 1.07 0.46 1.43 0.47 0.50 3.57 0.55 5.35 0.56 0.68 0.80	0.178 0.38 1 0.357 0.40 1 1.07 0.46 1 1.03 0.47 1 1.04 0.50 1 3.57 0.55 1 5.35 0.56 1 - 0.68 1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			

*For , use 2 for DB, DF and 1 for DT

Static Equivalent Load 0 = 0 r + 0 a

Contact	Singl	e, DT	DB o	or DF	_
Angle	0	0 0 0		0	Sin
15°	0.5	0.46	1	0.92	moi
25°	0.5	0.38	1	0.76	- vvii
30°	0.5	0.33	1	0.66	use
40°	0.5	0.26	1	0.52	

_	Single or DT	
-	mounting	
-	When	
_	r > 0.5 r + 0 a	
_	use $0 = r$	

Во	oundar	y Din (mm)		ons	Basi (N		ings (Single) {kg		Factor	Spee		Eff.Load Centers		nent and		Mass (kg)
d	D	В	$m{r}$ min.	$r_{ m 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	0	(mi Grease	n-') Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	арргох.
55	90 100 100	18 21 21	1.1 1.5 1.5	0.6 1 1	34 000 51 000 46 500	28 600 39 500 36 000	3 500 5 200 4 700	2 920 4 050 3 700	15.5 —	11 000 7 100 5 300	15 000 10 000 7 100	18.7 32.9 43.0	62 64 64	83 91 91	1 1.5 1.5	0.43 0.613 0.627
	100 100 120	21 21 29	1.5 1.5 2	1 1 1	51 500 53 000 86 000	37 000 40 000 61 500	5 250 5 400 8 750	3 800 4 100 6 250	14.5 —	6 000 10 000 5 000	8 500 14 000 6 700	43.0 20.9 39.8	64 64 65	91 91 110	1.5 1.5 2	0.596 0.688 1.41
	120 120	29 29	2	1 1	79 000 89 000	56 500 58 500	8 050 9 100	5 750 6 000	_	4 500 5 000	6 300 7 500	51.2 51.2	65 65	110 110	2	1.45 1.36
60	85 85 95	13 13 18	1 1 1.1	0.6 0.6 0.6	18 300 19 400 33 000	17 700 18 700 29 500	1 870 1 980 3 350	1 810 1 910 3 000	16.5 —	9 500 11 000 7 100	13 000 15 000 10 000	23.4 16.2 31.4	66 66 67	79 79 88	1 1 1	0.197 0.194 0.417
	95 110 110	18 22 22	1.1 1.5 1.5	0.6 1 1	35 000 62 000 56 000	30 500 48 500 44 500	3 600 6 300 5 700	3 150 4 950 4 550	15.7 — —	10 000 6 700 4 800	14 000 9 000 6 300	19.4 35.5 46.7	67 69 69	88 101 101	1 1.5 1.5	0.46 0.798 0.815
	110 110 130	22 22 31	1.5 1.5 2.1	1 1 1.1	61 500 64 000 98 000	45 000 49 000 71 500	6 300 6 550 10 000	4 600 5 000 7 250	14.4 —	5 300 9 500 4 800	7 500 13 000 6 300	46.7 22.4 42.9	69 69 72	101 101 118	1.5 1.5 2	0.791 0.889 1.74
	130 130	31 31	2.1 2.1	1.1 1.1	90 000 102 000	65 500 68 500	9 200 10 500	6 700 7 000	_ _	4 300 4 800	5 600 6 700	55.4 55.4	72 72	118 118	2	1.78 1.7
65	90 90 100	13 13 18	1 1 1.1	0.6 0.6 0.6	19 100 20 200 35 000	19 400 20 500 33 000	1 940 2 060 3 550	1 980 2 090 3 350	16.7 —	9 000 10 000 6 700	12 000 14 000 9 500	24.6 16.9 32.8	71 71 72	84 84 93	1 1 1	0.211 0.208 0.455
	100 120 120	18 23 23	1.1 1.5 1.5	0.6 1 1	37 000 70 500 63 500	34 500 58 000 52 500	3 800 7 150 6 500	3 500 5 900 5 350	15.9 — —	10 000 6 000 4 300	13 000 8 500 6 000	20.0 38.2 50.3	72 74 74	93 111 111	1 1.5 1.5	0.493 1.03 1.05
	120 120 140	23 23 33	1.5 1.5 2.1	1 1 1.1	70 000 73 000 111 000	53 500 58 500 82 000	7 150 7 450 11 300	5 450 6 000 8 350	14.6 —	4 800 9 000 4 300	7 100 12 000 6 000	50.3 23.9 46.1	74 74 77	111 111 128	1.5 1.5 2	1.01 1.14 2.12
	140 140	33 33	2.1 2.1	1.1 1.1	102 000 114 000	75 500 77 000	10 400 11 600	7 700 7 850	_	3 800 4 300	5 300 6 300	59.5 59.5	77 77	128 128	2	2.17 2.09

Notes	(1)	For applications operating near the limiting speed, refer to Page B49.
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(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

Bearing	g Numbers (²) Basi			c Load Rating	s (Matched {kg		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (
Single	Dı	uplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	in ⁻¹) Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	Г _b (³) max.
7011 C 7211 A 7211 B		DF DT DF DT DF DT	55 500 83 000 75 000	57 500 79 000 72 000	5 650 8 450 7 650	5 850 8 050 7 350	9 000 6 000 4 000	12 000 8 000 5 600	37.4 65.7 86.0	1.4 23.7 44.0	— 61 61	85 94 94	0.6 1 1
*7211 BE 7211 C 7311 A	DB	DF DT DF DT	86 000 139 000	80 000 123 000	8 800 14 200	8 150 12 500	4 500 8 500 4 000	6 700 12 000 5 600	86.0 41.7 79.5	44.0 0.3 21.5	61 — 61	94 94 114	1 1 1
7311 B *7311 BE		DF DT	128 000 —	113 000 —	13 100 —	11 500 —	3 600 4 000	5 000 6 000	102.4 102.4	44.4 44.4	61 61	114 114	1 1
7912 A5 7912 C 7012 A	DB	DF DT DF DT DF DT	29 800 31 500 53 500	35 500 37 500 59 000	3 050 3 200 5 450	3 600 3 800 6 000	7 500 9 000 6 000	10 000 12 000 8 000	46.8 32.4 62.7	20.8 6.4 26.7	— — 65	80 80 90	0.6 0.6 0.6
7012 C 7212 A 7212 B	DB	DF DT DF DT DF DT	57 000 100 000 91 000	61 500 97 500 89 000	5 800 10 200 9 300	6 250 9 950 9 050	8 500 5 300 3 800	12 000 7 100 5 300	38.8 71.1 93.3	2.8 27.1 49.3	— 66 66	90 104 104	0.6 1 1
*7212 BE 7212 C 7312 A	DB	DF DT DF DT	104 000 159 000	98 500 143 000	10 600 16 200	10 000 14 500	4 300 7 500 3 800	6 000 11 000 5 000	93.3 44.8 85.9	49.3 0.8 23.9	66 — 67	104 104 123	1 1 1
7312 B *7312 BE		DF DT	146 000 —	131 000 —	14 900 —	13 400 —	3 400 3 800	4 500 5 600	110.7 110.7	48.7 48.7	67 67	123 123	1 1
7913 A5 7913 C 7013 A	DB	DF DT DF DT DF DT	31 000 33 000 56 500	39 000 41 000 65 500	3 150 3 350 5 750	3 950 4 200 6 700	7 100 8 500 5 600	9 500 12 000 7 500	49.1 33.8 65.6	23.1 7.8 29.6	— — 70	85 85 95	0.6 0.6 0.6
7013 C 7213 A 7213 B	DB	DF DT DF DT DF DT	60 500 114 000 103 000	68 500 116 000 105 000	6 150 11 600 10 500	7 000 11 800 10 700	8 000 4 800 3 400	11 000 6 700 4 800	40.1 76.4 100.6	4.1 30.4 54.6	— 71 71	95 114 114	0.6 1 1
*7213 BE 7213 C 7313 A	DB	DF DT DF DT	119 000 180 000	117 000 164 000	12 100 18 400	12 000 16 700	3 800 7 100 3 600	5 600 9 500 4 800	100.6 47.8 92.2	54.6 1.8 26.2	71 — 72	114 114 133	1 1 1
7313 B *7313 BE		DF DT	166 000 —	151 000 —	16 900 —	15 400 —	3 200 3 600	4 300 5 000	119.0 119.0	53.0 53.0	72 72	133 133	1 1

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

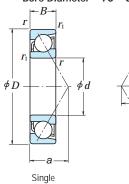
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing

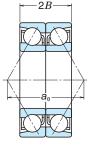
Numbers indicates the universal matching.

Nemarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bear Numbers indicates the universal matching.

SINGLE/MATCHED MOUNTINGS

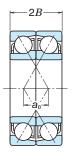
Bore Diameter 70 – 80 mm



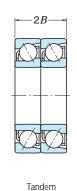


Back-to-Back

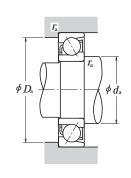
DB

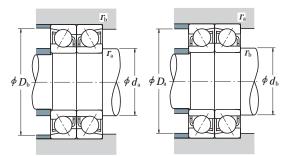


Face-to-Face



DT





Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$			Singl	e, DT			DB c	r DF	
	Angle Cor		F_a/I	7 _r ≦e	F_a/I	r > e	F_a/I	$r \leq e$	F_a/I	r > e
Angle			X	Y	X	Y	X	Y	X	Y
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00
15.	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Contact	Singl	e, DT	DB c	r DF	
Angle	X 0	Y_0	X 0	Y 0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

Bearin	g Numbers (²) Basic (N			c Load Rating	s (Matched {kg		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (
Single	Dupl	ex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	n ⁻¹) Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	Г _b (³) max.
7914 A	5 DB DF	DT	43 000	52 500	4 400	5 350	6 300	9 000	55.6	23.6	—	95	0.6
7914 C	DB DF		45 500	55 500	4 650	5 650	7 500	11 000	38.8	6.8	—	95	0.6
7014 A	DB DF		71 500	82 500	7 300	8 450	5 000	6 700	72.0	32.0	75	105	0.6
7014 C	DB DF	DT	76 000	86 000	7 750	8 750	7 100	10 000	44.1	4.1	—	105	0.6
7214 A	DB DF		124 000	127 000	12 600	13 000	4 500	6 300	80.3	32.3	76	119	1
7214 B	DB DF		112 000	116 000	11 500	11 800	3 200	4 500	105.8	57.8	76	119	1
*7214 B 7214 C 7314 A	EA DB DF DB DF		129 000 203 000	129 000 187 000	13 200 20 700	13 200 19 100	3 600 6 700 3 200	5 300 9 000 4 300	105.8 50.1 98.5	57.8 2.1 28.5	76 — 77	119 119 143	1 1 1
7314 B	DB DF	DT	186 000	172 000	19 000	17 500	2 800	4 000	127.3	57.3	77	143	1
*7314 B	EA		—	—	—	—	3 200	4 800	127.3	57.3	77	143	1
7915 A	5 DB DF	DT	44 000	55 500	4 450	5 650	6 000	8 500	58.0	26.0	—	100	0.6
7915 C	DB DF		46 500	58 500	4 750	5 950	7 100	10 000	40.1	8.1	—	100	0.6
7015 A	DB DF		73 000	87 500	7 450	8 900	4 800	6 700	74.8	34.8	80	110	0.6
7015 C	DB DF	DT	78 000	91 500	7 950	9 300	6 700	9 500	45.4	5.4	—	110	0.6
7215 A	DB DF		123 000	129 000	12 600	13 100	4 300	6 000	84.2	34.2	81	124	1
7215 B	DB DF		112 000	117 000	11 400	11 900	3 200	4 300	111.0	61.0	81	124	1
*7215 B 7215 C 7315 A 7315 B	EA DB DF DB DF DB DF	DT	134 000 221 000 202 000	140 000 212 000 195 000	13 700 22 500 20 600	14 200 21 600 19 800	3 600 6 300 3 000 2 800	5 000 9 000 4 000 3 800	111.0 52.4 104.8 135.6	61.0 2.4 30.8 61.6	81 — 82 82	124 124 153 153	1 1 1 1
7916 A	5 DB DF	DT	44 500	58 000	4 550	5 900	5 600	8 000	60.3	28.3	—	105	0.6
7916 C	DB DF		47 000	61 500	4 800	6 250	6 700	9 500	41.5	9.5	—	105	0.6
7016 A	DB DF		89 500	106 000	9 150	10 800	4 300	6 000	81.2	37.2	85	120	0.6
7016 C	DB DF	DT	95 500	111 000	9 700	11 300	6 300	9 000	49.4	5.4	—	120	0.6
7216 A	DB DF		145 000	152 000	14 700	15 600	4 000	5 600	89.5	37.5	86	134	1
7216 B	DB DF		131 000	139 000	13 300	14 100	2 800	4 000	118.3	66.3	86	134	1
*7216 B 7216 C 7316 A 7316 B	DB DF DB DF DB DF	DT	151 000 239 000 219 000	155 000 238 000 218 000	15 400 24 400 22 400	15 800 24 200 22 300	3 200 6 000 2 800 2 600	4 800 8 000 3 800 3 400	118.3 55.5 111.2 143.9	66.3 3.5 33.2 65.9	86 — 87 87	134 134 163 163	1 1 1 1
Note	(2) -			in the colum		, ,		1 /		, ,			

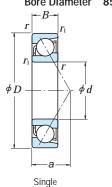
Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively. Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

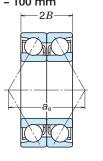
Во	oundar (y Din (mm)		ons	Bas (N		tings (Single) {k) gf}	Factor Limiting Eff.Load Abutment and Fillet Centers Dimensions (mm)					Mass (kg)		
d	D	В	$m{r}$ min.	$oldsymbol{r_1}{ ext{min.}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	'' ['] Oil	a	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	approx.
70	100 100 110	16 16 20	1 1 1.1	0.6 0.6 0.6	26 500 28 100 44 000	26 300 27 800 41 500	2 710 2 870 4 500	2 680 2 830 4 200	16.4 —	8 000 9 500 6 300	11 000 13 000 8 500	27.8 19.4 36.0	76 76 77	94 94 103	1 1 1	0.341 0.338 0.625
	110 125 125	20 24 24	1.1 1.5 1.5	0.6 1 1	47 000 76 500 69 000	43 000 63 500 58 000	4 800 7 800 7 050	4 400 6 500 5 900	15.7 — —	9 000 5 600 4 000	12 000 8 000 5 600	22.1 40.1 52.9	77 79 79	103 116 116	1 1.5 1.5	0.698 1.11 1.14
	125 125 150	24 24 35	1.5 1.5 2.1	1 1 1.1	75 500 79 500 125 000	58 500 64 500 93 500	7 700 8 100 12 700	6 000 6 600 9 550	14.6 —	4 500 8 500 4 000	6 700 11 000 5 300	52.9 25.1 49.3	79 79 82	116 116 138	1.5 1.5 2	1.08 1.24 2.6
	150 150	35 35	2.1 2.1	1.1 1.1	114 000 124 000	86 000 87 500	11 700 12 600	8 750 8 900	_	3 600 4 000	5 000 6 000	63.6 63.7	82 82	138 138	2	2.65 2.53
75	105 105 115	16 16 20	1 1 1.1	0.6 0.6 0.6	26 900 28 600 45 000	27 700 29 300 43 500	2 750 2 910 4 600	2 820 2 980 4 450	16.6 —	7 500 9 000 6 000	10 000 12 000 8 000	29.0 20.1 37.4	81 81 82	99 99 108	1 1 1	0.355 0.357 0.661
	115 130 130	20 25 25	1.1 1.5 1.5	0.6 1 1	48 000 76 000 68 500	45 500 64 500 58 500	4 900 7 750 7 000	4 650 6 550 5 950	15.9 — —	8 500 5 600 3 800	12 000 7 500 5 300	22.7 42.1 55.5	82 84 84	108 121 121	1 1.5 1.5	0.748 1.19 1.22
	130 130 160 160	25 25 37 37	1.5 1.5 2.1 2.1	1 1 1.1 1.1	78 500 83 000 136 000 125 000	63 500 70 000 106 000 97 500	8 000 8 450 13 800 12 700	6 450 7 100 10 800 9 900	14.8 —	4 300 8 000 3 800 3 400	6 300 11 000 5 000 4 800	55.5 26.2 52.4 67.8	84 84 87 87	121 121 148 148	1.5 1.5 2 2	1.18 1.36 3.13 3.19
80	110 110 125	16 16 22	1 1 1.1	0.6 0.6 0.6	27 300 29 000 55 000	29 000 30 500 53 000	2 790 2 960 5 650	2 960 3 150 5 400	16.7 —	7 100 8 500 5 600	10 000 12 000 7 500	30.2 20.7 40.6	86 86 87	104 104 118	1 1 1	0.38 0.376 0.88
	125 140 140	22 26 26	1.1 2 2	0.6 1 1	58 500 89 000 80 500	55 500 76 000 69 500	6 000 9 100 8 200	5 650 7 750 7 050	15.7 — —	8 000 5 000 3 600	11 000 7 100 5 000	24.7 44.8 59.1	87 90 90	118 130 130	1 2 2	0.966 1.46 1.49
	140 140 170 170	26 26 39 39	2 2 2.1 2.1	1 1 1.1 1.1	87 500 93 000 147 000 135 000	70 000 77 500 119 000 109 000	8 950 9 450 15 000 13 800	7 150 7 900 12 100 11 100	14.7 —	4 000 7 500 3 600 3 200	6 000 10 000 4 800 4 300	59.2 27.7 55.6 71.9	90 90 92 92	130 130 158 158	2 2 2 2	1.42 1.63 3.71 3.79

Notes (1) For applications operating near the limiting speed, refer to Page B49.

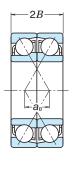
(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

SINGLE/MATCHED MOUNTINGS Bore Diameter 85 – 100 mm





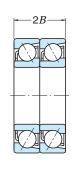
Back-to-Back

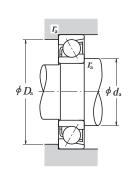


Face-to-Face

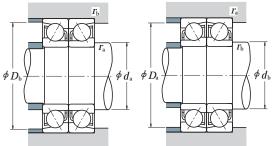
DF

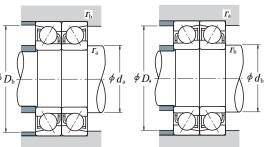
Factor





Eff.Load Abutment and Fillet Mass





Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	if ₀ F _a *			Singl	Single, DT			DB c	or DF		
			F_a/I	7 _r ≦e	F_a/I	r > e	F_a/I	$r \leq e$	F_a/I	r > e	
Angle	Cor		X	Y	X	Y	X	Y	X	Y	
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39	
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28	
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11	
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00	
13.	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93	
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82	
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66	
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63	
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41	
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24	
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93	

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Contact	Singl	e, DT	DB c	or DF	
Angle	<i>X</i> ₀	Y 0	X 0	Y 0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	0 -1

Bearing	Bearing Numbers (²) Basic Load Ratings (Matched) (N) {kgf}						ting (Matched) n ⁻¹)	Load (Spacing <i>a</i>	s (mm)	Abutment and Fillet Dimensions (mm)		
Single	Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	DB	O DF	d _b (³) min.	$D_{ m b}$ max.	r _b (³) max.
7917 A5	DB DF DT	59 500	77 000	6 100	7 850	5 300	7 500	65.8	29.8	—	115	0.6
7917 C	DB DF DT	63 000	81 500	6 450	8 300	6 300	9 000	45.5	9.5	—	115	0.6
7017 A	DB DF DT	91 500	112 000	9 350	11 400	4 300	5 600	84.1	40.1	90	125	0.6
7017 C 7217 A 7217 B	DB DF DT DB DF DT DB DF DT	98 000 167 000 151 000	117 000 178 000 162 000	9 950 17 100 15 400	12 000 18 200 16 500	6 000 3 800 2 800	8 500 5 300 3 800	50.8 95.8 126.6	6.8 39.8 70.6	91 91	125 144 144	0.6 1 1
7217 C 7317 A 7317 B	DB DF DT DB DF DT DB DF DT	174 000 258 000 236 000	181 000 265 000 244 000	17 800 26 300 24 100	18 500 27 000 24 800	5 600 2 600 2 400	7 500 3 600 3 200	59.5 117.5 152.2	3.5 35.5 70.2	92 92	144 173 173	1 1 1
7918 A5	DB DF DT	64 000	87 000	6 500	8 900	5 000	7 100	68.1	32.1	—	120	0.6
7918 C	DB DF DT	67 500	92 000	6 900	9 400	6 000	8 500	46.8	10.8	—	120	0.6
7018 A	DB DF DT	109 000	133 000	11 200	13 500	3 800	5 300	90.4	42.4	96	134	1
7018 C	DB DF DT	116 000	138 000	11 900	14 100	5 600	8 000	54.8	6.8	—	134	1
7218 A	DB DF DT	191 000	206 000	19 500	21 000	3 600	5 000	102.2	42.2	96	154	1
7218 B	DB DF DT	173 000	188 000	17 700	19 100	2 600	3 400	134.9	74.9	96	154	1
7218 C	DB DF DT	199 000	209 000	20 300	21 400	5 300	7 100	63.5	3.5	—	154	1
7318 A	DB DF DT	277 000	294 000	28 300	30 000	2 600	3 400	123.8	37.8	97	183	1
7318 B	DB DF DT	254 000	270 000	25 900	27 600	2 200	3 000	160.5	74.5	97	183	1
7919 A5	DB DF DT	64 500	91 000	6 600	9 250	4 800	6 700	70.5	34.5	_	125	0.6
7919 C	DB DF DT	68 500	96 000	7 000	9 800	5 600	8 000	48.1	12.1	_	125	0.6
7019 A	DB DF DT	109 000	134 000	11 100	13 600	3 800	5 000	93.3	45.3	_	139	1
7019 C	DB DF DT	119 000	146 000	12 200	14 900	5 300	7 500	56.1	8.1	—	139	1
7219 A	DB DF DT	208 000	221 000	21 200	22 600	3 400	4 500	108.5	44.5	102	163	1
7219 B	DB DF DT	188 000	202 000	19 200	20 500	2 400	3 200	143.2	79.2	102	163	1
7219 C	DB DF DT	216 000	224 000	22 000	22 800	4 800	6 700	67.5	3.5	—	163	1
7319 A	DB DF DT	297 000	325 000	30 500	33 000	2 400	3 200	130.2	40.2	102	193	1
7319 B	DB DF DT	272 000	298 000	27 700	30 500	2 200	3 000	168.7	78.7	102	193	1
7920 A5	DB DF DT	77 000	103 000	7 850	10 500	4 500	6 300	76.0	36.0	_	135	0.6
7920 C	DB DF DT	81 500	108 000	8 300	11 100	5 300	7 500	52.2	12.2	_	135	0.6
7020 A	DB DF DT	111 000	141 000	11 300	14 400	3 600	5 000	96.2	48.2	_	144	1

(3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

	DB
Boundary Dimensions	Basic Load Ratings (Single)

Tandem DT

8 500

4 000

3 600

8 000

9 000

6 000

6 000

3 000

2 600

5 600

6 700

4 500

107

65.1 109

84.3 109

26.1 107

48.1 109

33.7

38.0 107 158

186

186

133

133

3.05

0.804

0.794

2.5 5.83

2.5 5.98

1.5 | 1.48

Limiting

(mm)			(1)	1)	{k	gf}		Speeds (1) (min-1)				Dimensions (mm)			(kg)	
d	D	В	$m{r}$ min.	$r_{ m 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	approx.
85	120	18	1.1	0.6	36 500	38 500	3 750	3 900	—	6 700	9 000	32.9	92	113	1	0.541
	120	18	1.1	0.6	39 000	40 500	3 950	4 150	16.5	8 000	11 000	22.7	92	113	1	0.534
	130	22	1.1	0.6	56 500	56 000	5 750	5 700	—	5 300	7 100	42.0	92	123	1	0.913
	130	22	1.1	0.6	60 000	58 500	6 150	6 000	15.9	7 500	10 000	25.4	92	123	1	1.01
	150	28	2	1	103 000	89 000	10 500	9 100	—	4 800	6 700	47.9	95	140	2	1.83
	150	28	2	1	93 000	81 000	9 500	8 250	—	3 400	4 800	63.3	95	140	2	1.87
	150 180 180	28 41 41	2 3 3	1 1.1 1.1	107 000 159 000 146 000	90 500 133 000 122 000	10 900 16 200 14 800	9 250 13 500 12 400	14.7 —	6 700 3 400 3 000	9 500 4 500 4 000	29.7 58.8 76.1	95 99 99	140 166 166	2 2.5 2.5	2.04 4.33 4.42
90	125	18	1.1	0.6	39 500	43 500	4 000	4 450	_	6 300	8 500	34.1	97	118	1	0.56
	125	18	1.1	0.6	41 500	46 000	4 250	4 700	16.6	7 500	10 000	23.4	97	118	1	0.563
	140	24	1.5	1	67 500	66 500	6 850	6 750	_	4 800	6 700	45.2	99	131	1.5	1.19
	140	24	1.5	1	71 500	69 000	7 300	7 050	15.7	7 100	9 500	27.4	99	131	1.5	1.34
	160	30	2	1	118 000	103 000	12 000	10 500	—	4 500	6 000	51.1	100	150	2	2.25
	160	30	2	1	107 000	94 000	10 900	9 550	—	3 200	4 300	67.4	100	150	2	2.29
	160 190 190	30 43 43	2 3 3	1 1.1 1.1	123 000 171 000 156 000	105 000 147 000 135 000	12 500 17 400 15 900	10 700 15 000 13 800	14.6 —	6 300 3 200 2 800	9 000 4 300 3 800	31.7 61.9 80.2	100 104 104	150 176 176	2 2.5 2.5	2.51 5.06 5.17
95	130	18	1.1	0.6	40 000	45 500	4 050	4 650	_	6 000	8 500	35.2	102	123	1	0.597
	130	18	1.1	0.6	42 500	48 000	4 300	4 900	16.7	7 100	10 000	24.1	102	123	1	0.591
	145	24	1.5	1	67 000	67 000	6 800	6 800	_	4 500	6 300	46.6	104	136	1.5	1.43
	145	24	1.5	1	73 500	73 000	7 500	7 450	15.9	6 700	9 000	28.1	104	136	1.5	1.42
	170	32	2.1	1.1	128 000	111 000	13 000	11 300	—	4 300	5 600	54.2	107	158	2	2.68
	170	32	2.1	1.1	116 000	101 000	11 800	10 300	—	3 000	4 000	71.6	107	158	2	2.74

13 500 11 400 14.6

5 250

5 100 5 550 16.5

18 600 16 600

17 100 15 200

6 950 7 200

Notes (1) For applications operating near the limiting speed, refer to Page B49.

51 500

54 000

70 500

133 000 112 000

183 000 162 000

167 000 149 000

47 500

50 000

68 500

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

4 850

32 2.1 1.1 45 3 1.1 45 3 1.1

20 1.1 0.6

20 1.1 0.6

150 24 1.5 1

170

200

140

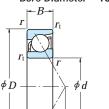
100 140

DB or DF

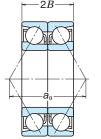
1.65 0.72 1.57 0.72

1.57 0.72 1.46 0.72 1.38 0.72 1.34 0.72 1.26 0.72 1.14 0.72

SINGLE/MATCHED MOUNTINGS Bore Diameter 100 - 120 mm

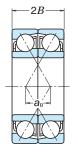


Single

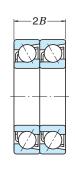


Back-to-Back

DB

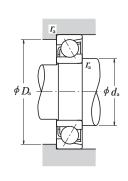


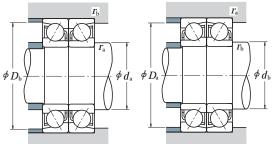
Face-to-Face

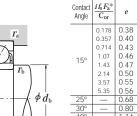


Tandem

DT







40°	_	1.14	1	0	0.35	0.5
*For <i>i</i>	use 2	for DB.	DF and	1 for DT		

Dynamic Equivalent Load $P = XF_r + YF_a$

Static Equivalent Load $P_0 = 1$	$X_0F_r + Y_0F_a$
----------------------------------	-------------------

Contact	Singl	e, DT	DB c		
Angle	<i>X</i> ₀	Y 0	X 0	Y 0	Singl
15°	0.5	0.46	1	0.92	mour
25°	0.5	0.38	1	0.76	Fr>
30°	0.5	0.33	1	0.66	use I
40°	0.5	0.26	1	0.52	

0.44

0 0.44 1.12 0 0.44 1.02 0 0.44 1.00

a

Во	oundar	y Dim mm)		ons		sic Load Rat N)	ings (Single) {k) gf}	Factor	Limiting Speeds (¹) (min-¹)		Eff.Load Centers		nent and nsions (Mass (kg)
d	D	В	r min.	$r_{\!\scriptscriptstyle 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{r_{ m a}}$ max.	approx.
100	150 180 180	24 34 34	1.5 2.1 2.1	1 1.1 1.1	75 500 144 000 130 000	77 000 126 000 114 000	7 700 14 700 13 300	7 900 12 800 11 700	16.0 —	6 300 4 000 2 800	9 000 5 300 3 800	28.7 57.4 75.7	109 112 112	141 168 168	1.5 2 2	1.46 3.22 3.28
	180 215 215	34 47 47	2.1 3 3	1.1 1.1 1.1	149 000 207 000 190 000	127 000 193 000 178 000	15 200 21 100 19 400	12 900 19 700 18 100	14.5 —	5 600 2 800 2 400	8 000 3 800 3 400	35.7 69.0 89.6	112 114 114	168 201 201	2 2.5 2.5	3.65 7.29 7.43
105	145 145 160	20 20 26	1.1 1.1 2	0.6 0.6 1	48 000 51 000 80 000	54 000 57 000 81 500	4 900 5 200 8 150	5 500 5 800 8 350	16.6 —	5 600 6 300 4 300	7 500 9 000 5 600	39.2 26.7 51.2	112 112 115	138 138 150	1 1 2	0.82 0.826 1.84
	160 190 190	26 36 36	2 2.1 2.1	1 1.1 1.1	88 000 157 000 142 000	89 500 142 000 129 000	9 000 16 000 14 500	9 100 14 400 13 100	15.9 — —	6 000 3 800 2 600	8 500 5 000 3 600	30.7 60.6 79.9	115 117 117	150 178 178	2 2 2	1.82 3.84 3.92
	190 225 225	36 49 49	2.1 3 3	1.1 1.1 1.1	162 000 208 000 191 000	143 000 193 000 177 000	16 600 21 200 19 400	14 600 19 700 18 100	14.5 — —	5 300 2 600 2 400	7 500 3 600 3 200	37.7 72.1 93.7	117 119 119	178 211 211	2 2.5 2.5	4.33 9.34 9.43
110	150 150 170	20 20 28	1.1 1.1 2	0.6 0.6 1	49 000 52 000 96 500	56 000 59 500 95 500	5 000 5 300 9 850	5 750 6 050 9 700	_ 16.7 _	5 300 6 300 4 000	7 100 8 500 5 300	40.3 27.4 54.4	117 117 120	143 143 160	1 1 2	0.877 0.867 2.28
	170 200 200	28 38 38	2 2.1 2.1	1 1.1 1.1	106 000 170 000 154 000	104 000 158 000 144 000	10 800 17 300 15 700	10 600 16 100 14 700	15.6 — —	5 600 3 600 2 600	8 000 4 800 3 400	32.7 63.7 84.0	120 122 122	160 188 188	2 2 2	2.26 4.49 4.58
	200 240 240	38 50 50	2.1 3 3	1.1 1.1 1.1	176 000 220 000 201 000	160 000 215 000 197 000	17 900 22 500 20 500	16 300 21 900 20 100	14.5 — —	5 000 2 600 2 200	7 100 3 400 3 000	39.8 75.5 98.4	122 124 124	188 226 226	2 2.5 2.5	5.1 11.1 11.2
120	165 165 180	22 22 28	1.1 1.1 2	0.6 0.6 1	67 500 72 000 102 000	77 000 81 000 107 000	6 900 7 300 10 400	7 850 8 300 10 900	— 16.5 —	4 800 5 600 3 600	6 300 7 500 5 000	44.2 30.1 57.3	127 127 130	158 158 170	1 1 2	1.15 1.15 2.45
	215 215 260 260	40 40 55 55	2.1 2.1 3 3	1.1 1.1 1.1 1.1	183 000 165 000 246 000 225 000	177 000 162 000 252 000 231 000	18 600 16 900 25 100 23 000	18 100 16 500 25 700 23 600	_ _ _ _	3 200 2 400 2 200 2 000	4 500 3 200 3 000 2 800	68.3 90.3 82.3 107.2	132 132 134 134	203 203 246 246		6.22 6.26 14.5 14.4

Notes	(1)	For applications operating near	the limiting speed,	refer to Page B49 .
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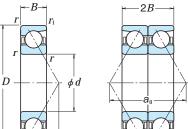
⁽²⁾ The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

Bearing	Numbers	(2)	Basi (N	c Load Rating I)	s (Matched		Limi Speeds (¹)	(Matched)	Spacing	Center js (mm)		nent and nsions (
Single	Duple	ex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(mir Grease	Oil	DB	DF	d _b (3) min.	$D_{ m b}$ max.	Г _b (³) max.
7020 C	DB DF	DT	122 000	154 000	12 500	15 800	5 300	7 100	57.5	9.5		144	1
7220 A	DB DF		233 000	251 000	23 800	25 600	3 200	4 300	114.8	46.8	107	173	1
7220 B	DB DF		212 000	229 000	21 600	23 300	2 200	3 000	151.5	83.5	107	173	1
7220 C	DB DF	DT	242 000	254 000	24 700	25 900	4 500	6 300	71.5	3.5		173	1
7320 A	DB DF		335 000	385 000	34 500	39 500	2 200	3 000	137.9	43.9	107	208	1
7320 B	DB DF		310 000	355 000	31 500	36 000	2 000	2 800	179.2	85.2	107	208	1
7921 A5	DB DF	DT	78 500	108 000	8 000	11 000	4 300	6 000	78.3	38.3	_	140	0.6
7921 C	DB DF		83 000	114 000	8 450	11 600	5 300	7 100	53.5	13.5	_	140	0.6
7021 A	DB DF		130 000	163 000	13 300	16 700	3 400	4 500	102.5	50.5	_	154	1
7021 C	DB DF	DT	143 000	179 000	14 600	18 200	4 800	6 700	61.5	9.5	—	154	1
7221 A	DB DF		254 000	283 000	25 900	28 900	3 000	4 000	121.2	49.2	112	183	1
7221 B	DB DF		231 000	258 000	23 500	26 300	2 200	3 000	159.8	87.8	112	183	1
7221 C	DB DF	DT	264 000	286 000	26 900	29 100	4 300	6 000	75.5	3.5	_	183	1
7321 A	DB DF		335 000	385 000	34 500	39 500	2 200	2 800	144.3	46.3	_	218	1
7321 B	DB DF		310 000	355 000	31 500	36 000	1 900	2 600	187.4	89.4	_	218	1
7922 A5	DB DF	DT	79 500	112 000	8 100	11 500	4 300	5 600	80.6	40.6	_	145	0.6
7922 C	DB DF		84 500	119 000	8 600	12 100	5 000	6 700	54.8	14.8	_	145	0.6
7022 A	DB DF		157 000	191 000	16 000	19 400	3 200	4 300	108.8	52.8	_	164	1
7022 C	DB DF	DT	172 000	208 000	17 600	21 200	4 500	6 300	65.5	9.5		164	1
7222 A	DB DF		276 000	315 000	28 100	32 500	2 800	4 000	127.5	51.5	117	193	1
7222 B	DB DF		250 000	289 000	25 500	29 400	2 000	2 800	168.1	92.1	117	193	1
7222 C	DB DF	DT	286 000	320 000	29 200	32 500	4 000	5 600	79.5	3.5	_	193	1
7322 A	DB DF		360 000	430 000	36 500	44 000	2 000	2 600	151.0	51.0	_	233	1
7322 B	DB DF		325 000	395 000	33 500	40 000	1 800	2 400	196.8	96.8	_	233	1
7924 A5	DB DF	DT	110 000	154 000	11 200	15 700	3 800	5 300	88.5	44.5	_	160	0.6
7924 C	DB DF		117 000	162 000	11 900	16 600	4 500	6 300	60.2	16.2	_	160	0.6
7024 A	DB DF		166 000	213 000	16 900	21 700	3 000	4 000	114.6	58.6	_	174	1
7224 A 7224 B 7324 A 7324 B	DB DF DB DF DB DF DB DF	DT DT	297 000 269 000 400 000 365 000	355 000 325 000 505 000 460 000	30 500 27 400 41 000 37 500	36 000 33 000 51 500 47 000	2 600 1 900 1 800 1 600	3 600 2 600 2 400 2 200	136.7 180.5 164.7 214.4	56.7 100.5 54.7 104.4	_ _ _ _	208 208 253 253	1 1 1 1

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

B 64 B 65

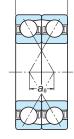
SINGLE/MATCHED MOUNTINGS Bore Diameter 130 – 170 mm



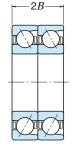
Single

Boundary Dimensions

(mm)



Factor



Tandem

DT

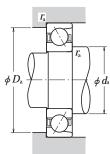
Centers

(mm)

Limiting

Speeds (1)

(min⁻¹)



Eff.Load Abutment and Fillet Mass

Dimensions (mm)

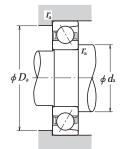
(kg)

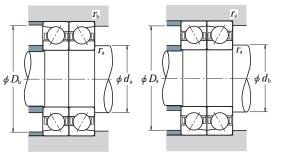


{kgf}

Basic Load Ratings (Single)

(N)





Cantant	if ₀ F _a *			Singl	e, DT		DB or DF			
Contact		e	F_a/I	$r \leq e$	$F_a/F_r > e$		$F_a/F_r \leq e$		$F_a/F_r > e$	
Angle	Cor		X	Y	X	Y	X	Y	X	Y
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00
15	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93

*For i, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	Singl	e, DT	DB c	r DF	
Angle	<i>X</i> ₀	Y 0	X 0	Y 0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

Bearing	Numbers (²)	Basi (N	c Load Rating	s (Matched {kg		Limi Speeds (¹)	(Matched)	Spacing	Center Js (mm)		nent and nsions (
Single	Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(mii Grease	Oil	DB	DF	d _b (³) min.	$D_{ m b}$ max.	Г _b (³) max.
7926 A5	DB DF DT	120 000	172 000	12 300	17 500	3 400	4 800	96.3	48.3	_	174	1
7926 C	DB DF DT	128 000	182 000	13 000	18 500	4 000	5 600	65.5	17.5	_	174	1
7026 A	DB DF DT	191 000	251 000	19 400	25 600	2 600	3 600	128.3	62.3	_	194	1
7226 A	DB DF DT	310 000	385 000	31 500	39 500	1 900	2 600	143.9	63.9	_	223	1
7226 B	DB DF DT	278 000	350 000	28 300	35 500	1 700	2 400	191.0	111.0	_	223	1
7326 A	DB DF DT	445 000	585 000	45 500	59 500	1 700	2 200	176.3	60.3	_	271	1.5
7326 B	DB DF DT	405 000	535 000	41 500	54 500	1 500	2 000	230.0	114.0	_	271	1.5
7928 A5	DB DF DT	122 000	180 000	12 400	18 400	3 200	4 500	100.9	52.9	_	184	1
7928 C	DB DF DT	129 000	191 000	13 200	19 400	3 800	5 300	68.2	20.2	_	184	1
7028 A	DB DF DT	194 000	265 000	19 800	27 000	2 600	3 400	134.0	68.0	_	204	1
7228 A 7228 B 7328 A 7328 B	DB DF DT DB DF DT DB DF DT DB DF DT	355 000 320 000 490 000 445 000	470 000 425 000 670 000 615 000	36 000 32 500 50 000 45 500	48 000 43 500 68 500 63 000	1 800 1 600 1 600 1 400	2 400 2 200 2 000 1 900	154.6 205.6 189.0 246.6	70.6 121.6 65.0 122.6	— — —	243 243 291 291	1 1 1.5 1.5
7930 A5	DB DF DT	157 000	231 000	16 000	23 500	3 000	4 000	112.0	56.0	_	204	1
7930 C	DB DF DT	166 000	244 000	16 900	24 900	3 600	4 800	76.2	20.2	_	204	1
7030 A	DB DF DT	222 000	305 000	22 700	31 500	1 900	2 400	143.3	73.3	_	218	1
7230 A	DB DF DT	405 000	560 000	41 000	57 000	1 600	2 200	166.3	76.3	_	263	1
7230 B	DB DF DT	365 000	510 000	37 000	52 000	1 500	2 000	221.2	131.2	_	263	1
7330 A	DB DF DT	515 000	745 000	52 500	75 500	1 500	1 900	200.7	70.7	_	311	1.5
7330 B	DB DF DT	470 000	680 000	48 000	69 500	1 300	1 800	262.2	132.2	_	311	1.5
7932 C	DB DF DT	173 000	265 000	17 600	27 000	3 000	4 000	78.9	22.9	_	214	1
7032 A	DB DF DT	252 000	355 000	25 700	36 000	1 700	2 400	153.5	77.5	_	233	1
7232 A	DB DF DT	425 000	615 000	43 500	62 500	1 500	2 000	177.9	81.9	_	283	1
7232 B	DB DF DT	385 000	555 000	39 500	57 000	1 400	1 900	236.8	140.8	_	283	1
7332 A	DB DF DT	565 000	845 000	57 500	86 000	1 400	1 800	212.3	76.3	_	331	1.5
7332 B	DB DF DT	515 000	770 000	52 500	78 500	1 200	1 700	277.8	141.8	_	331	1.5
7934 C	DB DF DT	183 000	297 000	18 700	30 000	2 800	3 800	81.6	25.6	_	224	1
7034 A	DB DF DT	300 000	430 000	31 000	43 500	1 600	2 200	166.1	82.1	_	253	1
7234 A	DB DF DT	480 000	715 000	49 000	73 000	1 400	1 900	190.6	86.6	_	301	1.5
7234 B	DB DF DT	435 000	650 000	44 000	66 500	1 300	1 700	253.4	149.4	_	301	1.5
7334 A	DB DF DT	630 000	970 000	64 500	99 000	1 300	1 700	225.0	81.0	_	351	1.5
7334 B	DB DF DT	575 000	890 000	59 000	90 500	1 100	1 600	294.3	150.3	_	351	1.5

Note (3) For bearings marked — in the column for d_{b_1} d_{b_2} and r_{b_3} for shafts are d_{a_3} (min.) and r_{a_3} (max.) respectively.

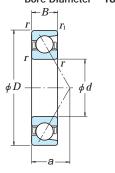
d	D	В	$m{r}$ min.	$oldsymbol{r_1}{ ext{min.}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	Óil	``a''	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{max}.$	approx.
130	180 180 200	24 24 33	1.5 1.5 2	1 1 1	74 000 78 500 117 000	86 000 91 000 125 000	7 550 8 000 12 000	8 750 9 250 12 800	_ 16.5 _	4 300 5 000 3 400	6 000 7 100 4 500	48.1 32.8 64.1	139 139 140	171 171 190	1.5 1.5 2	1.54 1.5 3.68
	230 230 280 280	40 40 58 58	3 4 4	1.1 1.1 1.5 1.5	189 000 171 000 273 000 250 000	193 000 175 000 293 000 268 000	19 300 17 400 27 900 25 500		_ _ _	2 400 2 200 2 200 1 900	3 200 3 000 2 800 2 600	72.0 95.5 88.2 115.0	144 144 148 148	216 216 262 262	2.5 2.5 3 3	7.06 7.1 17.5 17.6
140	190 190 210	24 24 33	1.5 1.5 2	1 1 1	75 000 79 500 120 000	90 000 95 500 133 000	7 650 8 100 12 200	9 200 9 700 13 500	_ 16.7 _	4 000 4 800 3 200	5 600 6 700 4 300	50.5 34.1 67.0	149 149 150	181 181 200	1.5 1.5 2	1.63 1.63 3.9
	250 250 300 300	42 42 62 62	3 4 4	1.1 1.1 1.5 1.5	218 000 197 000 300 000 275 000	234 000 213 000 335 000 310 000	20 100 30 500	23 900 21 700 34 500 31 500	_ _ _	2 200 2 000 2 000 1 700	3 000 2 800 2 600 2 400	77.3 102.8 94.5 123.3	154 154 158 158	236 236 282 282	2.5 2.5 3 3	8.92 8.94 21.4 21.6
150	210 210 225	28 28 35	2 2 2.1	1 1 1.1	96 500 102 000 137 000	115 000 122 000 154 000		11 800 12 400 15 700	_ 16.6 _	3 800 4 300 2 400	5 000 6 000 3 000	56.0 38.1 71.6	160 160 162	200 200 213	2 2 2	2.97 2.96 4.75
	270 270 320 320	45 45 65 65	3 4 4	1.1 1.1 1.5 1.5	248 000 225 000 315 000 289 000	280 000 254 000 370 000 340 000	25 300 22 900 32 500 29 400	28 500 25 900 38 000 34 500	_ _ _	2 000 1 800 1 800 1 600	2 800 2 600 2 400 2 200	83.1 110.6 100.3 131.1	164 164 168 168	256 256 302 302	2.5 2.5 3	11.2 11.2 26 25.9
160	220 240 290	28 38 48	2 2.1 3	1 1.1 1.1	106 000 155 000 263 000	133 000 176 000 305 000	10 800 15 800 26 800		16.7 —	3 800 2 200 1 900	5 000 2 800 2 600	39.4 76.7 89.0	170 172 174	210 228 276	2 2 2.5	3.1 5.77 14.1
	290 340 340	48 68 68	3 4 4	1.1 1.5 1.5	238 000 345 000 315 000	279 000 420 000 385 000	24 200 35 500 32 000	28 400 43 000 39 500	_ _ _	1 700 1 700 1 500	2 400 2 200 2 000	118.4 106.2 138.9	174 178 178	276 322 322	2.5 3 3	14.2 30.7 30.8
170	230 260 310	28 42 52	2 2.1 4	1 1.1 1.5	113 000 186 000 295 000	148 000 214 000 360 000	11 500 19 000 30 000	15 100 21 900 36 500	16.8 — —	3 600 2 000 1 800	4 800 2 600 2 400	40.8 83.1 95.3	180 182 188	220 248 292	2 2 3	3.36 7.9 17.3
	310 360 360	52 72 72	4 4 4	1.5 1.5 1.5	266 000 390 000 355 000	325 000 485 000 445 000	27 200 39 500 36 000	33 000 49 500 45 500	_ _ _	1 600 1 600 1 400	2 200 2 200 2 000	126.7 112.5 147.2	188 188 188	292 342 342	3 3 3	17.6 35.8 35.6

Notes (1) For applications operating near the limiting speed, refer to Page B49.

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

SINGLE/MATCHED MOUNTINGS

Bore Diameter 180 - 200 mm

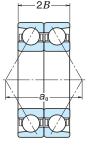


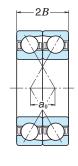
360 420

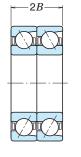
1.5

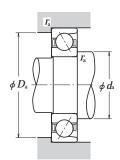
80 5 2

420 80 5 2









Back-to-Back Single DB **Boundary Dimensions** Basic Load Ratings (Single)

Face-to-Face
DF

Tandem DT

1 800 | 146.5 | 218 1 800 | 129.5 | 222

1 600 | 170.1 | 222

1 300

1 300

1 200

Во	oundar	y Dim (mm)		ons	Bas (N	ic Load Ratir N)	ngs (Single) {kg		Factor	Limit Speed (min	s (¹)	Eff.Load Centers	Abutment and Fillet Dimensions (mm)			Mass (kg)
d	D	В	$m{r}$ min.	$r_{ m 1}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	f_0	Grease	['] Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	арргох.
180	250 280 320	33 46 52	2 2.1 4	1 1.1 1.5	145 000 207 000 305 000	184 000 252 000 385 000	14 800 21 100 31 000	18 800 25 700 39 000	16.6 —	3 200 1 900 1 700	4 500 2 400 2 200	45.3 89.4 98.2	190 192 198	240 268 302	2 2 3	4.9 10.5 18.1
	320 380 380	52 75 75	4 4 4	1.5 1.5 1.5	276 000 410 000 375 000	350 000 535 000 490 000	28 100 41 500 38 000	35 500 54 500 50 000	_ _ _	1 500 1 500 1 300	2 000 2 000 1 800	130.9 118.3 155.0	198 198 198	302 362 362	3 3 3	18.4 42.1 42.6
190	260 290 340	33 46 55	2 2.1 4	1 1.1 1.5	147 000 224 000 315 000	192 000 280 000 410 000	15 000 22 800 32 000	19 600 28 600 42 000	16.7 — —	3 000 1 800 1 600	4 300 2 400 2 200	46.6 92.3 104.0	200 202 208	250 278 322	2 2 3	4.98 11.3 22.4
	340 400 400	55 78 78	4 5 5	1.5 2 2	284 000 450 000 410 000	375 000 600 000 550 000	28 900 46 000 42 000	38 000 61 000 56 000	_ _ _	1 400 1 400 1 300	2 000 1 900 1 700	138.7 124.2 162.8	208 212 212	322 378 378	3 4 4	22.5 47.5 47.2
200	280 310 360	38 51 58	2.1 2.1 4	1.1 1.1 1.5	189 000 240 000 335 000	244 000 310 000 450 000	19 300 24 500 34 500	24 900 31 500 46 000	16.5 —	2 800 1 700 1 500	4 000 2 200 2 000	51.2 99.1 109.8	212 212 218	268 298 342	2 2 3	6.85 13.7 26.5

Notes (1) For applications operating near the limiting speed, refer to Page B49.

305 000 410 000

475 000 660 000

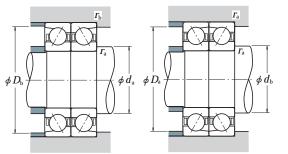
430 000 600 000

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

31 000 41 500

48 500 67 000

44 000 61 500



Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$			Singl	e, DT			DB c	r DF	
		e	F_a/I	$r \leq e$	F_a/I	r > e	F_a/I	$r \leq e$	F _a /F	r > e
Angle	Cor		X	Y	X	Y	X	Y	X	Y
	0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
	0.357	0.40	1	0	0.44	1.40	1	1.57	0.72	2.28
	0.714	0.43	1	0	0.44	1.30	1	1.46	0.72	2.11
15°	1.07	0.46	1	0	0.44	1.23	1	1.38	0.72	2.00
10.	1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
	2.14	0.50	1	0	0.44	1.12	1	1.26	0.72	1.82
	3.57	0.55	1	0	0.44	1.02	1	1.14	0.72	1.66
	5.35	0.56	1	0	0.44	1.00	1	1.12	0.72	1.63
25°	_	0.68	1	0	0.41	0.87	1	0.92	0.67	1.41
30°	_	0.80	1	0	0.39	0.76	1	0.78	0.63	1.24
40°	_	1.14	1	0	0.35	0.57	1	0.55	0.57	0.93

*For I, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Angle X ₀ Y ₀ X ₀ Y ₀ Single or DT 15° 0.5 0.46 1 0.92 mounting	
15° 0.5 0.46 1 0.92 mounting	
When	
25° 0.5 0.38 1 0.76 $F_{\circ} > 0.5 F_{\circ} + V_{\circ}$	F.
30° 0.5 0.33 1 0.66 use $P_0 = F_r$	ur a
40° 0.5 0.26 1 0.52	

Bearing	Numbers (2)		ic Load Rating	js (Matched {kg		Limi Speeds (¹)	(Matched)	Load Center Spacings (mm) Dimensions				
Single	Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(mir Grease	Oil	DB	DF	d _b (3) min.	$D_{ m b}$ max.	$r_{ m b}$ (3) max.
7936 C	DB DF DT	236 000	370 000	24 000	37 500	2 600	3 600	90.6	24.6	_	244	1
7036 A	DB DF DT	335 000	505 000	34 500	51 500	1 500	2 000	178.8	86.8	_	273	1
7236 A	DB DF DT	495 000	770 000	50 500	78 500	1 400	1 800	196.3	92.3	_	311	1.5
7236 B	DB DF DT	450 000	700 000	45 500	71 000	1 200	1 700	261.8	157.8	_	311	1.5
7336 A	DB DF DT	665 000	1 070 000	68 000	109 000	1 200	1 600	236.6	86.6	_	371	1.5
7336 B	DB DF DT	605 000	975 000	62 000	99 500	1 100	1 500	309.9	159.9	_	371	1.5
7938 C	DB DF DT	239 000	385 000	24 400	39 000	2 400	3 400	93.3	27.3	_	254	1
7038 A	DB DF DT	365 000	560 000	37 000	57 000	1 400	1 900	184.6	92.6	_	283	1
7238 A	DB DF DT	510 000	825 000	52 000	84 000	1 300	1 700	208.0	98.0	_	331	1.5
7238 B 7338 A 7338 B	DB DF DT DB DF DT DB DF DT	460 000 730 000 670 000	750 000 1 200 000 1 100 000		76 000 122 000 112 000	1 100 1 100 1 000	1 600 1 500 1 400	277.3 248.3 325.5	167.3 92.3 169.5	_ _ _	331 390 390	1.5 2 2
7940 C	DB DF DT	305 000	490 000	31 500	50 000	2 200	3 200	102.3	26.3	_	273	1
7040 A	DB DF DT	390 000	620 000	40 000	63 500	1 300	1 800	198.2	96.2	_	303	1
7240 A	DB DF DT	550 000	900 000	56 000	92 000	1 200	1 600	219.6	103.6	_	351	1.5
7240 B 7340 A 7340 B	DB DF DT DB DF DT DB DF DT	495 000 770 000 700 000	815 000 1 320 000 1 200 000		83 000 134 000 123 000	1 100 1 100 950	1 500 1 400 1 300	292.9 259.0 340.1	176.9 99.0 180.1	_ _ _	351 410 410	

Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

B 68 B 69

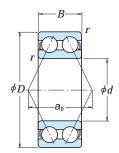
26.6 54.4

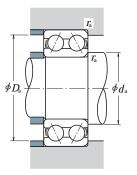
4 55.3

398 4

398

Bore Diameter 10 – 85 mm



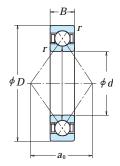


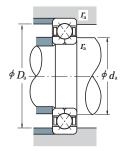
Dynamic Equivalent Load $P = XF_{\rm r} + YF_{\rm a}$							
$F_a/F_r \leq e$ $F_a/F_r > e$							
X	Y	X	Y	e			
1	0.92	0.67	1.41	0.68			
Static E	quival	ent Loa	d				
$P_0 =$	$F_{\rm r}$ +0	.76 <i>F</i> _a					

		Dimension nm)	S	1)		nd Ratings	gf}	١ `	g Speeds	D .
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	in ⁻¹) Oil	Bearing Numbers
10	30	14.3	0.6	7 150	3 900	730	400	17 000	22 000	5200
12	32	15.9	0.6	10 500	5 800	1 070	590	15 000	20 000	5201
15	35	15.9	0.6	11 700	7 050	1 190	715	13 000	17 000	5202
	42	19	1	17 600	10 200	1 800	1 040	11 000	15 000	5302
17	40	17.5	0.6	14 600	9 050	1 490	920	11 000	15 000	5203
	47	22.2	1	21 000	12 600	2 140	1 280	10 000	13 000	5303
20	47	20.6	1	19 600	12 400	2 000	1 270	10 000	13 000	5204
	52	22.2	1.1	24 600	15 000	2 510	1 530	9 000	12 000	5304
25	52	20.6	1	21 300	14 700	2 170	1 500	8 500	11 000	5205
	62	25.4	1.1	32 500	20 700	3 350	2 110	7 500	10 000	5305
30	62	23.8	1	29 600	21 100	3 000	2 150	7 100	9 500	5206
	72	30.2	1.1	40 500	28 100	4 150	2 870	6 300	8 500	5306
35	72	27	1.1	39 000	28 700	4 000	2 920	6 300	8 000	5207
	80	34.9	1.5	51 000	36 000	5 200	3 700	5 600	7 500	5307
40	80	30.2	1.1	44 000	33 500	4 500	3 400	5 600	7 100	5208
	90	36.5	1.5	56 500	41 000	5 800	4 200	5 300	6 700	5308
45	85	30.2	1.1	49 500	38 000	5 050	3 900	5 000	6 700	5209
	100	39.7	1.5	68 500	51 000	7 000	5 200	4 500	6 000	5309
50	90	30.2	1.1	53 000	43 500	5 400	4 400	4 800	6 000	5210
	110	44.4	2	81 500	61 500	8 300	6 250	4 300	5 600	5310
55	100	33.3	1.5	56 000	49 000	5 700	5 000	4 300	5 600	5211
	120	49.2	2	95 000	73 000	9 700	7 450	3 800	5 000	5311
60	110	36.5	1.5	69 000	62 000	7 050	6 300	3 800	5 000	5212
	130	54	2.1	125 000	98 500	12 800	10 000	3 400	4 500	5312
65	120	38.1	1.5	76 500	69 000	7 800	7 050	3 600	4 500	5213
	140	58.7	2.1	142 000	113 000	14 500	11 500	3 200	4 300	5313
70	125	39.7	1.5	94 000	82 000	9 600	8 400	3 400	4 500	5214
	150	63.5	2.1	159 000	128 000	16 200	13 100	3 000	3 800	5314
75	130	41.3	1.5	93 500	83 000	9 550	8 500	3 200	4 300	5215
80	140	44.4	2	99 000	93 000	10 100	9 500	3 000	3 800	5216
85	150	49.2	2	116 000	110 000	11 800	11 200	2 800	3 600	5217

Load Center Spacings		utment and Fi mensions (m		Mass (kg)
(mm) <i>a</i> ₀	$d_{\scriptscriptstyle m a}$ min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	approx.
14.5	15	25	0.6	0.050
16.7	17	27	0.6	0.060
18.3	20	30	0.6	0.070
22.0	21	36	1	0.11
20.8	22	35	0.6	0.090
25.0	23	41	1	0.14
24.3	26	41	1	0.12
26.7	27	45	1	0.23
26.8	31	46	1	0.19
31.8	32	55	1	0.34
31.6	36	56	1	0.29
36.5	37	65	1	0.51
36.6	42	65	1	0.43
41.6	44	71	1.5	0.79
41.5	47	73	1	0.57
45.5	49	81	1.5	1.05
43.4	52	78	1	0.62
50.6	54	91	1.5	1.4
45.9	57	83	1	0.67
55.6	60	100	2	1.95
50.1	64	91	1.5	0.96
60.6	65	110	2	2.3
56.5	69	101	1.5	1.35
69.2	72	118	2	3.15
59.7	74	111	1.5	1.65
72.8	77	128	2	3.85
63.8	79	116	1.5	1.8
78.3	82	138	2	4.9
66.1	84	121	1.5	1.9
69.6	90	130	2	2.5
75.3	95	140	2	3.4

Bore Diameter 30 – 95 mm





Dynamic Equivalent Load $P_{\rm a} = F_{\rm a}$

Static Equivalent Load $P_{0a} = F_a$

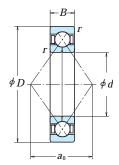
[Boundary D (mr		S	(Basic Loa N)		gf}	Limiting (mi	•
d	D	В	$m{r}$ min.	C_{a}	C_{0a}	C_{a}	C_{0a}	Grease	Oil
30	62	16	1	31 000	45 000	3 150	4 600	8 500	12 000
	72	19	1.1	46 000	63 000	4 700	6 450	8 000	11 000
35	72	17	1.1	41 000	61 500	4 200	6 250	7 500	10 000
	80	21	1.5	55 000	80 000	5 600	8 150	7 100	9 500
40	80	18	1.1	49 000	77 500	5 000	7 900	6 700	9 000
	90	23	1.5	67 000	100 000	6 850	10 200	6 300	8 500
45	85	19	1.1	55 000	88 500	5 600	9 000	6 300	8 500
	100	25	1.5	87 500	133 000	8 900	13 500	5 600	7 500
50	90	20	1.1	57 000	97 000	5 850	9 900	5 600	8 000
	110	27	2	102 000	159 000	10 400	16 200	5 000	6 700
55	100	21	1.5	71 000	122 000	7 200	12 500	5 300	7 100
	120	29	2	118 000	187 000	12 000	19 100	4 500	6 300
60	110	22	1.5	85 500	150 000	8 750	15 300	4 800	6 300
	130	31	2.1	135 000	217 000	13 800	22 200	4 300	5 600
65	120	23	1.5	97 500	179 000	9 950	18 300	4 300	6 000
	140	33	2.1	153 000	250 000	15 600	25 500	3 800	5 300
70	125	24	1.5	106 000	197 000	10 800	20 100	4 000	5 600
	150	35	2.1	172 000	285 000	17 500	29 100	3 600	5 000
75	130	25	1.5	110 000	212 000	11 200	21 700	3 800	5 300
	160	37	2.1	187 000	320 000	19 100	33 000	3 400	4 800
80	125	22	1.1	77 000	167 000	7 850	17 000	3 800	5 300
	140	26	2	124 000	236 000	12 600	24 100	3 600	5 000
	170	39	2.1	202 000	360 000	20 600	37 000	3 200	4 300
85	130	22	1.1	79 000	176 000	8 050	18 000	3 800	5 000
	150	28	2	143 000	276 000	14 600	28 200	3 400	4 800
	180	41	3	218 000	405 000	22 300	41 000	3 000	4 000
90	140	24	1.5	94 000	208 000	9 600	21 200	3 400	4 800
	160	30	2	164 000	320 000	16 700	32 500	3 200	4 300
	190	43	3	235 000	450 000	23 900	45 500	2 800	3 800
95	145	24	1.5	96 500	220 000	9 800	22 500	3 400	4 500
	170	32	2.1	177 000	340 000	18 000	35 000	3 000	4 000
	200	45	3	251 000	495 000	25 600	50 500	2 600	3 600

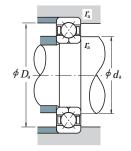
Bearing	Load Center Spacings		butment and I Dimensions (n		Mass (kg)
Numbers	a_0	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{arGamma}_{a}$ max.	approx.
QJ 206	32.2	36	56	1	0.24
QJ 306	35.7	37	65	1	0.42
QJ 207	37.5	42	65	1	0.35
QJ 307	40.3	44	71	1.5	0.57
QJ 208	42.0	47	73	1	0.45
QJ 308	45.5	49	81	1.5	0.78
QJ 209	45.5	52	78	1	0.52
QJ 309	50.8	54	91	1.5	1.05
QJ 210	49.0	57	83	1	0.59
QJ 310	56.0	60	100	2	1.35
QJ 211	54.3	64	91	1.5	0.77
QJ 311	61.3	65	110	2	1.75
QJ 212	59.5	69	101	1.5	0.98
QJ 312	66.5	72	118	2	2.15
QJ 213	64.8	74	111	1.5	1.2
QJ 313	71.8	77	128	2	2.7
QJ 214	68.3	79	116	1.5	1.3
QJ 314	77.0	82	138	2	3.18
QJ 215	71.8	84	121	1.5	1.5
QJ 315	82.3	87	148	2	3.9
QJ 1016	71.8	87	118	1	1.05
QJ 216	77.0	90	130	2	1.85
QJ 316	87.5	92	158	2	4.6
QJ 1017	75.3	92	123	1	1.1
QJ 217	82.3	95	140	2	2.2
QJ 317	92.8	99	166	2.5	5.34
QJ 1018	80.5	99	131	1.5	1.45
QJ 218	87.5	100	150	2	2.75
QJ 318	98.0	104	176	2.5	6.4
QJ 1019	84.0	104	136	1.5	1.5
QJ 219	92.8	107	158	2	3.35
QJ 319	103.3	109	186	2.5	7.4

Remarks When using four-point contact ball bearings, please contact NSK.

<u>NSK</u>

Bore Diameter 100 – 200 mm





Dynamic Equivalent Load $P_{\rm a} = F_{\rm a}$

Static Equivalent Load $P_{0a} = F_{a}$

E	Boundary D		i	(Basic Load N)		gf}	Limiting :	
d	D	В	$m{r}$ min.	$C_{ m a}$	$C_{0\mathrm{a}}$	C_{a}	C_{0a}	Grease	Oil
100	150	24	1.5	98 500	232 000	10 000	23 700	3 200	4 300
	180	34	2.1	199 000	390 000	20 300	39 500	2 800	3 800
	215	47	3	300 000	640 000	31 000	65 500	2 400	3 400
105	160	26	2	115 000	269 000	11 800	27 400	3 000	4 000
	190	36	2.1	217 000	435 000	22 100	44 500	2 600	3 600
	225	49	3	305 000	640 000	31 000	65 500	2 400	3 200
110	170	28	2	139 000	315 000	14 200	32 000	2 800	3 800
	200	38	2.1	235 000	490 000	24 000	50 000	2 600	3 400
	240	50	3	320 000	710 000	32 500	72 500	2 200	3 000
120	180	28	2	147 000	350 000	15 000	36 000	2 600	3 600
	215	40	2.1	265 000	585 000	27 000	60 000	2 400	3 200
	260	55	3	360 000	835 000	36 500	85 500	2 000	2 800
130	200	33	2	169 000	415 000	17 300	42 000	2 400	3 200
	230	40	3	274 000	635 000	28 000	65 000	2 200	3 000
	280	58	4	400 000	970 000	40 500	99 000	1 900	2 600
140	210	33	2	172 000	435 000	17 600	44 500	2 200	3 000
	250	42	3	239 000	710 000	29 900	72 500	2 000	2 800
	300	62	4	440 000	1 110 000	44 500	114 000	1 700	2 400
150	225	35	2.1	197 000	505 000	20 100	51 500	2 000	2 800
	270	45	3	315 000	785 000	32 000	80 000	1 800	2 600
	320	65	4	460 000	1 230 000	47 000	125 000	1 600	2 200
160	240	38	2.1	224 000	580 000	22 800	59 000	1 900	2 600
	290	48	3	380 000	1 010 000	39 000	103 000	1 700	2 400
	340	68	4	505 000	1 400 000	51 500	143 000	1 500	2 000
170	260	42	2.1	268 000	705 000	27 300	72 000	1 800	2 400
	310	52	4	425 000	1 180 000	43 500	121 000	1 600	2 200
	360	72	4	565 000	1 610 000	57 500	164 000	1 400	2 000
180	280	46	2.1	299 000	830 000	30 500	84 500	1 700	2 200
	320	52	4	440 000	1 270 000	45 000	130 000	1 500	2 000
	380	75	4	595 000	1 770 000	60 500	180 000	1 300	1 800
190	290	46	2.1	325 000	925 000	33 000	94 000	1 600	2 200
	340	55	4	440 000	1 290 000	44 500	131 000	1 400	2 000
	400	78	5	655 000	1 980 000	67 000	202 000	1 300	1 700
200	310	51	2.1	345 000	1 020 000	35 500	104 000	1 500	2 000
	360	58	4	490 000	1 480 000	49 500	151 000	1 300	1 800
	420	80	5	690 000	2 180 000	70 500	222 000	1 200	1 600

Bearing	Load Center Spacings		butment and I Dimensions (n		Mass (kg)
Numbers	a_0	d_{a} min.	$D_{ m a}$ max.	$oldsymbol{r_{a}}{}_{max.}$	арргох.
QJ 1020	87.5	109	141	1.5	1.6
QJ 220	98.0	112	168	2	4.0
QJ 320	110.3	114	201	2.5	9.3
QJ 1021	92.8	115	150	2	2.0
QJ 221	103.3	117	178	2	4.7
QJ 321	115.5	119	211	2.5	10.5
QJ 1022	98.0	120	160	2	2.5
QJ 222	108.5	122	188	2	5.6
QJ 322	122.5	124	226	2.5	12.5
QJ 1024	105.0	130	170	2	2.65
QJ 224	117.3	132	203	2	6.9
QJ 324	133.0	134	246	2.5	15.4
QJ 1026	115.5	140	190	2	4.0
QJ 226	126.0	144	216	2.5	7.7
QJ 326	143.5	148	262	3	19
QJ 1028	122.5	150	200	2	4.3
QJ 228	136.5	154	236	2.5	9.8
QJ 328	154.0	158	282	3	24
QJ 1030	131.3	162	213	2	5.2
QJ 230	147.0	164	256	2.5	12
QJ 330	164.5	168	302	3	29
QJ 1032	140.0	172	228	2	6.4
QJ 232	157.5	174	276	2.5	15
QJ 332	175.1	178	322	3	31
QJ 1034	150.5	182	248	2	8.6
QJ 234	168.0	188	292	3	19.5
QJ 334	185.6	188	342	3	41
QJ 1036	161.0	192	268	2	11
QJ 236	175.1	198	302	3	20.5
QJ 336	196.1	198	362	3	48
QJ 1038	168.0	202	278	2 3 4	11.5
QJ 238	185.6	208	322		23
QJ 338	206.6	212	378		54.5
QJ 1040	178.6	212	298	2	15
QJ 240	196.1	218	342	3	27
QJ 340	217.1	222	398	4	61.5

Remarks When using four-point contact ball bearings, please contact NSK.

SELF-ALIGNING BALL BEARINGS

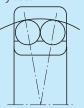
SELF-ALIGNING BALL BEARINGS

Bore Diameter 5 – 110 mm ---- B78

DESIGN, TYPES, AND FEATURES

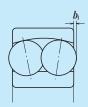
The outer ring has a spherical raceway and its center of curvature coincides with that of the bearing; therefore, the axis of the inner ring, balls and cage can deflect to some extent around the bearing center. This type is recommended when the alignment of the shaft and housing is difficult and when the shaft may bend. Since the contact angle is small, the axial load capacity is low.

Pressed steel cages are usually used.



PROTRUSION AMOUNT OF BALLS

Among self-aligning ball bearings, there are some in which the balls protrude from the side face as shown below. This protrusion amount b_1 is listed in the following table.



Bearing No.	b ₁ (mm)
2222(K), 2316(K)	0.5
2319(K), 2320(K) 2321 , 2322(K)	0.5
1318(K)	1.5
1319(K)	2
1320(K), 1321 1322(K)	3

TOLERANCES AND RUNNING

ACCURACY Table 8.2 (Pages A60 to A63)

RECOMMENDED FITS...... Table 9.2 (Page A84)
Table 9.4 (Page A85)

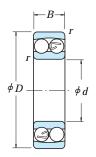
INTERNAL CLEARANCE Table 9.12 (Page A90)

PERMISSIBLE MISALIGNMENT

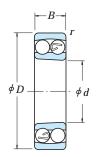
The permissible misalignment of self-aligning ball bearings is approximately 0.07 to 0.12 radian (4° to 7°) under normal loads. However, depending on the surrounding structure, such an angle may not be possible. Use care in the structural design.



Bore Diameter 5 – 30 mm



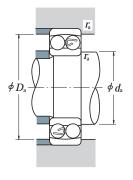




Tapered Bore

								ı		
Во	oundary Di mn)	imensior	ns	(N		ad Ratings	gf}	"	Speeds n ⁻¹)	Bearing
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
5	19	6	0.3	2 530	475	258	49	30 000	36 000	135
6	19	6	0.3	2 530	475	258	49	30 000	36 000	126
7	22	7	0.3	2 750	600	280	61	26 000	32 000	127
8	22	7	0.3	2 750	600	280	61	26 000	32 000	108
9	26	8	0.6	4 150	895	425	91	26 000	30 000	129
10	30	9	0.6	5 550	1 190	570	121	22 000	28 000	1200
	30	14	0.6	7 450	1 590	760	162	24 000	28 000	2200
	35	11	0.6	7 350	1 620	750	165	20 000	24 000	1300
	35	17	0.6	9 200	2 010	935	205	18 000	22 000	2300
12	32 32 37 37	10 14 12 17	0.6 0.6 1	5 700 7 750 9 650 12 100	1 270 1 730 2 160 2 730	580 790 985 1 240	130 177 221 278	22 000 22 000 18 000 17 000	26 000 26 000 22 000 22 000	1201 2201 1301 2301
15	35 35 42 42	11 14 13 17	0.6 0.6 1	7 600 7 800 9 700 12 300	1 750 1 850 2 290 2 910	775 795 990 1 250	179 188 234 296	18 000 18 000 16 000 14 000	22 000 22 000 20 000 18 000	1202 2202 1302 2302
17	40 40 47 47	12 16 14 19	0.6 0.6 1	8 000 9 950 12 700 14 700	2 010 2 420 3 200 3 550	815 1 010 1 300 1 500	205 247 325 365	16 000 16 000 14 000 13 000	20 000 20 000 17 000 16 000	1203 2203 1303 2303
20	47	14	1	10 000	2 610	1 020	266	14 000	17 000	1204
	47	18	1	12 800	3 300	1 310	340	14 000	17 000	2204
	52	15	1.1	12 600	3 350	1 280	340	12 000	15 000	1304
	52	21	1.1	18 500	4 700	1 880	480	11 000	14 000	2304
25	52	15	1	12 200	3 300	1 250	335	12 000	14 000	1205
	52	18	1	12 400	3 450	1 270	350	12 000	14 000	2205
	62	17	1.1	18 200	5 000	1 850	510	10 000	13 000	1305
	62	24	1.1	24 900	6 600	2 530	675	9 500	12 000	2305
30	62	16	1	15 800	4 650	1 610	475	10 000	12 000	1206
	62	20	1	15 300	4 550	1 560	460	10 000	12 000	2206
	72	19	1.1	21 400	6 300	2 190	645	8 500	11 000	1306
	72	27	1.1	32 000	8 750	3 250	895	8 000	10 000	2306

Note (1) The suffix K represents bearings with tapered bores (1:12) **Remarks** For the dimensions related to adapters, refer to Page **B358**.



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$T_{\rm r} \leq e$	$F_{\rm a}/F_{\rm r} > e$			
X	Y	X	Y		
1	Y ₃	0.65	Y_2		

Static Equivalent Load

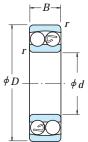
 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

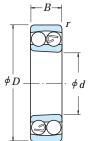
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are listed in the table below.

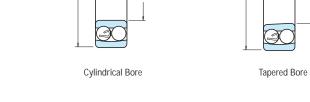
Numbers	Abutment	and Fillet Din (mm)	nensions	Constant	Ах	ctors	Mass (kg)	
Tapered Bore(1)	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
_ _ _	7 8 9	17 17 20	0.3 0.3 0.3	0.34 0.34 0.31	2.9 2.9 3.1	1.9 1.9 2.0	1.9 1.9 2.1	0.009 0.008 0.013
_	10 13	20 22	0.3 0.6	0.31 0.32	3.1 3.1	2.0 2.0	2.1 2.1	0.016 0.021
_ _ _ _	14 14 14 14	26 26 31 31	0.6 0.6 0.6 0.6	0.32 0.64 0.35 0.71	3.1 1.5 2.8 1.4	2.0 0.98 1.8 0.89	2.1 1.0 1.9 0.93	0.033 0.042 0.057 0.077
_ _ _ _	16 16 17 17	28 28 32 32	0.6 0.6 1	0.36 0.58 0.33 0.60	2.7 1.7 2.9 1.6	1.8 1.1 1.9 1.1	1.8 1.1 2.0 1.1	0.039 0.048 0.066 0.082
_ _ _ _	19 19 20 20	31 31 37 37	0.6 0.6 1	0.32 0.50 0.33 0.51	3.1 1.9 2.9 1.9	2.0 1.3 1.9 1.2	2.1 1.3 2.0 1.3	0.051 0.055 0.093 0.108
_ _ _ _	21 21 22 22	36 36 42 42	0.6 0.6 1	0.31 0.50 0.32 0.51	3.1 1.9 3.1 1.9	2.0 1.3 2.0 1.2	2.1 1.3 2.1 1.3	0.072 0.085 0.13 0.15
1204 K 2204 K 1304 K 2304 K	25 25 26.5 26.5	42 42 45.5 45.5	1 1 1	0.29 0.47 0.29 0.50	3.4 2.1 3.4 1.9	2.2 1.3 2.2 1.2	2.3 1.4 2.3 1.3	0.12 0.133 0.165 0.193
1205 K 2205 K 1305 K 2305 K	30 30 31.5 31.5	47 47 55.5 55.5	1 1 1	0.28 0.41 0.28 0.47	3.5 2.4 3.5 2.1	2.3 1.5 2.3 1.4	2.4 1.6 2.4 1.4	0.14 0.15 0.255 0.319
1206 K 2206 K 1306 K 2306 K	35 35 36.5 36.5	57 57 65.5 65.5	1 1 1 1	0.25 0.38 0.26 0.44	3.9 2.5 3.7 2.2	2.5 1.6 2.4 1.4	2.6 1.7 2.5 1.5	0.22 0.249 0.385 0.48

B 78 B 79

Bore Diameter 35 – 70 mm



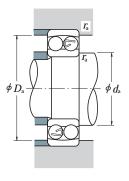




В	oundary Di (mn		ns	(N		ad Ratings {kg	qf}	Limiting (mi	•	Bearing
d	D	B	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
35	72	17	1.1	15 900	5 100	1 620	520	8 500	10 000	1207
	72	23	1.1	21 700	6 600	2 210	675	8 500	10 000	2207
	80	21	1.5	25 300	7 850	2 580	800	7 500	9 500	1307
	80	31	1.5	40 000	11 300	4 100	1 150	7 100	9 000	2307
40	80	18	1.1	19 300	6 500	1 970	665	7 500	9 000	1208
	80	23	1.1	22 400	7 350	2 290	750	7 500	9 000	2208
	90	23	1.5	29 800	9 700	3 050	990	6 700	8 500	1308
	90	33	1.5	45 500	13 500	4 650	1 380	6 300	8 000	2308
45	85	19	1.1	22 000	7 350	2 240	750	7 100	8 500	1209
	85	23	1.1	23 300	8 150	2 380	830	7 100	8 500	2209
	100	25	1.5	38 500	12 700	3 900	1 300	6 000	7 500	1309
	100	36	1.5	55 000	16 700	5 600	1 700	5 600	7 100	2309
50	90	20	1.1	22 800	8 100	2 330	830	6 300	8 000	1210
	90	23	1.1	23 300	8 450	2 380	865	6 300	8 000	2210
	110	27	2	43 500	14 100	4 450	1 440	5 600	6 700	1310
	110	40	2	65 000	20 200	6 650	2 060	5 000	6 300	2310
55	100	21	1.5	26 900	10 000	2 750	1 020	6 000	7 100	1211
	100	25	1.5	26 700	9 900	2 720	1 010	6 000	7 100	2211
	120	29	2	51 500	17 900	5 250	1 820	5 000	6 300	1311
	120	43	2	76 500	24 000	7 800	2 450	4 800	6 000	2311
60	110	22	1.5	30 500	11 500	3 100	1 180	5 300	6 300	1212
	110	28	1.5	34 000	12 600	3 500	1 290	5 300	6 300	2212
	130	31	2.1	57 500	20 800	5 900	2 130	4 500	5 600	1312
	130	46	2.1	88 500	28 300	9 000	2 880	4 300	5 300	2312
65	120	23	1.5	31 000	12 500	3 150	1 280	4 800	6 000	1213
	120	31	1.5	43 500	16 400	4 450	1 670	4 800	6 000	2213
	140	33	2.1	62 500	22 900	6 350	2 330	4 300	5 300	1313
	140	48	2.1	97 000	32 500	9 900	3 300	3 800	4 800	2313
70	125	24	1.5	35 000	13 800	3 550	1 410	4 800	5 600	1214
	125	31	1.5	44 000	17 100	4 500	1 740	4 500	5 600	2214
	150	35	2.1	75 000	27 700	7 650	2 830	4 000	5 000	1314
	150	51	2.1	111 000	37 500	11 300	3 850	3 600	4 500	2314

Note (1) The suffix K represents bearings with tapered bores (1 : 12)

Remarks For the dimensions related to adapters, refer to Page B358 and B359.



Dynamic Equivalent Load

 $P = XF_{r} + YF_{a}$

$F_{\rm a}/I$	$T_{\rm r} \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y ₃	0.65	Y_2

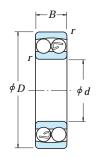
Static Equivalent Load

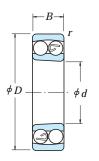
 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of e, Y_2 , Y_3 , and Y_0 are listed in the table below.

Numbers	Abutment a	and Fillet Din (mm)	nensions	Constant	Axial Load Factors			Mass (kg)
Tapered Bore(¹)	$d_{\scriptscriptstyle m a}$ min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{max}.$	e	Y_2	Y_3	Y_0	approx.
1207 K	41.5	65.5	1	0.23	4.2	2.7	2.8	0.32
2207 K	41.5	65.5	1	0.37	2.6	1.7	1.8	0.378
1307 K	43	72	1.5	0.26	3.8	2.5	2.6	0.51
2307 K	43	72	1.5	0.46	2.1	1.4	1.4	0.642
1208 K	46.5	73.5	1	0.22	4.3	2.8	2.9	0.415
2208 K	46.5	73.5	1	0.33	3.0	1.9	2.0	0.477
1308 K	48	82	1.5	0.24	4.0	2.6	2.7	0.715
2308 K	48	82	1.5	0.43	2.3	1.5	1.5	0.889
1209 K	51.5	78.5	1	0.21	4.7	3.0	3.1	0.465
2209 K	51.5	78.5	1	0.30	3.2	2.1	2.2	0.522
1309 K	53	92	1.5	0.25	4.0	2.6	2.7	0.955
2309 K	53	92	1.5	0.41	2.4	1.5	1.6	1.2
1210 K 2210 K 1310 K 2310 K	56.5 56.5 59	83.5 83.5 101 101	1 1 2 2	0.21 0.28 0.23 0.42	4.7 3.4 4.2 2.3	3.1 2.2 2.7 1.5	3.2 2.3 2.8 1.6	0.525 0.564 1.25 1.58
1211 K	63	92	1.5	0.20	4.9	3.2	3.3	0.705
2211 K	63	92	1.5	0.28	3.5	2.3	2.4	0.746
1311 K	64	111	2	0.23	4.2	2.7	2.8	1.6
2311 K	64	111	2	0.41	2.4	1.5	1.6	2.03
1212 K	68	102	1.5	0.18	5.3	3.4	3.6	0.90
2212 K	68	102	1.5	0.28	3.5	2.3	2.4	1.03
1312 K	71	119	2	0.23	4.3	2.8	2.9	2.03
2312 K	71	119	2	0.40	2.4	1.6	1.6	2.57
1213 K	73	112	1.5	0.17	5.7	3.7	3.8	1.15
2213 K	73	112	1.5	0.28	3.5	2.3	2.4	1.4
1313 K	76	129	2	0.23	4.2	2.7	2.9	2.54
2313 K	76	129	2	0.39	2.5	1.6	1.7	3.2
= = = = = = = = = = = = = = = = = = = =	78 78 81 81	117 117 139 139	1.5 1.5 2 2	0.18 0.26 0.22 0.38	5.3 3.7 4.4 2.6	3.4 2.4 2.8 1.7	3.6 2.5 3.0 1.8	

Bore Diameter 75 – 110 mm

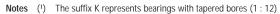




Cylindrical Bore

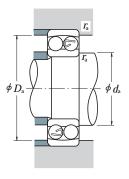
Tapered Bore

В	oundary D (mr		าร	(N		oad Ratings {kç	gf}	Limiting (mir		Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
75	130	25	1.5	39 000	15 700	4 000	1 600	4 300	5 300	1215
	130	31	1.5	44 500	17 800	4 550	1 820	4 300	5 300	2215
	160	37	2.1	80 000	30 000	8 150	3 050	3 800	4 500	1315
	160	55	2.1	125 000	43 000	12 700	4 400	3 400	4 300	2315
80	140	26	2	40 000	17 000	4 100	1 730	4 000	5 000	1216
	140	33	2	49 000	19 900	5 000	2 030	4 000	5 000	2216
	170	39	2.1	89 000	33 000	9 100	3 400	3 600	4 300	1316
	170	58	2.1	130 000	45 000	13 200	4 600	3 200	4 000	* 2316
85	150	28	2	49 500	20 800	5 050	2 120	3 800	4 500	1217
	150	36	2	58 500	23 600	5 950	2 400	3 800	4 800	2217
	180	41	3	98 500	38 000	10 000	3 850	3 400	4 000	1317
	180	60	3	142 000	51 500	14 500	5 250	3 000	3 800	2317
90	160	30	2	57 500	23 500	5 850	2 400	3 600	4 300	1218
	160	40	2	70 500	28 700	7 200	2 930	3 600	4 300	2218
	190	43	3	117 000	44 500	12 000	4 550	3 200	3 800	* 1318
	190	64	3	154 000	57 500	15 700	5 850	2 800	3 600	2318
95	170	32	2.1	64 000	27 100	6 550	2 770	3 400	4 000	1219
	170	43	2.1	84 000	34 500	8 550	3 500	3 400	4 000	2219
	200	45	3	129 000	51 000	13 200	5 200	3 000	3 600	* 1319
	200	67	3	161 000	64 500	16 400	6 550	2 800	3 400	* 2319
100	180	34	2.1	69 500	29 700	7 100	3 050	3 200	3 800	1220
	180	46	2.1	94 500	38 500	9 650	3 900	3 200	3 800	2220
	215	47	3	140 000	57 500	14 300	5 850	2 800	3 400	* 1320
	215	73	3	187 000	79 000	19 100	8 050	2 400	3 200	* 2320
105	190	36	2.1	75 000	32 500	7 650	3 300	3 000	3 600	1221
	190	50	2.1	109 000	45 000	11 100	4 550	3 000	3 600	2221
	225	49	3	154 000	64 500	15 700	6 600	2 600	3 200	* 1321
	225	77	3	200 000	87 000	20 400	8 850	2 400	3 000	* 2321
110	200	38	2.1	87 000	38 500	8 900	3 950	2 800	3 400	1222
	200	53	2.1	122 000	51 500	12 500	5 250	2 800	3 400	* 2222
	240	50	3	161 000	72 000	16 400	7 300	2 400	3 000	* 1322
	240	80	3	211 000	94 500	21 600	9 650	2 200	2 800	* 2322



^(*) The balls of the bearings marked * protrude slightly from the bearing face. The protrusion amounts are shown on Page **B77**.

Remarks For the dimensions related to adapters, refer to Pages B360 and B361.



Dynamic Equivalent Load

P = X	$P_{\rm r} + Y P_{\rm a}$		
$F_{\rm a}/I$	$F_{\rm r} \leq e$	$F_{\rm a}/I$	r > e
Y	V	Y	V

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y ₃	0.65	Y ₂

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are listed in the table below.

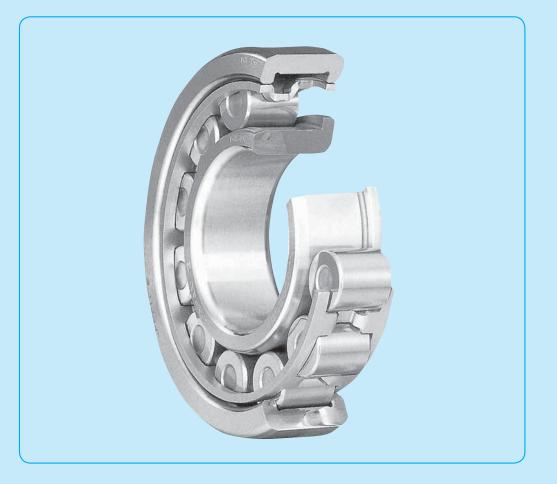
Numbers	Abutment	and Fillet Di (mm)	mensions	Constant	Ах	ial Load Fa	actors	Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
1215 K	83	122	1.5	0.17	5.6	3.6	3.8	1.41
2215 K	83	122	1.5	0.25	3.9	2.5	2.6	1.6
1315 K	86	149	2	0.22	4.4	2.8	2.9	3.65
2315 K	86	149	2	0.38	2.5	1.6	1.7	4.77
1216 K	89	131	2	0.16	6.0	3.9	4.1	1.73
2216 K	89	131	2	0.25	3.9	2.5	2.7	1.97
1316 K	91	159	2	0.22	4.5	2.9	3.1	4.31
* 2316 K	91	159	2	0.39	2.5	1.6	1.7	5.54
1217 K	94	141	2	0.17	5.7	3.7	3.8	2.09
2217 K	94	141	2	0.25	3.9	2.5	2.6	2.48
1317 K	98	167	2.5	0.21	4.6	2.9	3.1	5.13
2317 K	98	167	2.5	0.37	2.6	1.7	1.8	6.56
1218 K	99	151	2	0.17	5.8	3.8	3.9	2.55
2218 K	99	151	2	0.27	3.7	2.4	2.5	3.13
* 1318 K	103	177	2.5	0.22	4.3	2.8	2.9	5.94
2318 K	103	177	2.5	0.38	2.6	1.7	1.7	7.76
1219 K	106	159	2	0.17	5.8	3.7	3.9	3.21
2219 K	106	159	2	0.27	3.7	2.4	2.5	3.87
* 1319 K	108	187	2.5	0.23	4.3	2.8	2.9	6.84
* 2319 K	108	187	2.5	0.38	2.6	1.7	1.8	9.01
1220 K	111	169	2	0.17	5.6	3.6	3.8	3.82
2220 K	111	169	2	0.27	3.7	2.4	2.5	4.53
* 1320 K	113	202	2.5	0.24	4.1	2.7	2.8	8.46
* 2320 K	113	202	2.5	0.38	2.6	1.7	1.8	11.6
= = =	116	179	2	0.18	5.5	3.6	3.7	4.52
	116	179	2	0.28	3.5	2.3	2.4	5.64
	118	212	2.5	0.23	4.2	2.7	2.9	10
	118	212	2.5	0.38	2.6	1.7	1.7	14.4
1222 K	121	189	2	0.17	5.7	3.7	3.9	5.33
* 2222 K	121	189	2	0.28	3.5	2.2	2.3	6.64
* 1322 K	123	227	2.5	0.22	4.4	2.8	3.0	12
* 2322 K	123	227	2.5	0.37	2.6	1.7	1.8	17.4



CYLINDRICAL ROLLER BEARINGS

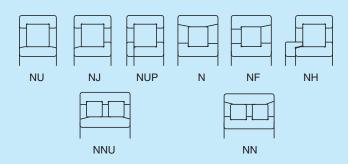
SINGLE-ROW CYLINDRICAL ROLLER BEARINGS	Bore Diameter	20 –	65 mm ······	В	88
	Bore Diameter	70 – 1	60 mm ······	В	94
	Bore Diameter	170 – 5	00 mm ······	В1	02
L-SHAPED THRUST COLLARS FOR CYLINDRICAL ROLLER BEARINGS	Bore Diameter	20 – 3	20 mm ······	B1	06
DOUBLE-ROW CYLINDRICAL ROLLER BEARINGS	Bore Diameter	25 – 3	60 mm ·····	В1	110

Four-Row Cylindrical Roller Bearings are described on Pages B334 to B343.



DESIGN, TYPES, AND FEATURES

Depending on the existence of ribs on their rings, Cylindrical Roller Bearings are classified into the following types.



Types NU, N, NNU, and NN are suitable as free-end bearings. Types NJ and NF can sustain limited axial loads in one direction. Types NH and NUP can be used as fixed-end bearings.

NH-type cylindrical roller bearings consist of the NJ-type cylindrical roller bearings and HJ-type L-shaped thrust collars (See Page B104 to B105).

The inner ring loose rib of a NUP-type cylindrical roller bearing should be mounted so that the marked side is on the outside.

B 84 B 85 Use pressed, machined, or molded cages for standard cylindrical roller bearings as shown in Table 1.

Table 1 Standard Cages for Cylindrical Roller Bearings

Series	Pressed Steel Cages (W)	Machined Brass Cages (M)	Molded Polyamide Cages (T)
NU10**	_	1005 – 10/500	_
N2**	204 – 230	232 – 264	_
NU2**	214 – 230	232 – 264	_
NU2**E	205E – 213E	214E – 240E	204E
NU22**	2204 – 2230	2232 – 2252	_
NU22**E	_	2222E – 2240E	2204E – 2220E
N3**	304 - 324	326 – 352	_
NU3**	312 – 330	332 – 352	_
NU3**E	305E – 311E	312E – 340E	304E
NU23**	2304 – 2320	2322 – 2340	_
NU23**E	_	2322E – 2340E	2304E - 2320E
NU4**	405 – 416	417 – 430	_

The basic load ratings listed in the bearing tables are based on the Cage Classification in Table 1.

For a given bearing number, if the type of cage is not the standard one, the number of rollers may vary; in such a case, the load rating will differ from the one listed in the bearing tables.

Among the NN Type of double-row bearings, there are many of high precision that have tapered bores, and they are primarily used in the main spindles of machine tools. Their cages are either molded polyphenylenesulfide (PPS) or machined brass.

PRECAUTIONS FOR USE OF CYLINDRICAL ROLLER BEARINGS

If the load on cylindrical roller bearings becomes too small during operation, slippage between the rollers and raceways occurs, which may result in smearing. Especially with large bearings since the weight of the roller and cage is high

In case of strong shock loads or vibration, pressed-steel cages are sometimes inadequate.

If very small bearing load or strong shock loads or vibration are expected, please consult with NSK for selection of the bearings.

Bearings with molded polyamide cages (ET type) can be used continuously at temperatures between — 40 and 120°C. If the bearings are used in gear oil, nonflammable hydraulic oil, or ester oil at a high temperature over 100°C, please contact NSK beforehand.

TOLERANCES AND RUNNING ACCURACY

CYLINDRICAL ROLLER BEARINGS	Table 8.	.2 (Pages	A60 to	A63)
DOUBLE-ROW CYLINDRICAL ROLLER				
BEARINGS	Table 8.	2 (Pages	A60 to	A63)

Nomin Diameter	al Bore d (mm)	Tolerances fo NU, NJ, NUP, NF	or $F_{ m w}$ of types H, and NNU ${ extstyle \int_{ m w}}$	Tolerance types N, NF,	Tolerances for $E_{\rm w}$ of types N, NF, and NN $\Delta E_{\rm w}$		
over	incl.	high	low	high	low		
_	20	+10	0	0	-10		
20	50	+15	0	0	— 15		
50	120	+20	0	0	-20		
120	200	+25	0	0	-25		
200	250	+30	0	0	-30		
250	315	+35	0	0	-35		
315	400	+40	0	0	-40		
400	500	+45	0	_	_		

RECOMMENDED FITS

CYLINDRICAL ROLLER BEARINGS	Table 9.2 (Page A84)
	Table 9.4 (Page A85)
DOUBLE-ROW CYLINDRICAL ROLLER	
BEARINGS	Table 9.2 (Page A84)
	Table 9.4 (Page A85)

INTERNAL CLEARANCES

CYLINDRICAL ROLLER BEARINGS..... Table 9.14 (Page A91)

DOUBLE-ROW CYLINDRICAL ROLLER BEARINGS.... Table 9.14 (Page A91)

PERMISSIBLE MISALIGNMENT

The permissible misalignment of cylindrical roller bearings varies depending on the type and internal specifications, but under normal loads, the angles are approximately as follows:

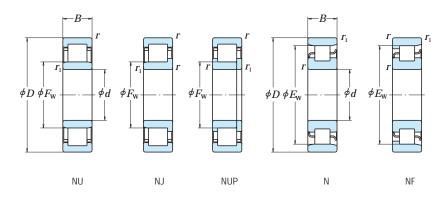
For double-row cylindrical roller bearings, nearly no misalignment is allowed.

LIMITING SPEEDS

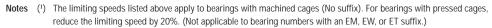
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

B 86 B 87

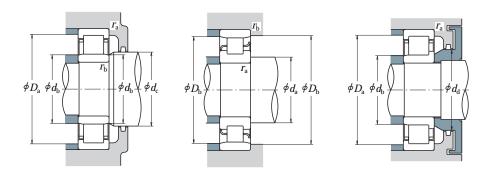
Bore Diameter 20 – 35 mm



		Bou	ndary Dir (mm	mensions)			Basic Load (N)		Limiting S (min	
d	D	В	$m{r}$ min.	$r_1 \atop ext{min.}$	F_{W}	E_{W}	$C_{ m r}$	$C_{ m 0r}$	Grease	Oil
20	47	14	1	0.6		40	15 400	12 700	15 000	18 000
	47	14	1	0.6	26.5	—	25 700	22 600	13 000	16 000
	47	18	1	0.6	27	—	20 700	18 400	13 000	16 000
	47 52 52	18 15 15	1 1.1 1.1	0.6 0.6 0.6	26.5 — 27.5	44.5 —	30 500 21 400 31 500	28 300 17 300 26 900	13 000 12 000 12 000	16 000 15 000 15 000
	52 52	21 21	1.1 1.1	0.6 0.6	28.5 27.5	_	30 500 42 000	27 200 39 000	11 000 11 000	14 000 14 000
25	47	12	0.6	0.3	30.5		14 300	13 100	15 000	18 000
	52	15	1	0.6	—	45	17 700	15 700	13 000	16 000
	52	15	1	0.6	31.5		29 300	27 700	12 000	14 000
	52 62 62	18 17 17	1 1.1 1.1	0.6 1.1 1.1	31.5 — 34	53 —	35 000 29 300 41 500	34 500 25 200 37 500	12 000 10 000 10 000	14 000 13 000 12 000
	62 80	24 21	1.1 1.5	1.1 1.5	34 38.8	<u> </u>	57 000 46 500	56 000 40 000	9 000 9 000	11 000 11 000
30	55	13	1	0.6	36.5	48.5	19 700	19 600	12 000	15 000
	62	16	1	0.6	—	53.5	24 900	23 300	11 000	13 000
	62	16	1	0.6	37.5	—	39 000	37 500	9 500	12 000
	62 72 72	20 19 19	1 1.1 1.1	0.6 1.1 1.1	37.5 — 40.5	62 —	49 000 38 500 53 000	50 000 35 000 50 000	9 500 8 500 8 500	12 000 11 000 10 000
	72	27	1.1	1.1	40.5	-	74 500	77 500	8 000	9 500
	90	23	1.5	1.5	45	73	62 500	55 000	7 500	9 500
35	62	14	1	0.6	42	55	22 600	23 200	11 000	13 000
	72	17	1.1	0.6	—	61.8	35 500	34 000	9 500	11 000
	72	17	1.1	0.6	44	—	50 500	50 000	8 500	10 000
	72	23	1.1	0.6	44		61 500	65 500	8 500	10 000
	80	21	1.5	1.1	—	68.2	49 500	47 000	8 000	9 500
	80	21	1.5	1.1	46.2		66 500	65 500	7 500	9 500
	80	31	1.5	1.1	46.2	—	93 000	101 000	6 700	8 500
	100	25	1.5	1.5	53	83	75 500	69 000	6 700	8 000



⁽²) The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

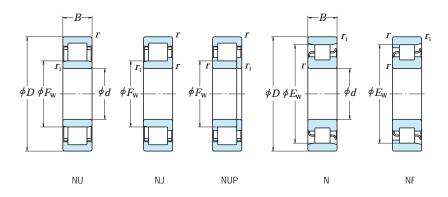


Bea	ring Number	·S(2)					P	butmer	nt and Fi (mi	llet Dime m)	nsions				Mass (kg)
	(3) NU NJ	NUP	N	NF	d _a (4) min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$m{r_{\mathrm{a}}}$ max.	$r_{ m b}$ max.	арргох.
N 204 NU 204 ET NU2204	 NU NJ	NUP	N 	NF 	25 25 25	 24 24	 25 25	 29 29	— 32 32	— 42 42	43 	42 —	1 1 1	0.6 0.6 0.6	0.107 0.107 0.144
NU2204 ET N 304 NU 304 ET		NUP NUP	_ N _	NF	25 26.5 26.5	24 24	25 — 26	29 — 30	32 — 33	42 — 45.5	 48 	 46 	1 1 1	0.6 0.6 0.6	0.138 0.148 0.145
NU2304 NU2304 ET		NUP NUP	_	_	26.5 26.5	24 24	27 26	30 30	33 33	45.5 45.5	_	_	1 1	0.6 0.6	0.217 0.209
NU1005 N 205 NU 205 EW	NU — — — NU NJ	_ NUP	_ N _	NF —	 30 30	27 29	30 — 30	32 — 34	_ 37	43 — 47	 48 	 46 	0.6 1 1	0.3 0.6 0.6	0.094 0.135 0.136
NU2205 ET N 305 NU 305 EW		NUP NUP	_ N _	NF	30 31.5 31.5	29 — 31.5	30 — 32	34 — 37	37 - 40	47 — 55.5	 55.5 _	 50 	1 1 1	0.6 1 1	0.16 0.233 0.269
NU2305 ET NU 405	NU NJ	NUP —	N	_ NF	31.5 33	31.5 33	32 37	37 41	40 46	55.5 72	— 72	<u> </u>	1 1.5	1 1.5	0.338 0.57
NU1006 N 206 NU 206 EW	NU	_ NUP	N N	NF —	35 35 35	34 34	36 — 36	38 — 40	<u> </u>	50 — 57	51 58 —	49 56 —	1 1 1	0.5 0.6 0.6	0.136 0.208 0.205
NU2206 ET N 306 NU 306 EW		NUP NUP	N	NF —	35 36.5 36.5	34 — 36.5	36 — 39	40 — 44	44 — 48	57 — 65.5	 65.5 _	 64 	1 1 1	0.6 1 1	0.255 0.353 0.409
NU2306 ET NU 406	NU NJ	NUP —	N	_ NF	36.5 38	36.5 38	39 43	44 47	48 52	65.5 82	— 82	— 75	1 1.5	1 1.5	0.518 0.758
NU1007 N 207 NU 207 EW	NN NN NN NN	_ NUP	N N	NF	40 41.5 41.5	39 39	41 — 42	44 — 46	 50	57 — 65.5	58 68 —	56 64 —	1 1 1	0.5 0.6 0.6	0.18 0.301 0.304
NU2207 ET N 307 NU 307 EW		NUP — NUP	_ N _	NF	41.5 43 41.5	39 — 41.5	42 — 44	46 — 48	50 — 53	65.5 — 72	73.5 —	 70 	1 1.5 1.5	0.6 1 1	0.40 0.476 0.545
NU2307 ET NU 407	NO NJ	NUP —	_ N	_ NF	43 43	41.5 43	44 51	48 55	53 61	72 92	— 92	— 85	1.5 1.5	1 1.5	0.711 1.01

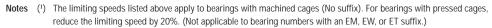
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

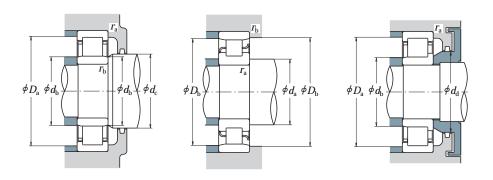
Bore Diameter 40 – 55 mm



		Bou	ndary Di	mensions			Basic Load		Limiting S (min	
d	D	В	$m{r}$ min.	$r_{\scriptscriptstyle 1}$ min.	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
40	68	15	1	0.6	47	61	27 300	29 000	10 000	12 000
	80	18	1.1	1.1	—	70	43 500	43 000	8 500	10 000
	80	18	1.1	1.1	49.5	—	55 500	55 500	7 500	9 000
	80	23	1.1	1.1	49.5	—	72 500	77 500	7 500	9 000
	90	23	1.5	1.5	—	77.5	58 500	57 000	6 700	8 500
	90	23	1.5	1.5	52	—	83 000	81 500	6 700	8 000
	90 110	33 27	1.5 2	1.5 2	52 58	<u> </u>	114 000 95 500	122 000 89 000	6 000 6 000	7 500 7 500
45	75	16	1	0.6	52.5	67.5	32 500	35 500	9 000	11 000
	85	19	1.1	1.1	—	75	46 000	47 000	7 500	9 000
	85	19	1.1	1.1	54.5	—	63 000	66 500	6 700	8 000
	85 100 100	23 25 25	1.1 1.5 1.5	1.1 1.5 1.5	54.5 — 58.5	86.5 —	76 000 79 000 97 500	84 500 77 500 98 500	6 700 6 300 6 000	8 500 7 500 7 500
	100	36	1.5	1.5	58.5		137 000	153 000	5 300	6 700
	120	29	2	2	64.5	100.5	107 000	102 000	5 600	6 700
50	80	16	1	0.6	57.5	72.5	32 000	36 000	8 000	10 000
	90	20	1.1	1.1	—	80.4	48 000	51 000	7 100	8 500
	90	20	1.1	1.1	59.5	—	69 000	76 500	6 300	7 500
	90 110 110	23 27 27	1.1 2 2	1.1 2 2	59.5 — 65	95 —	83 500 87 000 110 000	97 000 86 000 113 000	6 300 5 600 5 000	8 000 6 700 6 000
	110	40	2	2	65		163 000	187 000	5 000	6 300
	130	31	2.1	2.1	—	110.8	139 000	136 000	5 000	6 000
	130	31	2.1	2.1	70.8	110.8	129 000	124 000	5 000	6 000
55	90	18	1.1	1	64.5	80.5	37 500	44 000	7 500	9 000
	100	21	1.5	1.1	—	88.5	58 000	62 500	6 300	7 500
	100	21	1.5	1.1	66	—	86 500	98 500	5 600	7 100
	100 120 120	25 29 29	1.5 2 2	1.1 2 2	66 — 70.5	104.5 —	101 000 111 000 137 000	122 000 111 000 143 000	5 600 5 000 4 500	7 100 6 300 5 600
	120	43	2	2	70.5		201 000	233 000	4 500	5 600
	140	33	2.1	2.1	77.2	117.2	139 000	138 000	4 500	5 600



⁽²) The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

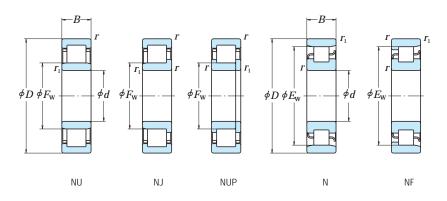


Bear	ring Numbers(2)				ļ	Abutme	nt and F (m	illet Dime m)	ensions				Mass (kg)
	(3) NU NJ N	UP N	NF	$d_{\!\scriptscriptstyle a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$m{r_{\mathrm{a}}}$ max.	$r_{ m b}$ max.	арргох.
NU1008 N 208 NU 208 EW		UP N - N UP -	NF	45 46.5 46.5	44 — 46.5	46 — 48	49 — 52	_ _ 56	63 — 73.5	64 73.5 —	62 72 —	1 1 1	0.6 1 1	0.223 0.375 0.379
NU2208 ET N 308 NU 308 EW		UP — — N UP —	NF	46.5 48 48	46.5 — 48	48 — 50	52 — 55	56 — 60	73.5 — 82	— 82 —	_ 79 _	1 1.5 1.5	1 1.5 1.5	0.480 0.649 0.747
NU2308 ET NU 408		UP — UP N	_ NF	48 49	48 49	50 56	55 60	60 67	82 101	_ 101	<u> </u>	1.5 2	1.5 2	0.933 1.28
NU1009 N 209 NU 209 EW	NU NJ N	– N – N UP –	NF NF	50 51.5 51.5	49 — 51.5	51 — 52	54 — 57	_ 61	70 — 78.5	71 78.5 —	68 77 —	1 1 1	0.6 1 1	0.279 0.429 0.438
NU2209 ET N 309 NU 309 EW		UP — — N UP —	NF	51.5 53 53	51.5 — 53	52 — 56	57 — 60	61 — 66	78.5 — 92	— 92 —	_ 77 _	1 1.5 1.5	1 1.5 1.5	0.521 0.869 1.01
NU2309 ET NU 409		UP — UP N	_ NF	53 54	53 54	56 62	60 66	66 74	92 111	_ 111	 103	1.5 2	1.5 2	1.28 1.62
NU1010 N 210 NU 210 EW		UP N - N UP -	NF	55 56.5 56.5	54 — 56.5	56 — 57	59 — 62	— — 67	75 — 83.5	76 83.5 —	73 82 —	1 1 1	0.6 1 1	0.301 0.483 0.50
NU2210 ET N 310 NU 310 EW		UP — — N UP —	NF	56.5 59 59	56.5 — 59	57 — 63	62 — 67	67 — 73	83.5 — 101	 101 	— 97 —	1 2 2	1 2 2	0.562 1.11 1.3
NU2310 ET N 410 NU 410		UP — — N UP N	NF NF	59 65 61	59 — 61	63 — 68	67 — 73	73 — 81	101 — 119	— 117 119	— 113 113.3	2 2 2	2 2 2	1.7 2.0 1.99
NU1011 N 211 NU 211 EW	NO NY -	– N – N UP –	NF	61.5 63 63	60 — 61.5	63 — 64	66 — 68	_ 73	83.5 — 92	85 93.5 —	82 91 —	1 1.5 1.5	1 1 1	0.445 0.634 0.669
NU2211 ET N 311 NU 311 EW		UP — — N UP —	NF	63 64 64	61.5 — 64	64 — 68	68 — 72	73 — 80	92 — 111	111 —	107 —	1.5 2 2	1 2 2	0.783 1.42 1.64
NU2311 ET NU 411		UP — UP N	_ NF	64 66	64 66	68 75	72 79	80 87	111 129	_ 129	_ 119	2 2	2 2	2.18 2.5

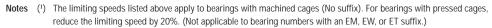
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

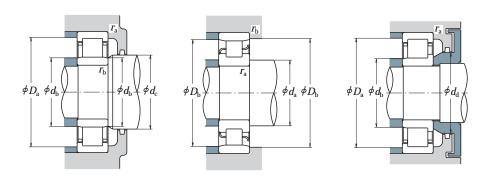
Bore Diameter 60 – 75 mm



		Bou	ndary Dir (mm	mensions ı)			Basic Load (N		Limiting Sp (min	
d	D	В	$m{r}$ min.	$r_1 \ ext{min.}$	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
60	95 110 110 110 130 130 130	18 22 22 28 31 31 31 46	1.1 1.5 1.5 1.5 2.1 2.1 2.1 2.1	1 1.5 1.5 1.5 2.1 2.1 2.1 2.1	69.5 — 72 72 — 77 77 77	85.5 97.5 — — 113 — —	40 000 68 500 97 500 131 000 124 000 124 000 150 000 222 000	48 500 75 000 107 000 157 000 126 000 126 000 157 000 262 000	6 700 6 000 5 300 5 300 4 800 4 800 4 800 4 300	8 500 7 100 6 300 6 300 5 600 5 600 5 600 5 300
65	150 100 120 120 120	35 18 23 23 31	2.1 1.1 1.5 1.5	2.1 1 1.5 1.5 1.5	74.5 — 78.5 78.5	127 90.5 105.6 —	167 000 41 000 84 000 108 000 149 000	168 000 51 000 94 500 119 000 181 000	4 300 6 300 5 300 4 800 4 800	5 300 8 000 6 300 5 600 6 000
	140 140 140 140 160	33 33 33 48 37	2.1 2.1 2.1 2.1 2.1	2.1 2.1 2.1 2.1 2.1	83.5 82.5 82.5 89.3	121.5 — — — 135.3	135 000 135 000 181 000 233 000 182 000	139 000 139 000 191 000 265 000 186 000	4 300 4 300 4 300 3 800 4 000	5 300 5 300 5 300 4 800 4 800
70	110 125 125 125 150 150	20 24 24 31 35 35	1.1 1.5 1.5 1.5 2.1 2.1	1 1.5 1.5 1.5 2.1 2.1	80 — 83.5 83.5 — 90	100 110.5 — — 130	58 500 83 500 119 000 156 000 149 000	70 500 95 000 137 000 194 000 156 000	6 000 5 000 5 000 4 500 4 000 4 000	7 100 6 300 6 300 5 600 5 000 5 000
75	150 150 150 180 115	35 51 42 20	2.1 2.1 2.1 3	2.1 2.1 2.1 3	89 89 100 85	— — 152 105	158 000 205 000 274 000 228 000 60 000	168 000 222 000 325 000 236 000 74 500	4 000 4 000 3 600 3 600 5 600	5 000 5 000 4 500 4 300 6 700
73	130 130 130 130 160 160 160 160	25 25 25 31 37 37 37 55 45	1.5 1.5 1.5 2.1 2.1 2.1 2.1 3	1.5 1.5 1.5 2.1 2.1 2.1 2.1 3	88.5 88.5 — 95.5 95 95	116.5 — — 139.5 — — — — 160.5	96 500 130 000 162 000 179 000 179 000 240 000 330 000 262 000	111 000 156 000 207 000 189 000 189 000 263 000 395 000 274 000	4 800 4 800 4 300 3 800 3 800 3 400 3 400	6 000 6 000 5 300 4 800 4 800 4 800 4 300 4 000



⁽²) The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

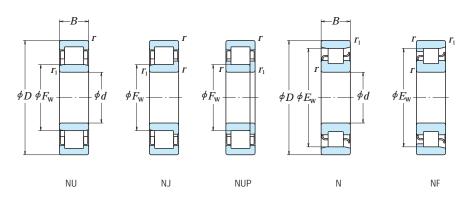


Bear	ring Numbers	S(2)				ļ	Abutmer	nt and Fi (m	illet Dime m)	ensions				Mass (kg)
	(3) NU NJ I	NUP N	I NF	$d_{\!\scriptscriptstyle a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	$r_{ m b}$ max.	approx.
NU1012 N 212 NU 212 EW	 ИИ ИЛ	- 1 - 1 - QUV		66.5 68 68	65 — 68	68 — 70	71 — 75	_ _ 80	88.5 — 102	90 102 —	87 100 —	1 1.5 1.5	1 1.5 1.5	0.474 0.823 0.824
NU2212 ET N 312 NU 312		NUP - - 1 NUP -	NF	68 71 71	68 — 71	70 — 75	75 — 79	80 — 86	102 — 119	119 —	115 —	1.5 2 2	1.5 2 2	1.06 1.78 1.82
NU 312 EM NU2312 ET NU 412	NO NO I	NUP -		71 71 71 71	71 71 71	75 75	79 79 79 85	86 86	119 119 139	_ 139	_ 130	2 2 2	2 2 2	2.06 2.7 3.04
NU1013 N 213	NU NJ	! !	I NF	71.5 73	70 —	80 73 —	76 —	94 — —	93.5	95 112	92 108	1 1.5	1 1.5	0.504 1.05
NU 213 EW NU2213 ET N 313	NU NJ I	NUP - NUP - 1	 J NF	73 73 76	73 73 —	76 76 —	81 81 —	87 87 —	112 112 —	_ 129	_ _ 125	1.5 1.5 2	1.5 1.5 2	1.05 1.41 2.17
NU 313 NU 313 EM NU2313 ET	NO NO I	NUP -	 	76 76 76	76 76 76	81 80 80	85 85 85	93 93 93	129 129 129	_	_	2 2 2	2 2 2	2.23 2.56 3.16
NU 413 NU1014 N 214	— — ИП ИЛ I	1 — 1 QU <i>N</i> 1 —	I NF	76 76.5 78	76 75 —	86 79 —	91 82 —	100	149 103.5 —	149 105 117	138.8 101 113	2 1 1.5	2 1 1.5	3.63 0.693 1.14
NU 214 EM NU2214 ET N 314		NUP - NUP - - 1		78 78 81	78 78 —	81 81 —	86 86	92 92	117 117 —	139	133.5	1.5 1.5 2	1.5 1.5 2	1.29 1.49 2.67
NU 314 NU 314 EM	NU NJ I	NUP - NUP -		81 81	81 81	87 86	92 92	100	139 139	_	_	2	2	2.75 3.09
NU2314 ET NU 414 NU1015		NUP – NUP N 1 —	l NF	81 83 81.5	81 83 80	86 97 83	92 102 87	100 112 —	139 167 108.5	167 110	155 106	2 2.5 1	2 2.5 1	3.92 5.28 0.731
N 215 NU 215 EM NU2215 ET		- 1 NUP - NUP -	NF 	83 83 83	83 83	— 86 86	90 90	96 96	— 122 122	122 —	119 — —	1.5 1.5 1.5	1.5 1.5 1.5	1.23 1.44 1.57
N 315 NU 315 NU 315 EM	NU NJ I	_ NUP -	NF — —	86 86 86	— 86 86	93 92	97 97	106 106	149 149	149 —	143	2 2 2	2 2 2	3.2 3.26 3.73
NU2315 ET NU 415		NUP - - I	- —	86 88	86 88	92 102	97 97 107	106 106 118	149 149 177	_ 177	 164	2 2.5	2 2.5	4.86 6.27

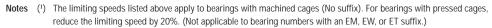
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

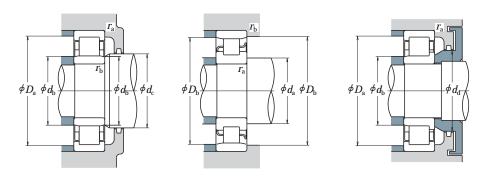
Bore Diameter 80 – 95 mm



		Bou	ndary Di (mm	mensions n)			Basic Load (N		Limiting Sp (min	
d	D	В	$m{r}$ min.	$oldsymbol{r_1}{min.}$	F_{W}	$E_{ m W}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
80	125 140 140	22 26 26	1.1 2 2	1 2 2	91.5 — 95.3	113.5 125.3 —	72 500 106 000 139 000	90 500 122 000 167 000	5 300 4 500 4 500	6 300 5 300 5 300
	140 170 170	33 39 39	2 2.1 2.1	2 2.1 2.1	95.3 — 101	147 —	186 000 190 000 256 000	243 000 207 000 282 000	4 000 3 600 3 600	5 000 4 300 4 300
	170 200	58 48	2.1	2.1 3	101 110	 170	355 000 299 000	430 000 315 000	3 200 3 200	4 000 3 800
85	130 150 150	22 28 28	1.1 2 2	1 2 2	96.5 — 100.5	118.5 133.8 —	74 500 120 000 167 000	95 500 140 000 199 000	5 000 4 300 4 300	6 000 5 000 5 000
	150 180 180	36 41 41	2 3 3	2 3 3	100.5 — 108	156 —	217 000 225 000 212 000	279 000 247 000 228 000	3 800 3 400 3 400	4 500 4 000 4 000
	180 180 210	41 60 52	3 3 4	3 3 4	108 108 113	_ _ 177	291 000 395 000 335 000	330 000 485 000 350 000	3 400 3 000 3 000	4 000 3 800 3 800
90	140 160 160	24 30 30	1.5 2 2	1.1 2 2	103 — 107	127 143 —	88 000 152 000 182 000	114 000 178 000 217 000	4 500 4 000 4 000	5 600 4 800 4 800
	160 190 190	40 43 43	2 3 3	2 3 3	107 — 115	165 —	242 000 240 000 240 000	315 000 265 000 265 000	3 600 3 200 3 200	4 300 3 800 3 800
	190 190 225	43 64 54	3 3 4	3 3 4	113.5 113.5 123.5	_ _ 191.5	315 000 435 000 375 000	355 000 535 000 400 000	3 200 2 800 2 800	3 800 3 400 3 400
95	145 170 170	24 32 32	1.5 2.1 2.1	1.1 2.1 2.1	108 — 112.5	132 151.5 —	90 500 166 000 220 000	120 000 196 000 265 000	4 300 3 800 3 800	5 300 4 500 4 500
	170 200 200	43 45 45	2.1 3 3	2.1 3 3	112.5 — 121.5	173.5 —	286 000 259 000 259 000	370 000 289 000 289 000	3 400 3 000 3 000	4 000 3 600 3 600
	200 200 240	45 67 55	3 3 4	3 3 4	121.5 121.5 133.5	_ _ 201.5	335 000 460 000 400 000	385 000 585 000 445 000	3 000 2 600 2 600	3 600 3 400 3 200



⁽²) The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

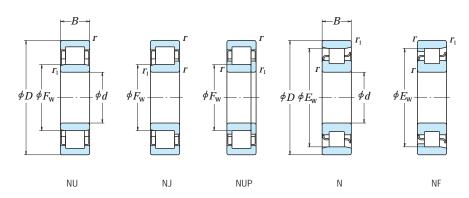


Bear	ing Numbe	rs(2)					ŀ	Abutmer	nt and Fi (m	illet Dime m)	ensions				Mass (kg)
	(3) NU NJ	NUP	N	NF	d _a (4) min.	$d_{ m b}$ min.	d ₀(5) max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	$r_{ m b}$ max.	арргох.
NU1016 N 216 NU 216 EM	NU — — — NU NJ	NUP NUP	N N	NF	86.5 89 89	85 — 89	90 — 92	94 — 97	_ 104	118.5 — 131	120 131 —	115 128 —	1 2 2	1 2 2	0.969 1.47 1.7
NU2216 ET N 316 NU 316 EM	NO NJ	NUP NUP	_ N	NF	89 91 91	89 — 91	92 — 98	97 — 105	104 — 114	131 — 159	_ 159 _	_ 150 _	2 2 2	2 2 2	1.96 3.85 4.45
NU2316 ET NU 416	NN NN	NUP —	_ N	_ NF	91 93	91 93	98 107	105 112	114 124	159 187	_ 187	 173	2 2.5	2 2.5	5.73 7.36
NU1017 N 217 NU 217 EM	UU LU UU	_ NUP	N N	NF	91.5 94 94	90 — 94	95 — 98	99 — 104	_ 110	123.5 — 141	125 141 —	120 137 —	1 2 2	1 2 2	1.01 1.87 2.11
NU2217 ET N 317 NU 317	NU NJ	NUP NUP	N	NF	94 98 98	94 — 98	98 — 105	104 — 110	110 — 119	141 — 167	_ 167 _	_ 159 _	2 2.5 2.5	2 2.5 2.5	2.44 4.53 4.6
NU 317 EM NU2317 ET NU 417	NU NJ NU NJ	NUP NUP	_ _ N	_ NF	98 98 101	98 98 101	105 105 110	110 110 115	119 119 128	167 167 194	_ _ 194	_ _ 180	2.5 2.5 3	2.5 2.5 3	5.26 6.77 9.56
NU1018 N 218 NU 218 EM	NU — — — NU NJ	NUP NUP	N N	NF	98 99 99	96.5 — 99	101 104	106 — 109	_ 116	132 — 151	133.5 151 —	129 146 —	1.5 2 2	1 2 2	1.35 2.31 2.6
NU2218 ET N 318 NU 318	NU NJ	NUP NUP	N	NF	99 103 103	99 — 103	104 — 112	109 — 117	116 — 127	151 — 177	_ 177 _	168 —	2 2.5 2.5	2 2.5 2.5	3.11 5.31 5.38
NU 318 EM NU2318 ET NU 418	NU NJ	NUP NUP	_ N	_ NF	103 103 106	103 103 106	111 111 120	117 117 125	127 127 139	177 177 209	_ _ 209	_ _ 196	2.5 2.5 3	2.5 2.5 3	6.1 7.9 11.5
NU1019 N 219 NU 219 EM	NU NJ	_ NUP	N N	NF	103 106 106	101.5 — 106	106 — 110	111 — 116	_ 123	137 — 159	138.5 159 —	134 155 —	1.5 2 2	1 2 2	1.41 2.79 3.17
NU2219 ET N 319 NU 319	NU NJ	NUP NUP	N	NF	106 108 108	106 — 108	110 — 118	116 — 124	123 — 134	159 — 187	_ 187 _	 177 	2 2.5 2.5	2 2.5 2.5	3.81 6.09 6.23
NU 319 EM NU2319 ET NU 419	MN MY MN MY MO MY	NUP NUP NUP	_ _ _	_ NF	108 108 108 111	108 108 111	118 118 130	124 124 124 136	134 134 134 149	187 187 187 224	 224	 206	2.5 2.5 2.5 3	2.5 2.5 2.5 3	7.13 9.21 13.6

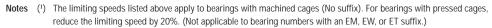
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

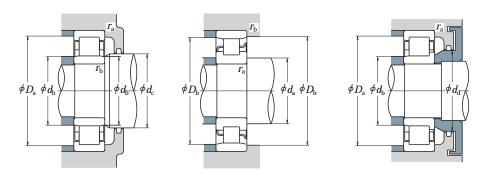
Bore Diameter 100 – 120 mm



		Bou	ndary Dir (mm	mensions ı)				nd Ratings N)	Limiting Sp (min	
d	D	В	$m{r}$ min.	$r_{\scriptscriptstyle 1}$ min.	$F_{ m W}$	$E_{ m W}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
100	150	24	1.5	1.1	113	137	93 000	126 000	4 300	5 300
	180	34	2.1	2.1	—	160	183 000	217 000	3 600	4 300
	180	34	2.1	2.1	119	—	249 000	305 000	3 600	4 300
	180 215 215	46 47 47	2.1 3 3	2.1 3 3	119 — 129.5	185.5 —	335 000 299 000 299 000	445 000 335 000 335 000	3 200 2 800 2 800	3 800 3 400 3 400
	215	47	3	3	127.5	_	380 000	425 000	2 800	3 400
	215	73	3	3	127.5	_	570 000	715 000	2 400	3 000
	250	58	4	4	139	211	450 000	500 000	2 600	3 000
105	160	26	2	1.1	119.5	145.5	109 000	149 000	4 000	4 800
	190	36	2.1	2.1	—	168.8	201 000	241 000	3 400	4 000
	190	36	2.1	2.1	125	—	262 000	310 000	3 400	4 000
	225	49	3	3		195	340 000	390 000	2 600	3 200
	225	49	3	3	133	—	425 000	480 000	2 600	3 200
	260	60	4	4	144.5	220.5	495 000	555 000	2 400	3 000
110	170	28	2	1.1	125	155	131 000	174 000	3 800	4 500
	200	38	2.1	2.1	—	178.5	229 000	272 000	3 200	3 800
	200	38	2.1	2.1	132.5	—	293 000	365 000	3 200	3 800
	200 240 240 280	53 50 50 65	2.1 3 3 4	2.1 3 3 4	132.5 — 143 155	207 — —	385 000 380 000 450 000 550 000	515 000 435 000 525 000 620 000	2 800 2 600 2 600 2 200	3 400 3 000 3 000 2 800
120	180	28	2	1.1	135	165	139 000	191 000	3 400	4 300
	215	40	2.1	2.1	—	191.5	260 000	320 000	3 000	3 400
	215	40	2.1	2.1	143.5	—	335 000	420 000	3 000	3 400
	215 260 260	58 55 55	2.1 3 3	2.1 3 3	143.5 — 154	226 —	450 000 450 000 530 000	620 000 510 000 610 000	2 600 2 200 2 200	3 200 2 800 2 800
	260	86	3	3	154		795 000	1 030 000	2 000	2 600
	310	72	5	5	170	260	675 000	770 000	2 000	2 400



⁽²⁾ The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

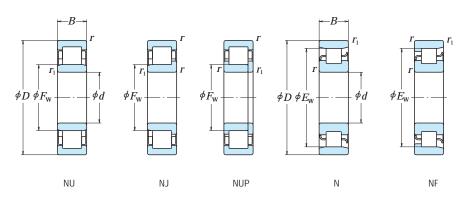


Bear	ing Numbe	ers(2)					Þ	butmer	nt and Fi (m	illet Dime m)	ensions				Mass (kg)
	NU NJ	NUP	N	NF	d _a (⁴) min.	$d_{ m b}$ min.	d _b (5) max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	$r_{ m b}$ max.	арргох.
NU1020 N 220 NU 220 EM	NN NY NN NY	NUP — NUP	N N	NF	108 111 111	106.5 — 111	111 — 116	116 — 122	_ _ 130	142 — 169	143.5 169 —	139 163 —	1.5 2 2	1 2 2	1.47 3.36 3.81
NU2220 ET N 320 NU 320	ИП ИЛ — — ИП ИЛ	NUP — NUP	_ N _	NF —	111 113 113	111 — 113	116 — 126	122 — 132	130 — 143	169 — 202	 202 	190 —	2 2.5 2.5	2 2.5 2.5	4.69 7.59 7.69
NU 320 EM NU2320 ET NU 420	ИП ИЛ ИП ИЛ ИП ИЛ	NUP NUP	_ N	_ _ NF	113 113 116	113 113 116	124 124 135	132 132 141	143 143 156	202 202 234	_ _ 234	_ _ 215	2.5 2.5 3	2.5 2.5 3	8.63 11.8 15.5
NU1021 N 221 NU 221 EM	NN NN NN -	_ NUP	N N	NF NF	114 116 116	111.5 — 116	118 — 121	122 — 129	_ _ 137	151 — 179	153.5 179 —	147 172 —	2 2 2	1 2 2	1.83 4.0 4.58
N 321 NU 321 EM NU 421	NN NN NN NN	NUP	N — N	NF — NF	118 118 121	— 118 121	— 131 141	— 137 147	— 149 162	— 212 244	212 — 244	199 — 225	2.5 2.5 3	2.5 2.5 3	8.69 9.84 17.3
NU1022 N 222 NU 222 EM	ИП ИЛ — — ИП ИЛ	_ NUP	N N	NF NF	119 121 121	116.5 — 121	123 — 129	128 — 135	_ _ 144	161 — 189	163.5 189 —	157 182 —	2 2 2	1 2 2	2.27 4.64 5.37
NU2222 EM N 322 NU 322 EM NU 422	NN NY NN NY NN NY	NUP NUP	N —	_ NF _ _	121 123 123 126	121 — 123 126	129 — 139 151	135 — 145 157	144 — 158 173	189 — 227 264	 227 	211 —	2 2.5 2.5 3	2 2.5 2.5 3	7.65 10.3 11.8 22.1
NU1024 N 224 NU 224 EM	NN NN — — NN NN	NUP — NUP	N N	NF	129 131 131	126.5 — 131	133 — 140	138 — 146	_ _ 156	171 — 204	173.5 204 —	167 196 —	2 2 2	1 2 2	2.43 5.63 6.43
NU2224 EM N 324 NU 324 EM	ИП ИЛ — — ИП ИЛ	NUP — NUP	_ N _	NF —	131 133 133	131 — 133	140 — 150	146 — 156	156 — 171	204 — 247	 247 	230 —	2 2.5 2.5	2 2.5 2.5	9.51 12.9 15
NU2324 EM NU 424	NO NJ	NUP NUP	_ N	_	133 140	133 140	150 166	156 172	171 190	247 290	_ 290	_ 266	2.5 4	2.5 4	25 30.2

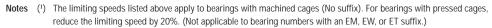
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

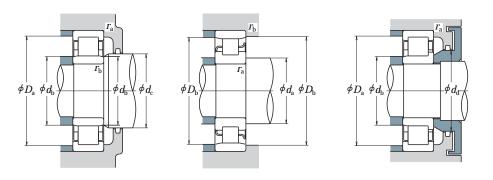
Bore Diameter 130 – 160 mm



		Bou	ndary Dii (mm	mensions n)				nd Ratings N)	Limiting S _I	
d	D	В	$m{r}$ min.	$r_1 \atop ext{min.}$	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
130	200 230 230	33 40 40	2 3 3	1.1 3 3	148 — 153.5	182 204 —	172 000 270 000 365 000	238 000 340 000 455 000	3 200 2 600 2 600	3 800 3 200 3 200
	230 280 280	64 58 58	3 4 4	3 4 4	153.5 — 167	243 —	530 000 500 000 615 000	735 000 570 000 735 000	2 400 2 200 2 200	3 000 2 600 2 600
	280 340	93 78	4 5	4 5	167 185	 285	920 000 825 000	1 230 000 955 000	1 900 1 800	2 400 2 200
140	210 250 250	33 42 42	2 3 3	1.1 3 3	158 — 169	192 221 —	176 000 297 000 395 000	250 000 375 000 515 000	3 000 2 400 2 400	3 600 3 000 3 000
	250 300 300	68 62 62	3 4 4	3 4 4	169 — 180	260 —	550 000 550 000 665 000	790 000 640 000 795 000	2 200 2 000 2 000	2 800 2 400 2 400
	300 360	102 82	4 5	4 5	180 198	302	1 020 000 875 000	1 380 000 1 020 000	1 700 1 700	2 200 2 000
150	225 270 270	35 45 45	2.1 3 3	1.5 3 3	169.5 — 182	205.5 238 —	202 000 360 000 450 000	294 000 465 000 595 000	2 800 2 200 2 200	3 400 2 800 2 800
	270 320 320	73 65 65	3 4 4	3 4 4	182 — 193	277 —	635 000 665 000 760 000	930 000 805 000 920 000	2 000 1 800 1 800	2 600 2 200 2 200
	320 380	108 85	4 5	4 5	193 213	_	1 160 000 930 000	1 600 000 1 120 000	1 600 1 600	2 000 2 000
160	240 290 290	38 48 48	2.1 3 3	1.5 3 3	180 — 195	220 255 —	238 000 430 000 500 000	340 000 570 000 665 000	2 600 2 200 2 200	3 200 2 600 2 600
	290 340 340 340	80 68 68 114	3 4 4 4	3 4 4 4	193 — 204 204	292 — —	810 000 700 000 860 000 1 310 000	1 190 000 875 000 1 050 000 1 820 000	1 900 1 700 1 700 1 500	2 400 2 000 2 000 1 900



⁽²) The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.

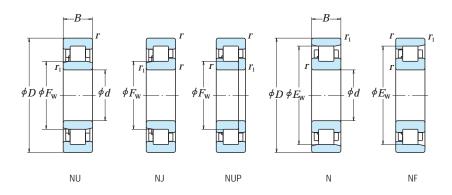


Bearing Numbers ⁽²⁾			ŀ	Abutmer	nt and F (m	illet Dime m)	ensions				Mass (kg)
(3) NU NJ NUP N NF	$d_{\!\scriptscriptstyle a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{\mathrm{b}}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	$r_{ m b}$ max.	арргох.
NU1026 NU NJ — N NE		136.5	146	151	—	191	193.5	184	2	1	3.66
N 226 — — N NE		—	—	—	—	—	217	208	2.5	2.5	6.48
NU 226 EM NU NJ NUP — —		143	150	158	168	217	—	—	2.5	2.5	8.03
NU2226 EM NU NJ NUP — — N 326 — — N NI NU326EM NU NJ NUP — —	143 146 146	143 — 146	150 — 163	158 — 169	168 — 184	217 — 264	264 —	 247.5 _	2.5 3 3	2.5 3 3	9.44 17.7 18.7
NU2326EM NU NJ NUP — —	146	146	163	169	184	264			3	3	30
NU 426 NU NJ — — NF	150	150	180	187	208	320	320	291	4	4	39.6
NU1028 NU NJ NUP N —	149	146.5	156	161	_	201	203.5	194	2	1	3.87
N 228 — — N NF	153	—	—	—	_	—	237	225	2.5	2.5	8.08
NU228EM NU NJ NUP — —	153	153	165	171	182	237	—	—	2.5	2.5	9.38
NU2228EM NU NJ NUP	153	153	165	171	182	237		_	2.5	2.5	15.2
N 328 N NF	156	—	—	—	—	—	284	266	3	3	21.7
NU328EM NU NJ NUP	156	156	176	182	198	284		_	3	3	22.8
NU2328EM NU NJ NUP	156	156	176	182	198	284		308	3	3	37.7
NU 428 NU NJ N	160	160	193	200	222	340	340		4	4	46.4
NU1030 NU NJ — N NE	161	158	167	173	_	214	217	208	2	1.5	4.77
N 230 — — N NE	163	—	—	—	_	—	257	242	2.5	2.5	10.4
NU230EM NU NJ NUP — —	163	163	177	184	196	257	—	—	2.5	2.5	11.9
NU2230EM NU NJ NUP N 330 N NI NU330EM NU NJ NUP	163 166 166	163 — 166	177 — 188	184 — 195	196 — 213	257 — 304	304 —	283 —	2.5 3 3	2.5 3 3	19.3 25.8 27.1
NU2330EM NU NJ NUP NU 430 NU NJ	166 170	166 170	188 208	195 216	213 237	304 360	_	_	3 4	3 4	45.1 55.8
NU1032 NU NJ — N NE	171	168	178	184	_	229	232	222	2	1.5	5.81
N 232 — — N NE	173	—	—	—	_	—	277	261	2.5	2.5	14.1
NU232EM NU NJ NUP — —	173	173	190	197	210	277	—	—	2.5	2.5	14.7
NU2232EM NU NJ NUP N 332 N NU332EM NU NJ NUP NU2332EM NU NJ NUP	173 176 176 176	173 — 176 176	188 — 199 199	197 — 211 211	210 — 228 228	277 — 324 324	324 —	_ 298 _ _	2.5 3 3 3	2.5 3 3 3	24.5 30.8 32.1 53.9

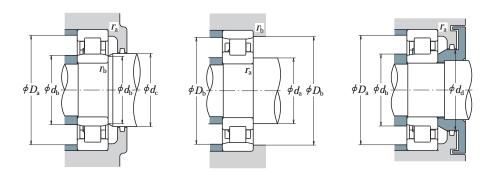
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) d_b (max.) are values for adjusting rings for NU, NJ Types.

Bore Diameter 170 – 220 mm



		Bou	ndary Di (mm	mensions n)				nd Ratings N)	Limiting S	
d	D	В	$m{r}$ min.	$r_{\scriptscriptstyle 1}$ min.	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
170	260	42	2.1	2.1	193	237	287 000	415 000	2 400	2 800
	310	52	4	4	—	272	475 000	635 000	2 000	2 400
	310	52	4	4	207	—	605 000	800 000	2 000	2 400
	310 360 360 360	86 72 72 120	4 4 4	4 4 4	205 — 218 216	310 	925 000 795 000 930 000 1 490 000	1 330 000 1 010 000 1 150 000 2 070 000	1 800 1 600 1 600 1 400	2 200 2 000 2 000 1 800
180	280	46	2.1	2.1	205	255	355 000	510 000	2 200	2 600
	320	52	4	4	—	282	495 000	675 000	1 900	2 200
	320	52	4	4	217	—	625 000	850 000	1 900	2 200
	320 380 380 380	86 75 75 126	4 4 4 4	4 4 4	215 — 231 227	328 —	1 010 000 905 000 985 000 1 560 000	1 510 000 1 150 000 1 230 000 2 220 000	1 700 1 500 1 500 1 300	2 000 1 800 1 800 1 700
190	290	46	2.1	2.1	215	265	365 000	535 000	2 000	2 600
	340	55	4	4	—	299	555 000	770 000	1 800	2 200
	340	55	4	4	230	—	695 000	955 000	1 800	2 200
	340 400 400 400	92 78 78 132	4 5 5 5	4 5 5 5	228 — 245 240	345 —	1 100 000 975 000 1 060 000 1 770 000	1 670 000 1 260 000 1 340 000 2 520 000	1 600 1 400 1 400 1 300	2 000 1 700 1 700 1 600
200	310	51	2.1	2.1	229	281	390 000	580 000	2 000	2 400
	360	58	4	4	—	316	620 000	865 000	1 700	2 000
	360	58	4	4	243	—	765 000	1 060 000	1 700	2 000
	360 420 420 420	98 80 80 138	4 5 5 5	4 5 5 5	241 — 258 253	360 —	1 220 000 975 000 1 140 000 1 910 000	1 870 000 1 270 000 1 450 000 2 760 000	1 500 1 300 1 300 1 200	1 800 1 600 1 600 1 500
220	340	56	3	3	250	310	500 000	750 000	1 800	2 200
	400	65	4	4	—	350	760 000	1 080 000	1 500	1 800
	400	65	4	4	270	—	760 000	1 080 000	1 500	1 800
	400	108	4	4	270	—	1 140 000	1 810 000	1 300	1 600
	460	88	5	5	—	396	1 190 000	1 570 000	1 200	1 500
	460	88	5	5	284	—	1 190 000	1 570 000	1 200	1 500



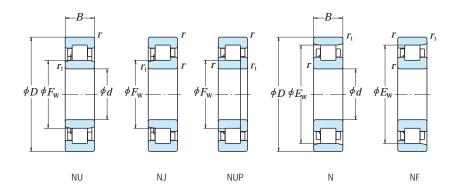
Ве	Bearing Numbers (1)				Abutment and Fillet Dimensions (mm)										Mass (kg)
	NU NI	NUP	N	NF	$d_{\!\scriptscriptstyle a}^{(2)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(3)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(2)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{ m a}$ max.	$r_{ m b}$ max.	approx.
NU1034 N 234 NU234EM	NU N. — — NU N.		N N	NF	181 186 186	181 — 186	190 — 202	197 — 211	_ _ 223	249 — 294	249 294 —	239 278 —	2 3 3	2 3 3	7.91 17.4 18.3
NU2234EM N 334 NU334EM NU2334EM	NU N. NU N. NU N.	J NUP	N —	_ _ _	186 186 186 186	186 — 186 186	200 — 213 210	211 — 223 223	223 — 241 241	294 — 344 344	344 —	316 —	3 3 3	3 3 3	29.9 36.6 37.9 63.4
NU1036 N 236 NU236EM	NU N.		N N	NF NF	191 196 196	191 — 196	202 — 212	209 — 221	_ _ 233	269 — 304	269 304 —	258 288 —	2 3 3	2 3 3	10.2 18.1 19
NU2236EM N 336 NU336EM NU2336EM	NU N. NU N. NU N.	J NUP	N —	NF —	196 196 196 196	196 — 196 196	210 — 226 222	221 — 235 235	233 — 255 255	304 — 364 364	364 —	335 —	3 3 3	3 3 3 3	31.4 42.6 44 74.6
NU1038 N 238 NU238EM	NU N. — — NU N.	_	N N	NF	201 206 206	201 — 206	212 — 225	219 — 234	_ _ 247	279 — 324	279 324 —	268 305 —	2 3 3	2 3 3	10.7 22 23
NU2238EM N 338 NU338EM NU2338EM	NU N. NU N. NU N.	J NUP	N -	_ _ _ _	206 210 210 210	206 — 210 210	223 — 240 235	234 — 248 248	247 — 268 268	324 — 380 380	380 — —	352 —	3 4 4 4	3 4 4 4	38.3 48.7 50.6 86.2
NU1040 N 240 NU240EM	NU N.	_	N N	NF NF	211 216 216	211 216	226 — 238	233 — 247	_ 261	299 — 344	299 344 —	284 323 —	2 3 3	2 3 3	14 26.2 27.4
NU2240EM N 340 NU340EM NU2340EM	NU N. NU N. NU N.	J NUP	N -	_ NF _ _	216 220 220 220	216 — 220 220	235 — 252 247	247 — 263 263	261 — 283 283	344 — 400 400	400 —	367 —	3 4 4 4	3 4 4 4	46.1 55.3 57.1 99.3
NU1044 N 244 NU 244	NU N	_	N N	NF	233 236 236	233 — 236	247 — 264	254 — 273	_ 289	327 — 384	327 384 —	313 357 —	2.5 3 3	2.5 3 3	18.2 37 37.3
NU2244 N 344 NU 344	NU - NU N	_ _ J _	N —	_ _ _	 240 240	236 — 240	264 — 278	273 — 287	289 — 307	384 — 440	440 —	403 —	3 4 4	3 4 4	61.8 72.8 74.6

Notes (1) When L-shaped thrust collars (Refer to page B105) are used, the bearings become the NH Type.

⁽²⁾ If axial loads are applied, increase d_a and reduce D_a from the values listed above.

⁽³⁾ $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

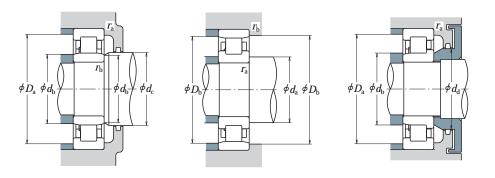
Bore Diameter 240 – 500 mm



		Bou	ndary Di (mm	mensions n)				nd Ratings N)	Limiting Speeds (min⁻¹)	
d	d D B		$m{r}$ min.	$r_1 \ ext{min.}$	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
240	360 440 440	56 72 72	3 4 4	3 4 4	270 — 295	330 385 —	530 000 935 000 935 000	820 000 1 340 000 1 340 000	1 600 1 300 1 300	2 000 1 600 1 600
	440 500 500	120 95 95	4 5 5	4 5 5	295 — 310	430	1 440 000 1 360 000 1 360 000	2 320 000 1 820 000 1 820 000	1 200 1 100 1 100	1 500 1 300 1 300
260	400 480 480	65 80 80	4 5 5	4 5 5	296 — 320	364 420 —	645 000 1 100 000 1 100 000	1 000 000 1 580 000 1 580 000	1 500 1 200 1 200	1 800 1 500 1 500
	480 540	130 102	5 6	5 6	320 336	_	1 710 000 1 540 000	2 770 000 2 090 000	1 100 1 000	1 300 1 200
280	420 500 500	65 80 80	4 5 5	4 5 5	316 — 340	384 440 —	660 000 1 140 000 1 140 000	1 050 000 1 680 000 1 680 000	1 400 1 100 1 100	1 700 1 400 1 400
300	460 540	74 85	4 5	4 5	340 364	420 —	885 000 1 400 000	1 400 000 2 070 000	1 300 1 100	1 500 1 300
320	480 580 580	74 92 92	4 5 5	4 5 5	360 — 390	440 510 —	905 000 1 540 000 1 540 000	1 470 000 2 270 000 2 270 000	1 200 950 950	1 400 1 200 1 200
340	520	82	5	5	385	475	1 080 000	1 740 000	1 100	1 300
360	540	82	5	5	405	495	1 110 000	1 830 000	1 000	1 300
380	560	82	5	5	425	_	1 140 000	1 910 000	1 000	1 200
400	600	90	5	5	450	550	1 360 000	2 280 000	900	1 100
420	620	90	5	5	470	570	1 390 000	2 380 000	850	1 100
440	650	94	6	6	493	_	1 470 000	2 530 000	800	1 000
460	680	100	6	6	516	624	1 580 000	2 740 000	750	950
480	700	100	6	6	536	644	1 620 000	2 860 000	750	900
500	720	100	6	6	556	664	1 660 000	2 970 000	710	850



⁽²⁾ If axial loads are applied, increase $d_{\rm a}$ and reduce $D_{\rm a}$ from the values listed above.

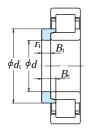


	Bearing Numbers (1)				Abutment and Fillet Dimensions (mm)								
	ии уј иир	N NF	$d_{\mathrm{a}}^{(2)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(3)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(2)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$r_{\rm a}$ max.	$r_{ m b}$ max.	арргох.
NU1048 N 248 NU 248	NO NJ — NO NJ MUP	N – N N	F 256	253 — 256	266 — 289	275 — 298	_ 316	347 — 424	347 424 —	333 392 —	2.5 3 3	2.5 3 3	19.5 49.6 50.4
NU2248 N 348 NU 348	NU — — — — — NU NJ —	 N	200	256 — 260	289 — 304	298 — 313	316 — 333	424 — 480	480 —	438	3 4 4	3 4 4	84.9 92.3 94.6
NU1052 N 252 NU 252	NO NY — NO NJ —	N N N –	- 280	276 — 280	292 — 314	300 — 323	_ _ 343	384 — 460	384 460	367 428 —	3 4 4	3 4 4	29.1 66.2 67.1
NU2252 NU 352	NU — NUP NU NJ —		280 286	280 286	314 330	323 339	343 359	460 514	_	_	4 5	4 5	111 118
NU1056 N 256 NU 256	NU NJ NUP NU NJ —	N N N N		296 — 300	312 — 334	320 — 344	_ 364	404 — 480	404 480 —	387 448 —	3 4 4	3 4 4	30.8 69.6 70.7
NU1060 NU 260	NU NJ —	N N	320	316 320	336 358	344 368	_ 391	444 520	444	424 —	3 4	3 4	43.7 89.2
NU1064 N 264 NU 264	NU — — NU NJ —	N N N –	- 340	336 — 340	356 — 384	365 — 394	_ 420	464 — 560	464 560 —	444 519 —	3 4 4	3 4 4	46.1 110 112
NU1068 NU1072	NU NJ — NU — —	N N N N		360 380	381 400	390 410	_	500 520	500 520	479 499	4	4	61.8 64.6
NU1076	NU — —			400	420	430	_	540	_	_	4	4	67.5
NU1080 NU1084	NU — NUP NU — —	N – N –	120	420 440	445 465	455 475	_	580 600	580 600	554.5 574.5	4 4	4	88.2 91.7
NU1088 NU1092	NU — — NU — NUP		- — - 486	466 486	488 511	498 521	_	624 654	— 654	— 628.5	5 5	5 5	105 123
NU1096 NU10/50	NN NN —	N –		506 526	531 551	541 558	_	674 694	674 694	654 674	5 5	5 5	127 131

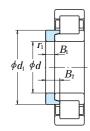
⁽³⁾ $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

L-Shaped Thrust Collars
Bore Diameter 20 – 85 mm

Bore Diameter 90 – 320 mm



L-Shaped Thrust Collar



L-Shaped Thrust Collar

	D I .	D'				
	Bounda	ry Dime (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$r_1 \atop ext{min.}$	Numbers	approx.
20	30	3	6.75	0.6	HJ 204	0.012
	29.8	3	5.5	0.6	HJ 204 E	0.011
	30	3	7.5	0.6	HJ 2204	0.012
	29.8	3	6.5	0.6	HJ 2204 E	0.012
	31.7	4	7.5	0.6	HJ 304	0.017
	31.4	4	6.5	0.6	HJ 304 E	0.017
	31.8 31.4	4	8.5 7.5	0.6 0.6	HJ 2304 HJ 2304 E	0.017 0.018
25	34.8	3	6	0.6	HJ 205 E	0.014
	34.8	3	6.5	0.6	HJ 2205 E	0.014
	38.2	4	7	1.1	HJ 305 E	0.025
	38.2	4	8	1.1	HJ 2305 E	0.026
	43.6	6	10.5	1.5	HJ 405	0.057
30	41.3	4	7	0.6	HJ 206 E	0.025
	41.4	4	7.5	0.6	HJ 2206 E	0.025
	45.1	5	8.5	1.1	HJ 306 E	0.042
	45.1	5	9.5	1.1	HJ 2306 E	0.043
	50.5	7	11.5	1.5	HJ 406	0.080
35	48.2	4	7	0.6	HJ 207 E	0.033
	48.2	4	8.5	0.6	HJ 2207 E	0.035
	51.1	6	9.5	1.1	HJ 307 E	0.060
	51.1	6	11	1.1	HJ 2307 E	0.062
	59	8	13	1.5	HJ 407	0.12
40	54.1	5	8.5	1.1	HJ 208 E	0.049
	54.1	5	9	1.1	HJ 2208 E	0.050
	57.6	7	11	1.5	HJ 308 E	0.088
	57.7	7	12.5	1.5	HJ 2308 E	0.091
	64.8	8	13	2	HJ 408	0.14
45	59.1	5	8.5	1.1	HJ 209 E	0.055
	59.1	5	9	1.1	HJ 2209 E	0.055
	64.5	7	11.5	1.5	HJ 309 E	0.11
	64.5	7	13	1.5	HJ 2309 E	0.113
	71.7	8	13.5	2	HJ 409	0.175
50	64.1	5	9	1.1	HJ 210 E	0.061
	64.1	5	9	1.1	HJ 2210 E	0.061
	71.4	8	13	2	HJ 310 E	0.151
	71.4	8	14.5	2	HJ 2310 E	0.155
	78.8	9	14.5	2.1	HJ 410	0.23

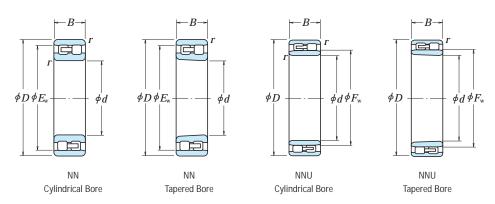
	Bounda	ry Dim (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$r_{\scriptscriptstyle 1}$ min.	Numbers	approx.
55	70.9	6	9.5	1.1	HJ 211 E	0.087
	70.9	6	10	1.1	HJ 2211 E	0.088
	77.6	9	14	2	HJ 311 E	0.195
	77.6	9	15.5	2	HJ 2311 E	0.20
	85.2	10	16.5	2.1	HJ 411	0.29
60	77.7	6	10	1.5	HJ 212 E	0.108
	77.7	6	10	1.5	HJ 2212 E	0.108
	84.5	9	14.5	2.1	HJ 312 E	0.231
	84.5	9	16	2.1	HJ 2312 E	0.237
	91.8	10	16.5	2.1	HJ 412	0.34
65	84.5	6	10	1.5	HJ 213 E	0.129
	84.5	6	10.5	1.5	HJ 2213 E	0.131
	90.6	10	15.5	2.1	HJ 313 E	0.288
	90.6	10	18	2.1	HJ 2313 E	0.298
	98.5	11	18	2.1	HJ 413	0.42
70	89.5	7	11	1.5	HJ 214 E	0.157
	89.5	7	11.5	1.5	HJ 2214 E	0.158
	97.5	10	15.5	2.1	HJ 314 E	0.33
	97.5	10	18.5	2.1	HJ 2314 E	0.345
	110.5	12	20	3	HJ 414	0.605
75	94.5	7	11	1.5	HJ 215 E	0.166
	94.5	7	11.5	1.5	HJ 2215 E	0.167
	104.2	11	16.5	2.1	HJ 315 E	0.41
	104.2	11	19.5	2.1	HJ 2315 E	0.43
	116	13	21.5	3	HJ 415	0.71
80	101.6	8	12.5	2	HJ 216 E	0.222
	101.6	8	12.5	2	HJ 2216 E	0.222
	110.6	11	17	2.1	HJ 316 E	0.46
	110.6	11	20	2.1	HJ 2316 E	0.48
	122	13	22	3	HJ 416	0.78
85	107.6	8	12.5	2	HJ 217 E	0.25
	107.6	8	13	2	HJ 2217 E	0.252
	117.9	12	18.5	3	HJ 317 E	0.575
	117.9	12	22	3	HJ 2317 E	0.595
	126	14	24	4	HJ 417	0.88

	Bounda	ry Dim (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$r_{\scriptscriptstyle 1}$ min.	Numbers	approx.
90	114.3	9	14	2	HJ 218 E	0.32
	114.3	9	15	2	HJ 2218 E	0.325
	124.2	12	18.5	3	HJ 318 E	0.63
	124.2	12	22	3	HJ 2318 E	0.66
	137	14	24	4	HJ 418	1.05
95	120.6	9	14	2.1	HJ 219 E	0.355
	120.6	9	15.5	2.1	HJ 2219 E	0.365
	132.2	13	20.5	3	HJ 319 E	0.785
	132.2	13	24.5	3	HJ 2319 E	0.815
	147	15	25.5	4	HJ 419	1.3
100	127.5	10	15	2.1	HJ 220 E	0.44
	127.5	10	16	2.1	HJ 2220 E	0.45
	139.6	13	20.5	3	HJ 320 E	0.89
	139.6	13	23.5	3	HJ 2320 E	0.92
	153.5	16	27	4	HJ 420	1.5
105	145	13	20.5	3	HJ 321 E	0.97
	159.5	16	27	4	HJ 421	1.65
110	141.7	11	17	2.1	HJ 222 E	0.62
	141.7	11	19.5	2.1	HJ 2222 E	0.645
	155.8	14	22	3	HJ 322 E	1.21
	155.8	14	26.5	3	HJ 2322 E	1.27
	171	17	29.5	4	HJ 422	2.1
120	153.4	11	17	2.1	HJ 224 E	0.71
	153.4	11	20	2.1	HJ 2224 E	0.745
	168.6	14	22.5	3	HJ 324 E	1.41
	168.6	14	26	3	HJ 2324 E	1.46
	188	17	30.5	5	HJ 424	2.6
130	164.2	11	17	3	HJ 226 E	0.79
	164.2	11	21	3	HJ 2226 E	0.84
	182.3	14	23	4	HJ 326 E	1.65
	182.3	14	28	4	HJ 2326 E	1.73
	205	18	32	5	HJ 426	3.3
140	180	11	18	3	HJ 228 E	0.99
	180	11	23	3	HJ 2228 E	1.07
	196	15	25	4	HJ 328 E	2.04
	196	15	31	4	HJ 2328 E	2.14
	219	18	33	5	HJ 428	3.75

	Bounda	ry Dim (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$r_1 \atop ext{min.}$	Numbers	approx.
150	193.7	12	19.5	3	HJ 230 E	1.26
	193.7	12	24.5	3	HJ 2230 E	1.35
	210	15	25	4	HJ 330 E	2.35
	210	15	31.5	4	HJ 2330 E	2.48
	234	20	36.5	5	HJ 430	4.7
160	207.3	12	20	3	HJ 232 E	1.48
	206.1	12	24.5	3	HJ 2232 E	1.55
	222	15	25	4	HJ 332 E	2.59
	222.1	15	32	4	HJ 2332 E	2.76
170	220.8	12	20	4	HJ 234 E	1.7
	219.5	12	24	4	HJ 2234 E	1.79
	238	16	33.5	4	HJ 2334 E	3.25
180	230.8	12	20	4	HJ 236 E	1.79
	229.5	12	24	4	HJ 2236 E	1.88
	252	17	35	4	HJ 2336 E	3.85
190	244.5	13	21.5	4	HJ 238 E	2.19
	243.2	13	26.5	4	HJ 2238 E	2.31
	260.6	18	36.5	5	HJ 2338 E	4.45
200	258.2	14	23	4	HJ 240 E	2.65
	258	14	34	4	HJ 2240	2.6
	256.9	14	28	4	HJ 2240 E	2.78
	280	18	30	5	HJ 340 E	5.0
220	286	15	27.5	4	HJ 244	3.55
	286	15	36.5	4	HJ 2244	3.55
	307	20	36	5	HJ 344	7.05
240	313	16	29.5	4	HJ 248	4.65
	313	16	38.5	4	HJ 2248	4.65
	334	22	39.5	5	HJ 348	8.2
260	340	18	33	5	HJ 252	6.2
	340	18	40.5	5	HJ 2252	6.2
	362	24	43	6	HJ 352	11.4
280	360	18	33	5	HJ 256	7.4
300	387	20	34.5	5	HJ 260	9.15
320	415	21	37	5	HJ 264	11.3



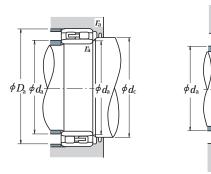
Bore Diameter 25 – 140 mm



			ry Dimensio (mm)	ons		Basic Load (N		Limiting Speeds (min ⁻¹)	
d	D	В	$m{r}$ min.	$F_{ m W}$	E_{W}	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
25	47	16	0.6	_	41.3	25 800	30 000	14 000	17 000
30	55	19	1	_	48.5	31 000	37 000	12 000	14 000
35	62	20	1	_	55	39 500	50 000	10 000	12 000
40	68	21	1	_	61	43 500	55 500	9 000	11 000
45	75	23	1	_	67.5	52 000	68 500	8 500	10 000
50	80	23	1	_	72.5	53 000	72 500	7 500	9 000
55	90	26	1.1	_	81	69 500	96 500	6 700	8 000
60	95	26	1.1	_	86.1	73 500	106 000	6 300	7 500
65	100	26	1.1	_	91	77 000	116 000	6 000	7 100
70	110	30	1.1	_	100	97 500	148 000	5 600	6 700
75	115	30	1.1	_	105	96 500	149 000	5 300	6 300
80	125	34	1.1	_	113	119 000	186 000	4 800	6 000
85	130	34	1.1	_	118	125 000	201 000	4 500	5 600
90	140	37	1.5	_	127	143 000	228 000	4 300	5 000
95	145	37	1.5	_	132	150 000	246 000	4 000	5 000
100	140 150	40 37	1.1 1.5	112 —	137	155 000 157 000	295 000 265 000	4 000 4 000	5 000 4 800
105	145 160	40 41	1.1 2	117 —	146	161 000 198 000	315 000 320 000	3 800 3 800	4 800 4 500
110	150 170	40 45	1.1 2	122 —	 155	167 000 229 000	335 000 375 000	3 600 3 400	4 500 4 300
120	165 180	45 46	1.1 2	133.5	 165	183 000 239 000	360 000 405 000	3 200 3 200	4 000 3 800
130	180 200	50 52	1.5 2	144	 182	274 000 284 000	545 000 475 000	3 000 3 000	3 800 3 600
140	190 210	50 53	1.5 2	154 —	 192	283 000 298 000	585 000 515 000	2 800 2 800	3 600 3 400



Remarks Production of double-row cylindrical roller bearings is generally in the high precision classes (Class 5 or better).



Bearing	Numbers		Abutment and Fillet Dimensions (mm)								
Cylindrical Bore	Tapered Bore(1)	$d_{\!\scriptscriptstyle a}$	max.	$d_{ ext{1a}} \atop ext{min.}$	$d_{ m c}$ min.	max.	a min.	$r_{ m a}$ max.	арргох.		
NN 3005	NN 3005 K	29	_	29	_	43	42	0.6	0.127		
NN 3006	NN 3006 K	35	_	36	_	50	50	1	0.198		
NN 3007	NN 3007 K	40	_	41	_	57	56	1	0.258		
NN 3008	NN 3008 K	45	_	46	_	63	62	1	0.309		
NN 3009	NN 3009 K	50	_	51	_	70	69	1	0.407		
NN 3010	NN 3010 K	55	_	56	_	75	74	1	0.436		
NN 3011	NN 3011 K	61.5	_	62	_	83.5	83	1	0.647		
NN 3012	NN 3012 K	66.5	_	67	_	88.5	88	1	0.693		
NN 3013	NN 3013 K	71.5	_	72	_	93.5	93	1	0.741		
NN 3014	NN 3014 K	76.5	_	77	_	103.5	102	1	1.06		
NN 3015	NN 3015 K	81.5	_	82	_	108.5	107	1	1.11		
NN 3016	NN 3016 K	86.5	_	87	_	118.5	115	1	1.54		
NN 3017	NN 3017 K	91.5	_	92	_	123.5	120	1	1.63		
NN 3018	NN 3018 K	98	_	99	_	132	129	1.5	2.09		
NN 3019	NN 3019 K	103	_	104	_	137	134	1.5	2.19		
NNU 4920 NN 3020	NNU 4920 K NN 3020 K	106.5 108	111 —	108 109	115 —	133.5 142	_ 139	1 1.5	1.9 2.28		
NNU 4921 NN 3021	NNU 4921 K NN 3021 K	111.5 114	116 —	113 115	120 —	138.5 151	148	1 2	1.99 2.88		
NNU 4922 NN 3022	NNU 4922 K NN 3022 K	116.5 119	121 —	118 121	125 —	143.5 161	 157	1 2	2.07 3.71		
NNU 4924 NN 3024	NNU 4924 K NN 3024 K	126.5 129	133 —	128 131	137 —	158.5 171	_ 167	1 2	2.85 4.04		
NNU 4926 NN 3026	NNU 4926 K NN 3026 K	138 139	143 —	140 141	148 —	172 191	 185	1.5 2	3.85 5.88		

151

153 150

201

158 182

4.08

6.34

195

2

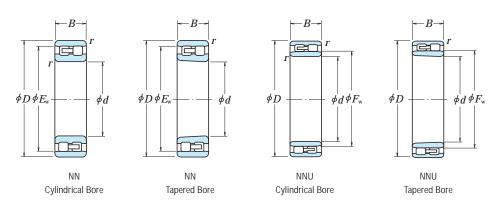
Note (2) d_a (max.) are values for adjusting rings for the NNU Type.

NNU 4928 NNU 4928 K 148

NN 3028 NN 3028 K 149

B 106 B 107

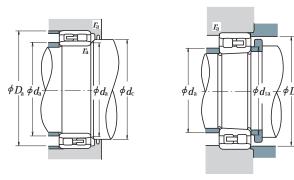
Bore Diameter 150 – 360 mm



			ry Dimensio (mm)	ons			ad Ratings N)	Limiting Speeds (min ⁻¹)		
d	D	В	$m{r}$ min.	$F_{ m W}$	$E_{ m W}$	$C_{ m r}$	$C_{ m 0r}$	Grease	Oil	
150	210 225	60 56	2 2.1	167 —	 206	350 000 335 000	715 000 585 000	2 600 2 600	3 200 3 000	
160	220 240	60 60	2 2.1	177 —	219	365 000 375 000	760 000 660 000	2 400 2 400	3 000 2 800	
170	230 260	60 67	2 2.1	187 —	236	375 000 450 000	805 000 805 000	2 400 2 200	2 800 2 600	
180	250 280	69 74	2 2.1	200 —	 255	480 000 565 000	1 020 000 995 000	2 200 2 000	2 600 2 400	
190	260 290	69 75	2 2.1	211.5 —	 265	485 000 595 000	1 060 000 1 080 000	2 000 2 000	2 600 2 400	
200	280 310	80 82	2.1 2.1	223	 282	570 000 655 000	1 220 000 1 170 000	1 900 1 800	2 400 2 200	
220	300 340	80 90	2.1 3	243	310	600 000 815 000	1 330 000 1 480 000	1 700 1 700	2 200 2 000	
240	320 360	80 92	2.1 3	263 —	330	625 000 855 000	1 450 000 1 600 000	1 600 1 500	2 000 1 800	
260	360 400	100 104	2.1 4	289 —	364	935 000 1 030 000	2 100 000 1 920 000	1 400 1 400	1 800 1 700	
280	380 420	100 106	2.1 4	309	384	960 000 1 080 000	2 230 000 2 080 000	1 300 1 300	1 700 1 500	
300	420 460	118 118	3 4	336	418	1 230 000 1 290 000	2 870 000 2 460 000	1 200 1 200	1 500 1 400	
320	440 480	118 121	3 4	356 —	438	1 260 000 1 350 000	3 050 000 2 670 000	1 100 1 100	1 400 1 300	
340	520	133	5	_	473	1 670 000	3 300 000	1 000	1 200	
360	540	134	5	_	493	1 700 000	3 450 000	950	1 200	



Remarks Production of double-row cylindrical roller bearings is generally in the high precision classes (Class 5 or better).



Bearing Numbers		Ak	outment	and Fillet (mm)	Dimensi	ions		Mass (kg)
Cylindrical Bore Tapered Borel	(1) min	$d_{\mathrm{a}}^{(2)}$ max.	$d_{ ext{1a}} \atop ext{min.}$	$d_{ m c}$ min.	max.	D_{a} min.	$r_{ m a}$ max.	approx.
NNU 4930 NNU 4930 NN 3030 NN 3030		166 —	162 162	171 —	201 214	 209	2 2	6.39 7.77
NNU 4932 NNU 4932 NN 3032 NN 3032		176 —	172 172	182 —	211 229	 222	2 2	6.76 9.41
NNU 4934 NNU 4934 NN 3034 NN 3034		186 —	182 183	192 —	221 249	 239	2 2	7.12 12.8
NNU 4936 NNU 4936 NN 3036 NN 3036		199 —	193 193	205 —	241 269	 258	2 2	10.4 16.8
NNU 4938 NNU 4938 NN 3038 NN 3038		211 —	203 203	217 —	251 279	 268	2 2	10.9 17.8
NNU 4940 NNU 4940 NN 3040 NN 3040		222 —	214 214	228 —	269 299	 285	2 2	15.3 22.7
NNU 4944 NNU 4944 NN 3044 NN 3044		242	234 236	248 —	289 327	 313	2 2.5	16.6 29.6
NNU 4948 NNU 4948 NN 3048 NN 3048		262 —	254 256	269 —	309 347	334	2 2.5	18 32.7
NNU 4952 NNU 4952 NN 3052 NN 3052		288 —	275 278	295 —	349 384	 368	2 3	31.1 47.7
NNU 4956 NNU 4956 NN 3056 NN 3056		308	295 298	315 —	369 404	388	2 3	33 51.1
NNU 4960 NNU 4960 NN 3060 NN 3060		335 —	318 319	343	407 444	 422	2.5 3	51.9 70.7
NNU 4964 NNU 4964 NN 3064 NN 3064		355 —	338 340	363 —	427 464	 442	2.5 3	54.9 76.6
NN 3068 NN 3068	K 360	_	365	_	500	477	4	102
NN 3072 NN 3072	K 380	_	385	_	520	497	4	106

Note (2) d_a (max.) are values for adjusting rings for the NNU Type.

TAPERED ROLLER BEARINGS

METRIC DESIGN TAPERED ROLLER REARINGS

INC

The DOU

INIO DEGICIT INII EI	THE TOPPER	DET IT	
Bor	re Diameter	15 – 100mm·····	B120
Bor	re Diameter 10	05 – 240mm·····	B128
Bor	re Diameter 20	60 – 440mm·····	B134
I DESIGN TAPEREI	D ROLLER BE	ARINGS	
Bor	re Diameter	12.000 – 47.625 mm ·····	B136
Bor	re Diameter	48.412 – 69.850mm·····	B150
Bor	re Diameter :	70.000 – 206.375 mm ·····	B158
index for inch des	sign tapered ro	oller bearings is in Appendix 14 (Page C26).	
BLE-ROW TAPERE	ED ROLLER BE	EARINGS	
Bor	re Diameter	40 – 260mm·····	B172

Four-Row Tapered Roller Bearings are described on pages B334 to B339.



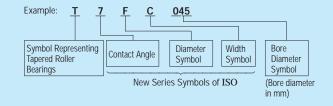
DESIGN, TYPES, AND FEATURES

Tapered roller bearings are designed so the apices of the cones formed by the raceways of the cone and cup and the conical rollers all coincide at one point on the axis of the bearing. When a radial load is imposed, an axial force component occurs; therefore, it is necessary to use two bearings in opposition or some other multiple arrangement.

For metric-design medium-angle and steep-angle tapered roller bearings, the respective contact angle symbol C or D is added after the bore number. For normal-angle tapered roller bearings, no contact angle symbol is used. Medium-angle tapered roller bearings are primarily used for the pinion shafts of differential gears of automobiles.

Among those with high load capacity(HR series), some bearings have the basic number suffixed by J to conform to the specifications of ISO for the cup back face raceway diameter, cup width, and contact angle. Therefore, the cone assembly and cup of bearings with the same basic number suffixed by J are internationally interchangeable.

Among metric-design tapered roller bearings specified by ISO 355, there are those having new dimensions that are different than the dimension series 3XX used in the past. Part of them are listed in the bearing tables. They conform to the specifications of ISO for the smaller end diameter of the cup and contact angle. The cone and cup assemblies are internationally interchangeable. The bearing number formulation, which is different than that for past metric design, is as follows:



B 110 B 111





Besides metric design tapered roller bearings, there are also inch design bearings. For the cone assemblies and cups of inch design bearings, except four-row tapered roller bearings, the bearing numbers are approximately formulated as follows:



For tapered roller bearings, besides single-row bearings, there are also various combinations of bearings, besides shighe row bearings, various combinations of bearings.

The cages of tapered roller bearings are usually pressed steel.

Table 1 Design and Featured of Combinations of Tapered Roller Bearings

Figure	Arrangement	Examples of Bearing No.	Features				
	Back-to-back	HR30210JDB+KLR10	Two standard bearings are combined. The bearing clearances are adjusted by cone spacers or cup spacers. The cones and cups and spacers are marked with serial numbers and mating marks. Components with the same serial number can be assembled referring to the matching symbols.				
	Face-to-face	HR30210JDF+KR					
	КВЕ Туре	100KBE31+L	The KBE type is a back-to-back arrangement of bearings with the cup and spacer integrated, and the KH type is a face-to-face arrangement in which the cones are integrated. Since the				
	КН Туре	110KH31+K	bearing clearance is adjusted using spacers, it is necessary for components to have the same serial number for assembly with reference to matching symbols.				

TOLERANCES AND RUNNING ACCURACY

METRIC DESIGN TAPERED ROLLER

BEARINGS Table 8.3 (Pages A64 to A67) INCH DESIGN TAPERED ROLLER BEARINGS Table 8.4 (Pages A68 and A69) Among inch design tapered roller bearings, there are those to which the following precision classes apply. For more details, please consult with NSK.

(1) J line bearings (in the bearing tables, bearings preceded by ▲)

Table 2 Tolerances for Cones(CLASS K)

Units: µm

2											
(ore Diameter d m)	Δ	<i>d</i> mp	$V_{d\mathrm{p}}$	$V_{d\mathrm{mp}}$	K _{ia}					
over	incl.	high	low	max.	max.	max.					
10	18	0	- 12	12	9	15					
18	30	0	- 12	12	9	18					
30	50	0	- 12	12	9	20					
50	80	0	- 15	15	11	25					
80	120	0	- 20	20	15	30					
120	180	0	- 25	25	19	35					
180	250	0	- 30	30	23	50					
250	315	0	- 35	35	26	60					
315	400	0	- 40	40	30	70					

Table 3 Tolerances for Cups(CALSS K)

Units: µm

						<u> </u>
Nominal Diam D (r		Δ	Dmp	V_{Dp}	$V_{D{ m mp}}$	K _{ea}
over	incl.	high	low	max.	max.	max.
18	30	0	-12	12	9	18
30	50	0	-14	14	11	20
50	80	0	-16	16	12	25
80	120	0	-18	18	14	35
120	150	0	-20	20	15	40
150	180	0	- 25	25	19	45
180	250	0	- 30	30	23	50
250	315	0	-35	35	26	60
315	400	0	-40	40	30	70
400	500	0	- 45	45	34	80

B 112 B 113



Table 4 Tolerances for Effective Widths of Cone Assemblies and Cups, and Overall Width (CLASS K)

Units: µm

	lore Diameter d nm)	of Cone	didth Deviation Assembly	Deviation	re Width on of Cup T _{2S}	Overall Width Deviation $\Delta_{T_{ m S}}$		
over	incl.	high low		high	low	high	low	
10	80	+100	0	+100	0	+200	0	
80	120	+100	- 100	+100	- 100	+200	- 200	
120	315	+150	- 150	+200	- 100	+350	- 250	
315	400	+200	- 200	+200	– 200	+400	- 400	

(2) Bearings for Front Axles of Automobiles

(In the bearing tables, those preceded by t)

Table 5 Tolerances for Bore Diameter and Overall Width

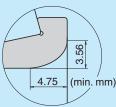
Units: µm

ı	Nominal Bo	re Diameter 1		Bore Di Devia ⊿	ation	Overall Width Deviation Δ_{Ts}	
(mm)	/er 1/25.4	(mm)	icl. 1/25.4	high	low	high	low
_	_	76.200	3.0000	+20	0	+356	0

The tolerances for outside diameter and those for radial runout of the cones and cups conform to Table 8.4.2 (Pages A68 and A69).

(3) Special Chamfer Dimensions

For bearings marked "spec." in the column of r in the bearing tables, the chamfer dimension of the cone back-face side is as shown on the following figure.



RECOMMENDED FITS

METRIC DESIGN TAPERED ROLLER	
BEARINGS	·· Table 9.2 (Page A84)
	Table 9.4 (Page A85)
INCH DESIGN TAPERED ROLLER BEARINGS	· Table 9.6 (Page A86)
	Table 9.7 (Page A87)

INTERNAL CLEARANCE

METRIC DESIGN TAPERED ROLLER BEARINGS	
(Matched and Double-Row) ······	Table 9.16 (Page A93)
INCH DESIGN TAPERED ROLLER BEARINGS	
(Matched and Double-Row)	Table 9.16 (Page A93)

DIMENSIONS RELATED TO MOUNTING

The dimensions related to mounting tapered roller bearings are listed in the bearing tables. Since the cages protrude from the ring faces of tapered roller bearings, please use care when designing shafts and housings.

When heavy axial loads are imposed, the shaft shoulder dimensions and strength must be sufficient to support the cone rib.

PERMISSIBLE MISALIGNMENT

The permissible misalignment angle for tapered roller bearings is approximately 0.0009 radian (3').

LIMITING SPEEDS

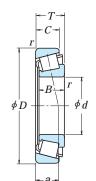
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

PRECAUTIONS FOR USE OF TAPERED ROLLER BEARINGS

- 1. If the load on tapered roller bearings becomes too small, or if the ratio of the axial and radial loads for matched bearings exceeds 'e'(e is listed in the bearing tables)during operation, slippage between the rollers and raceways occurs, which may result in smearing. Especially with large bearings since the weight of the rollers and cage is high. If such load conditions are expected, please contact NSK for selection of the bearings.
- 2. Confirm the dimension of "Abutment and Fillet Dimensions" of $D_{\rm a}$, $D_{\rm b}$, $S_{\rm a}$, $S_{\rm b}$ at the time of the HR series adoption.

B 114 B 115

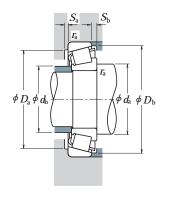
Bore Diameter 15 – 28 mm



		Bound	ary Dimen	sions				Basic Load			Limiting	•
			(mm)		Cone	Cup	1)	•	{kṛ	-	(mi	,
d	D	T	В	С	n	r nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
15	35	11.75	11	10	0.6	0.6	14 800	13 200	1 510	1 350	11 000	15 000
	42	14.25	13	11	1	1	23 600	21 100	2 400	2 160	9 500	13 000
17	40	13.25	12	11	1	1	20 100	19 900	2 050	2 030	9 500	13 000
	40	17.25	16	14	1	1	27 100	28 000	2 770	2 860	9 500	13 000
	47	15.25	14	12	1	1	29 200	26 700	2 980	2 720	8 500	12 000
20	47 47 42	15.25 20.25 15	14 19 15	10.5 16 12	1 1 0.6	1 1 0.6	22 000 37 500	20 300 36 500 27 400	2 240 3 800	2 070 3 750 2 800	8 000 8 500 9 000	11 000 11 000
20	47 47	15.25 15.25	14 14	12 12	1 0.3	1 1	24 600 27 900 23 900	28 500 24 000	2 510 2 850 2 430	2 900 2 450	8 000 8 000	12 000 11 000 11 000
	47	19.25	18	15	1	1	35 500	37 500	3 650	3 850	8 500	11 000
	47	19.25	18	15	1	1	31 500	33 500	3 200	3 400	8 000	11 000
	52	16.25	15	13	1.5	1.5	35 000	33 500	3 550	3 400	7 500	10 000
22	52	16.25	15	12	1.5	1.5	25 300	24 500	2 580	2 490	7 100	10 000
	52	22.25	21	18	1.5	1.5	45 500	47 500	4 650	4 850	8 000	11 000
	44	15	15	11.5	0.6	0.6	25 600	29 400	2 610	3 000	8 500	11 000
22	50	15.25	14	12	1	1	29 200	30 500	2 980	3 150	7 500	10 000
	50	15.25	14	12	1	1	27 200	29 500	2 780	3 000	7 500	10 000
	50	19.25	18	15	1	1	36 500	40 500	3 750	4 100	7 500	11 000
	50	19.25	18	15	1	1	33 500	39 500	3 400	4 000	7 500	10 000
	56	17.25	16	14	1.5	1.5	37 000	36 500	3 750	3 750	7 100	9 500
	56	17.25	16	13	1.5	1.5	34 500	34 000	3 500	3 500	6 700	9 500
25	47	15	15	11.5	0.6	0.6	27 400	33 000	2 800	3 400	8 000	11 000
	47	17	17	14	0.6	0.6	31 000	38 000	3 150	3 900	8 000	11 000
	52	16.25	15	13	1	1	32 000	35 000	3 300	3 550	7 100	10 000
	52	16.25	15	12	1	1	28 100	31 500	2 860	3 200	9 700	9 500
	52	19.25	18	16	1	1	40 000	45 000	4 050	4 600	7 100	10 000
	52	19.25	18	15	1	1	35 000	42 000	3 550	4 250	7 100	9 500
	52	22	22	18	1	1	47 500	56 500	4 850	5 750	7 500	10 000
	62	18.25	17	15	1.5	1.5	47 500	46 000	4 850	4 700	6 300	8 500
	62	18.25	17	14	1.5	1.5	42 000	45 000	4 300	4 550	6 000	8 500
	62	18.25	17	13	1.5	1.5	38 000	40 500	3 900	4 100	5 600	8 000
	62	18.25	17	13	1.5	1.5	38 000	40 500	3 900	4 100	5 600	8 000
	62	25.25	24	20	1.5	1.5	62 500	66 000	6 400	6 750	6 300	8 500
28	52	16	16	12	1	1	32 000	39 000	3 300	3 950	7 100	9 500
	58	17.25	16	14	1	1	39 500	41 500	4 050	4 200	6 300	9 000
	58	17.25	16	12	1	1	34 000	38 500	3 450	3 900	6 300	8 500
	58	20.25	19	16	1	1	47 500	54 000	4 850	5 500	6 300	9 000
	58	20.25	19	16	1	1	42 000	49 500	4 300	5 050	6 300	9 000
	68	19.75	18	15	1.5	1.5	55 000	55 500	5 650	5 650	6 000	8 000
	68	19.75	18	14	1.5	1.5	49 500	50 500	5 000	5 150	5 600	7 500
	68	19.75		14	1.5		49 500	50 500	5 000			7 500

Remarks The suffix C represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix C.





Dynamic Equivalent Load P = XF + VF

$P = X F_{\rm r} + Y F_{\rm a}$										
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$								
X	Y	X	Y							
1	0	0.4	V.							

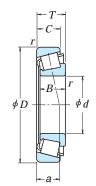
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$, use $P_0 = F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

	ISO355			Abutn		d Fillet [(mm)	Dimens	ions		Eff. Load Centers	Constant	Axial Fac	Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	1 max.	D _a min.	$D_{ m b}$ min.	S_{a} min.	$S_{ m b}$ min.	Cone Cup $m{r_{ m a}}_{ m max.}$	(mm) a	e	Y_1	Y_0	арргох.
30202 HR 30302 J HR 30203 J HR 30203 J HR 30303 J	2FB 2DB 2DD 2FB	23 24 26 26 26 29	19 22 23 22 24 23	30 36 34 34 41 41	30 36 34 34 40 34	33 38.5 37.5 37 43	2 2 2 2 2 2	1.5 3 2 3 3 4.5	0.6 0.6 1 1 1 1 1 1 1 1	8.2 9.5 9.7 11.2 10.4 15.4	0.32 0.29 0.35 0.31 0.29 0.81	1.9 2.1 1.7 1.9 2.1 0.74	1.0 1.2 0.96 1.1 1.2 0.41	0.053 0.098 0.079 0.103 0.134 0.129
HR 32303 J HR 32004 XJ HR 30204 J HR 30204 C-A- HR 32204 J	2FD 3CC 2DB — 2DD	28 28 29 29 29	23 24 27 26 25	41 37 41 41 41	39 35 40 37 38	43 40 44 44 44.5	2 3 2 2 3	4 3 3 3 4	1 1 0.6 0.6 1 1 0.3 1 1 1	12.5 10.6 11.0 13.0 12.6	0.29 0.37 0.35 0.55 0.33	2.1 1.6 1.7 1.1	1.2 0.88 0.96 0.60 1.0	0.178 0.097 0.127 0.126 0.161
HR 32204 CJ HR 30304 J 30304 D HR 32304 J	5DD 2FB — 2FD	29 31 34 33	25 27 26 26	41 44 43 43	36 44 37 42	44 47.5 49 48	2 2 2 3	4 3 4 4	1 1 1.5 1.5 1.5 1.5 1.5 1.5	14.5 11.6 16.7 13.9	0.52 0.30 0.81 0.30	1.2 2.0 0.74 2.0	0.64 1.1 0.41 1.1	0.166 0.172 0.168 0.241
HR 320/22 XJ HR 302/22 HR 302/22 C HR 322/22 HR 322/22 C	3CC — — — —	30 31 31 31 31	27 29 29 28 29	39 44 44 44 44	37 42 40 41 39	42 47 47 47 48	3 2 2 2 2	3.5 3 4 4	0.6 0.6 1 1 1 1 1 1 1 1	11.1 11.6 13.0 13.5 15.2	0.40 0.37 0.49 0.37 0.51	1.5 1.6 1.2 1.6 1.2	0.83 0.90 0.67 0.89 0.65	0.103 0.139 0.144 0.18 0.185
HR 303/22 HR 303/22 C HR 32005 XJ HR 33005 J HR 30205 J	4CC 2CE 3CC	33 33 33 33 34	30 30 30 29 31	47 47 42 42 46	46 44 40 41 44	50 52.5 45 44 48.5	2 3 3 3 2	3 4 3.5 3	1.5 1.5 1.5 1.5 0.6 0.6 0.6 0.6 1 1	12.4 15.9 11.8 11.0 12.7	0.32 0.59 0.43 0.29 0.37	1.9 1.0 1.4 2.1 1.6	1.0 0.56 0.77 1.1 0.88	0.208 0.207 0.116 0.131 0.157
HR 30205 C HR 32205 J HR 32205 C HR 33205 J HR 30305 J	2CD — 2DE 2FB	34 34 34 34 36	32 30 30 29 34	46 46 46 46 54	43 44 40 43 54	49.5 50 50 49.5 57	2 2 2 4 2	4 3 4 4 3	1 1 1 1 1 1 1 1 1.5 1.5	14.4 13.5 15.8 14.1 13.2	0.53 0.36 0.53 0.35 0.30	1.1 1.7 1.1 1.7 2.0	0.62 0.92 0.62 0.94 1.1	0.155 0.189 0.19 0.221 0.27
HR 30305 C HR 30305 DJ HR 31305 J HR 32305 J HR 320/28 XJ	(7FB) 7FB 2FD 4CC	36 39 39 38 37	35 34 33 32 33	53 53 53 53 46	49 47 47 51 44	58.5 59 59 57 50	3 2 3 3	4 5 5 5 4	1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1 1 1	16.4 19.9 19.9 15.6 12.8	0.55 0.83 0.83 0.30 0.43	1.1 0.73 0.73 2.0 1.4	0.60 0.40 0.40 1.1 0.77	0.276 0.265 0.265 0.376 0.146
HR 302/28 HR 302/28 C HR 322/28 HR 322/28 CJ HR 303/28 HR 303/28 C	 5DD 	37 37 37 37 39 39	34 34 34 33 37 38	52 52 52 52 52 59 59	50 48 49 45 58 57	55 54 55 55 61 63	2 2 2 2 2 3	3 5 4 4 4.5 5.5	1 1 1 1 1 1 1 1 1.5 1.5 1.5 1.5	13.2 16.9 14.6 16.8 14.5 17.4	0.35 0.64 0.37 0.56 0.31 0.52	1.7 0.94 1.6 1.1 1.9 1.2	0.93 0.52 0.89 0.59 1.1 0.64	0.203 0.198 0.243 0.251 0.341 0.335

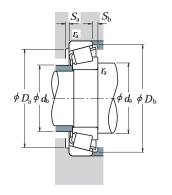
Bore Diameter 30 – 35 mm



		Bound	ary Dimen (mm)	sions				Basic Load	Ratings {kgf	١	Limiting Speeds (min ⁻¹)	
d	D	T	В	C		Cup r nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
30	47 55 55	12 17 20	12 17 20	9 13 16	0.3 1 1	0.3 1 1	17 600 36 000 42 000	24 400 44 500 54 000	3 700	2 490 4 550 5 500	7 500 6 700 6 700	10 000 9 000 9 000
	62 62 62	17.25 17.25 21.25	16 16 20	14 12 17	1 1 1	1 1 1	43 000 35 500 52 000	47 500 37 000 60 000	3 650	4 850 3 800 6 150	6 000 5 600 6 000	8 000 7 500 8 500
	62 62 72 72	21.25 25 20.75 20.75	20 25 19 19	16 19.5 16 14	1 1 1.5 1.5	1 1 1.5 1.5	48 000 66 500 59 500 56 500	56 000 79 500 60 000 55 500	6 800 6 050	5 750 8 100 6 100 5 650	6 000 6 000 5 300 5 300	8 000 8 000 7 500 7 100
	72 72 72 72	20.75 20.75 28.75 28.75	19 19 27 27	14 14 23 23	1.5 1.5 1.5 1.5	1.5 1.5 1.5 1.5	49 000 49 000 80 000 76 000	52 500 52 500 88 500 86 500	5 000 8 150	5 350 5 350 9 000 8 800	4 800 4 800 5 600 5 600	6 700 6 800 7 500 7 500
32	58 58 65 65	17 21 18.25 18.25	17 20 17 17	13 16 15 14	1 1 1	1 1 1	37 500 41 000 48 500 45 500	47 000 50 000 54 000 52 500	4 150 4 950	4 800 5 100 5 500 5 350	6 300 6 300 5 600 5 600	8 500 8 500 8 000 7 500
	65 65 65 75	22.25 22.25 26 21.75	21 21 26 20	18 17 20.5 17	1 1 1 1.5	1 1 1 1.5	56 000 49 500 70 000 56 000	65 000 60 000 86 500 56 000	5 050 7 150	6 650 6 100 8 850 5 700	6 000 5 600 5 600 5 300	8 000 7 500 8 000 7 100
35	55 62 62	14 18 21	14 18 21	11.5 14 17	0.6 1 1	0.6 1 1	27 400 43 500 49 000	39 000 55 500 65 000	4 400	3 950 5 650 6 650	6 300 5 600 5 600	8 500 8 000 8 000
	72 72 72	18.25 18.25 24.25	17 17 23	15 13 19	1.5 1.5 1.5	1.5 1.5 1.5	54 000 47 000 70 500	59 500 54 500 83 500	4 750	6 050 5 550 8 550	5 300 5 000 5 300	7 100 6 700 7 100
	72 72 80	24.25 28 22.75	23 28 21	18 22 18	1.5 1.5 2	1.5 1.5 1.5	60 500 86 500 76 000	71 500 108 000 79 000	8 850 1	7 300 1 100 8 050	5 000 5 300 4 800	7 100 7 100 6 700
	80 80 80 80	22.75 22.75 22.75 32.75	21 21 21 31	16 15 15 25	2 2 2 2	1.5 1.5 1.5 1.5	68 000 62 000 62 000 99 000	70 500 68 000 68 000 111 000	6 350 6 350	7 200 6 950 6 950 1 300	4 800 4 300 4 300 5 000	6 300 6 000 6 000 6 700

Remarks The suffix C represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix C.





Dynamic Equivalent Load P = XF + VF

$F = \Lambda$				
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e	
X	Y	X	Y	
1	0	0.4	Y ₁	

Static Equivalent Load

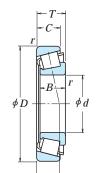
 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}\!>\!0.5\,F_{\rm r}+Y_0\,F_{\rm a}$, use P_0 = $F_{\rm r}$ The values of $\emph{e},~Y_1$, and Y_0 are

given in the table below.

HR 32906 J approx. Min. Max. Max. Min. Min. Min. Min. Min. Min. Min. Min	Bearing Numbers	ISO355 Dimension	ring Numbers			Abutn		d Fillet [(mm)	Dimens	ions	Cur	Eff. Load Centers	Constant	Axial Fact	Load tors	Mass (kg)	
HR 32006 XJ	bearing Numbers	Series	ing Numbers								1	a		e	<i>Y</i> ₁	Y_0	арргох.
HR 30206 C HR 32206 J 3DC 39 36 56 49 59 2 5 1 1 1 17.8 0.68 0.88 0.49 0.221 HR 32206 C — 39 35 56 48 59 2 5 5.5 1 1 1 17.8 0.55 1.1 0.60 0.293 HR 33206 J 2DE 39 35 56 52 59.5 5 5.5 1 1 1 17.8 0.34 1.8 0.97 0.355 HR 30306 J 2FB 41 40 63 62 66 3 4.5 1.5 1.5 1.5 10.32 1.9 1.1 0.60 0.383 HR 30306 DJ (7FB) 44 40 63 55 68 3 6.5 1.5 1.5 1.5 1.5 10.32 1.9 1.1 0.60 0.383 HR 30306 J 2FD 43 38 63 59 67 3 6.5 1.5 1.5 1.5 1.5 10.32 1.9 1.1 0.60 0.383 HR 32306 J 2FD 43 38 63 59 66 3 5.5 1.5 1.5 1.5 1.5 1.5 10.32 1.9 1.1 0.60 0.383 HR 32306 CJ 5FD 43 36 63 54 68 3 6.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1	HR 32006 XJ	4CC	32006 XJ	39	35	49	47	53	3	4	1	1	13.5	0.43	1.4	0.77	0.074 0.172 0.208
HR 33206 J	HR 30206 C	_	30206 C	39	36	56	49	59	2	5	1	1	17.8	0.68	0.88	0.49	0.238 0.221 0.297
HR 31306 J	HR 33206 J HR 30306 J	2FB	33206 J 30306 J	39 41	35 40	56 63	52 62	59.5 66	5 3	5.5 4.5	1 1.5	1 1.5	16.1 15.1	0.34 0.32	1.8	0.97	0.293 0.355 0.403 0.383
330/32 — 41 37 52 50 55 2 4 1 1 1 13.8 0.31 1.9 1.1 0.225 HR 302/32 — 41 39 59 56 61 3 3 1 1 14.7 0.37 1.6 0.88 0.277 HR 302/32 C — 41 39 59 54 62 3 4 1 1 1 16.9 0.55 1.1 0.60 0.273 HR 322/32 — 41 38 59 54 61 3 4 1 1 15.9 0.37 1.6 0.88 0.336 HR 322/32 C — 41 39 59 51 62 3 5 1 1 20.2 0.59 1.0 0.56 0.335 HR 332/32 J 2DE 41 38 59 55 62 5 5.5 1 1 17.0 0.35 1.7 0.95 0.40 303/32 — 44 42 66 64 68 3 4.5 1.5 1.5 1.5 15.9 0.33 1.8 1.0 0.435 HR 32907 J 2BD 43 40 50 50 52.5 3 2.5 0.6 0.6 10.7 0.29 2.1 1.1 0.123 HR 32007 XJ 4CC 44 40 56 54 60 4 4 1 1 15.0 0.45 1.3 0.73 0.229 HR 33007 J 2CE 44 40 56 55 59 4 4 1 1 1 15.0 0.45 1.3 0.73 0.229 HR 30207 J 3DB 46 43 63 62 67 3 3 1.5 1.5 1.5 15.0 0.37 1.6 0.88 0.34 HR 30207 J 3DB 46 43 63 62 67 3 3 1.5 1.5 1.5 15.0 0.37 1.6 0.88 0.34 HR 30207 J 3DB 46 43 63 62 67 3 3 1.5 1.5 1.5 19.6 0.66 0.91 0.50 0.331	HR 31306 J HR 32306 J	7FB 2FD	31306 J 32306 J	44	40 38	63 63	55 59	68 66	3	6.5 5.5	1.5 1.5	1.5 1.5	23.1 18.0	0.83 0.32	0.73 1.9	0.40 1.1	0.393 0.393 0.57 0.583
HR 322/32 C HR 332/32 J 2DE 41 38 59 55 62 5 5.5 1 1 20.2 0.59 1.0 0.56 0.335 303/32 — 44 42 66 64 68 3 4.5 1.5 1.5 1.5 15.0 0.35 1.7 0.95 0.40 0.435 HR 32907 J 2BD 43 40 50 50 52.5 3 2.5 0.6 0.6 10.7 0.29 2.1 1.1 0.123 HR 32007 XJ 4CC 44 40 56 54 60 4 4 1 1 15.0 0.45 1.3 0.73 0.229 HR 33007 J 2CE 44 40 56 55 59 4 4 1 1 1 14.1 0.31 2.0 1.1 0.267 HR 32007 J 3DB 46 43 63 62 67 3 3 1.5 1.5 1.5 15.0 0.37 1.6 0.88 0.34 HR 30207 C — 46 44 63 59 68 3 5 1.5 1.5 1.5 19.6 0.66 0.91 0.50 0.331	330/32 HR 302/32	_	330/32 302/32	41 41	37 39	52 59	50 56	55 61	2	4	i 1	i 1	13.8 14.7	0.31	1.9	1.1 0.88	0.191 0.225 0.277 0.273
HR 32007 XJ HR 33007 J 2CE 44 40 56 55 59 4 4 1 1 1 15.0 0.45 1.3 0.73 0.229 HR 30207 J 3DB 46 43 63 62 67 3 3 1.5 1.5 1.5 15.0 0.37 1.6 0.88 0.34 HR 30207 C 4 46 44 63 59 68 3 5 1.5 1.5 1.5 19.6 0.66 0.91 0.50 0.331	HR 322/32 C HR 332/32 J	— 2DE	322/32 C 332/32 J	41 41	39 38	59 59	51 55	62 62	3 5	5 5.5	1	1	20.2 17.0	0.59 0.35	1.0 1.7	0.56 0.95	0.336 0.335 0.40 0.435
HR 30207 C — 46	HR 32007 XJ	4CC	32007 XJ	44	40	56	54	60	4	4	1	1	15.0	0.45	1.3	0.73	0.123 0.229 0.267
0.00 0.40		3DB — 3DC	30207 C														0.34 0.331 0.456
HR 33207 J 2DE 46 41 63 61 68 5 6 1.5 1.5 18.3 0.35 1.7 0.93 0.54	HR 33207 J		33207 J	46	41	63	61	68	5	6	1.5	1.5	18.3	0.35	1.7	0.93	0.442 0.54 0.538
HR 30307 DJ HR 31307 J 7FB 51 44 71 62 77 3 7.5 2 1.5 25.2 0.83 0.73 0.40 0.519 HR 31307 J 7FB 51 44 71 62 77 3 7.5 2 1.5 25.2 0.83 0.73 0.40 0.52	HR 30307 DJ HR 31307 J	7FB 7FB	30307 DJ 31307 J	51 51	44 44	71 71	62 62	77 77	3	7.5 7.5	2	1.5 1.5	25.2 25.2	0.83	0.73 0.73	0.40 0.40	0.518 0.519 0.52 0.765

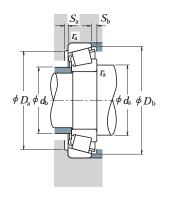
Bore Diameter 40 – 50 mm



	Boundary Dimensions (mm) Cone							Basic Load	3		Limiting	
,	$^{\prime}$,	N)	{kg		(mir	,
d	D	T	B	C	n	r nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
40	62	15	15	12	0.6	0.6	34 000	47 000	3 450	4 800	5 600	7 500
	68	19	19	14.5	1	1	53 000	71 000	5 400	7 250	5 300	7 100
	68	22	22	18	1	1	59 000	81 500	6 000	8 300	5 300	7 100
	75	26	26	20.5	1.5	1.5	78 500	101 000	8 000	10 300	4 800	6 700
	80	19.75	18	16	1.5	1.5	63 500	70 000	6 450	7 150	4 800	6 300
	80	24.75	23	19	1.5	1.5	77 000	90 500	7 900	9 200	4 800	6 300
	80	24.75	23	19	1.5	1.5	74 000	90 500	7 550	9 200	4 500	6 300
	80	32	32	25	1.5	1.5	107 000	137 000	10 900	14 000	4 800	6 300
	90	25.25	23	20	2	1.5	90 500	101 000	9 250	10 300	4 300	5 600
	90	25.25	23	18	2	1.5	84 500	93 500	8 600	9 500	4 300	5 600
	90	25.25	23	17	2	1.5	80 000	89 500	8 150	9 150	3 800	5 300
	90	25.25	23	17	2	1.5	80 000	89 500	8 150	9 150	3 800	5 300
	90	35.25	33	27	2	1.5	120 000	145 000	12 200	14 800	4 300	6 000
45	68	15	15	12	0.6	0.6	34 500	50 500	3 550	5 150	5 000	6 700
	75	20	20	15.5	1	1	60 000	83 000	6 150	8 450	4 500	6 300
	75	24	24	19	1	1	69 000	99 000	7 050	10 100	4 800	6 300
	80	26	26	20.5	1.5	1.5	84 000	113 000	8 550	11 600	4 500	6 000
	85	20.75	19	16	1.5	1.5	68 500	79 500	6 950	8 100	4 300	6 000
	85	24.75	23	19	1.5	1.5	83 000	102 000	8 500	10 400	4 300	6 000
	85	24.75	23	19	1.5	1.5	75 500	95 500	7 700	9 750	4 300	5 600
	85	32	32	25	1.5	1.5	111 000	147 000	11 300	15 000	4 300	6 000
	95	29	26.5	20	2.5	2.5	88 500	109 000	9 050	11 100	3 600	5 000
	95	36	35	30	2.5	2.5	139 000	174 000	14 200	17 800	4 000	5 300
	100	27.25	25	22	2	1.5	112 000	127 000	11 400	12 900	3 800	5 300
	100	27.25	25	18	2	1.5	95 500	109 000	9 750	11 100	3 400	4 800
	100 100	27.25 38.25	25 36	18 30	2	1.5 1.5	95 500 144 000	109 000 177 000	9 750 14 700	11 100 18 000	3 400 3 800	4 800 5 300
50	100	36	35	30	2.5	2.5	144 000	185 000	14 600	18 800	3 800	5 000
	72	15	15	12	0.6	0.6	36 000	54 000	3 650	5 500	4 500	6 300
	80	20	20	15.5	1	1	61 000	87 000	6 250	8 900	4 300	6 000
	80	24	24	19	1	1	70 500	104 000	7 150	10 600	4 300	6 000
	85	26	26	20	1.5	1.5	89 000	126 000	9 100	12 800	4 300	5 600
	90	21.75	20	17	1.5	1.5	76 000	91 500	7 750	9 300	4 000	5 300
	90	24.75	23	19	1.5	1.5	87 500	109 000	8 900	11 100	4 000	5 300
	90	24.75	23	18	1.5	1.5	77 500	102 000	7 900	10 400	3 800	5 300
	90	32	32	24.5	1.5	1.5	118 000	165 000	12 100	16 800	4 000	5 300
	105	32	29	22	3	3	109 000	133 000	11 100	13 600	3 200	4 500
	110	29.25	27	23	2.5	2	130 000	148 000	13 300	15 100	3 400	4 800
	110	29.25	27	19	2.5	2	114 000	132 000	11 700	13 400	3 200	4 300
	110	29.25	27	19	2.5	2	114 000	132 000	11 700	13 400	3 200	4 300
	110	42.25	40	33	2.5	2	176 000	220 000	17 900	22 400	3 600	4 800
	110	42.25	40	33	2.5	2	164 000	218 000	16 800	22 200	3 400	4 800

Remarks The suffix C represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix C.





Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

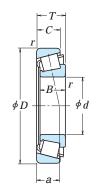
 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}\!>\!0.5\,F_{\rm r}+Y_0\,F_{\rm a}$, use P_0 = $F_{\rm r}$ The values of $\emph{e},~Y_1$, and Y_0 are

given in the table below.

	ISO355			Abutn	nent an	d Fillet (mm)	Dimens	sions	_	_	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	i	$r_{ m a}$	(mm) a	e	Y_1	Y_0	арргох.
HR 32908 J	2BC	48	44	57	57	59	3	3	0.6	0.6	11.5	0.29	2.1	1.1	0.161
HR 32008 XJ	3CD	49	45	62	60	65.5	4	4.5	1	1	15.0	0.38	1.6	0.87	0.28
HR 33008 J	2BE	49	45	62	61	65	4	4	1	1	14.6	0.28	2.1	1.2	0.322
HR 33108 J	2CE	51	46	66	65	71	4	5.5	1.5	1.5	18.0	0.36	1.7	0.93	0.503
HR 30208 J	3DB	51	48	71	69	75	3	3.5	1.5	1.5	16.6	0.37	1.6	0.88	0.437
HR 32208 J	3DC	51	48	71	68	75	3	5.5	1.5	1.5	18.9	0.37	1.6	0.88	0.548
HR 32208 CJ	5DC	51	47	71	65	76	3	5.5	1.5	1.5	21.9	0.55	1.1	0.60	0.558
HR 33208 J	2DE	51	46	71	67	76	5	7	1.5	1.5	20.8	0.36	1.7	0.92	0.744
HR 30308 J	2FB	52	52	81	76	82	3	5	2	1.5	19.5	0.35	1.7	0.96	0.758
HR 30308 C HR 30308 DJ HR 31308 J HR 32308 J	— 7FB 7FB 2FD	52 56 56 54	50 50 50 50	81 81 81 81	72 70 70 73	84 87 87 82	3 3 3	7 8 8 8	2 2 2 2	1.5 1.5 1.5 1.5	22.8 28.7 28.7 23.4	0.53 0.83 0.83 0.35	1.1 0.73 0.73 1.7	0.62 0.40 0.40 0.96	0.735 0.728 0.728 1.05
HR 32909 J	2BC	53	50	63	62	64	3	3	0.6	0.6	12.3	0.32	1.9	1.0	0.187
HR 32009 XJ	3CC	54	51	69	67	72	4	4.5	1	1	16.6	0.39	1.5	0.84	0.354
HR 33009 J	2CE	54	51	69	67	71	4	5	1	1	16.3	0.29	2.0	1.1	0.414
HR 33109 J	3CE	56	51	71	69	77	4	5.5	1.5	1.5	19.1	0.38	1.6	0.86	0.552
HR 30209 J	3DB	56	53	76	74	80	3	4.5	1.5	1.5	18.3	0.41	1.5	0.81	0.488
HR 32209 J	3DC	56	53	76	73	81	3	5.5	1.5	1.5	20.1	0.41	1.5	0.81	0.602
HR 32209 CJ	5DC	56	52	76	70	82	3	5.5	1.5	1.5	23.6	0.59	1.0	0.56	0.603
HR 33209 J	3DE	56	51	76	72	81	5	7	1.5	1.5	22.0	0.39	1.6	0.86	0.817
T 7 FC045	7FC	60	53	83	71	91	3	9	2	2	32.1	0.87	0.69	0.38	0.918
T 2 ED045	2ED	60	54	83	79	89	5	6	2	2	23.5	0.32	1.9	1.02	1.22
HR 30309 J	2FB	57	58	91	86	93	3	5	2	1.5	21.1	0.35	1.7	0.96	1.01
HR 30309 DJ	7FB	61	57	91	79	96	3	9	2	1.5	31.5	0.83	0.73	0.40	0.957
HR 31309 J HR 32309 J	7FB 2FD	61 59	57 56	91 91	79 82	96 93	3	9 8	2	1.5 1.5	31.5 25.0	0.83 0.35	0.73 1.7	0.40 0.96	0.947 1.42
T 2 ED050	2ED	65	59	88	83	94	6	6	2	2	24.2	0.34	1.8	0.96	1.3
HR 32910 J	2BC	58	54	67	66	69	3	3	0.6	0.6	13.5	0.34	1.8	0.97	0.193
HR 32010 XJ	3CC	59	56	74	71	77	4	4.5	1	1	17.9	0.42	1.4	0.78	0.38
HR 33010 J	2CE	59	55	74	71	76	4	5	1	1	17.4	0.32	1.9	1.0	0.452
HR 33110 J	3CE	61	56	76	74	82	4	6	1.5	1.5	20.3	0.41	1.5	0.8	0.597
HR 30210 J	3DB	61	58	81	79	85	3	4.5	1.5	1.5	19.6	0.42	1.4	0.79	0.557
HR 32210 J	3DC	61	57	81	78	86	3	5.5	1.5	1.5	21.0	0.42	1.4	0.79	0.642
HR 32210 CJ	5DC	61	58	81	76	87	3	6.5	1.5	1.5	24.6	0.59	1.0	0.56	0.655
HR 33210 J	3DE	61	56	81	76	87	5	7.5	1.5	1.5	23.2	0.41	1.5	0.80	0.867
T 7 FC050	7FC	74	59	91	78	100	5	10	2.5	2.5	36.4	0.87	0.69	0.38	1.22
HR 30310 J	2FB	65	65	100	95	102	3	6	2	2	23.1	0.35	1.7	0.96	1.28
HR 30310 DJ	7FB	70	62	100	87	105	3	10	2	2	34.3	0.83	0.73	0.40	1.26
HR 31310 J	7FB	70	62	100	87	105	3	10	2	2	34.3	0.83	0.73	0.40	1.26
HR 32310 J	2FD	68	62	100	91	102	3	9	2	2	28.0	0.35	1.7	0.96	1.88
HR 32310 CJ	5FD	68	59	100	82	103	3	9	2	2	32.8	0.55	1.1	0.60	1.93

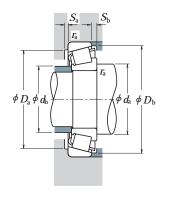
Bore Diameter 55 – 65 mm



	Boundary Dimensions (mm) Cone						(1)	Basic Load	0		Limiting 5	
d	D	T	В	C		Cup	(1)	,	{kṛ	-	(min Grease	Oil
u	D	1	D	C		$m{r}$ nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	OII
55	80	17	17	14	1	1	45 500	74 500	4 600	7 600	4 300	5 600
	90	23	23	17.5	1.5	1.5	81 500	117 000	8 300	11 900	3 800	5 300
	90	27	27	21	1.5	1.5	91 500	138 000	9 300	14 000	3 800	5 300
	95	30	30	23	1.5	1.5	112 000	158 000	11 500	16 100	3 800	5 000
	100	22.75	21	18	2	1.5	94 500	113 000	9 650	11 500	3 600	5 000
	100	26.75	25	21	2	1.5	110 000	137 000	11 200	14 000	3 600	5 000
	100	35	35	27	2	1.5	141 000	193 000	14 400	19 700	3 600	5 000
	115	34	31	23.5	3	3	126 000	164 000	12 800	16 700	3 000	4 300
	120	31.5	29	25	2.5	2	150 000	171 000	15 200	17 500	3 200	4 300
	120	31.5	29	21	2.5	2	131 000	153 000	13 400	15 600	2 800	4 000
	120	31.5	29	21	2.5	2	131 000	153 000	13 400	15 600	2 800	4 000
	120	45.5	43	35	2.5	2	204 000	258 000	20 800	26 300	3 200	4 300
	120	45.5	43	35	2.5	2	195 000	262 000	19 900	26 700	3 200	4 300
60	85	17	17	14	1	1	49 000	84 500	5 000	8 650	3 800	5 300
	95	23	23	17.5	1.5	1.5	85 500	127 000	8 700	12 900	3 600	5 000
	95	27	27	21	1.5	1.5	96 000	150 000	9 800	15 300	3 600	5 000
	100	30	30	23	1.5	1.5	115 000	166 000	11 700	16 900	3 400	4 800
	110	23.75	22	19	2	1.5	104 000	123 000	10 600	12 500	3 400	4 500
	110	29.75	28	24	2	1.5	131 000	167 000	13 400	17 000	3 400	4 500
	110	38	38	29	2	1.5	166 000	231 000	16 900	23 600	3 400	4 500
	125	37	33.5	26	3	3	151 000	197 000	15 400	20 100	2 800	3 800
	130	33.5	31	26	3	2.5	174 000	201 000	17 700	20 500	3 000	4 000
	130	33.5	31	22	3	2.5	151 000	177 000	15 400	18 100	2 600	3 800
	130	33.5	31	22	3	2.5	151 000	177 000	15 400	18 100	2 600	3 800
	130	48.5	46	37	3	2.5	233 000	295 000	23 700	30 000	3 000	4 000
	130	48.5	46	35	3	2.5	196 000	249 000	20 000	25 400	2 800	3 800
65	90	17	17	14	1	1	49 000	86 500	5 000	8 800	3 600	5 000
	100	23	23	17.5	1.5	1.5	86 500	132 000	8 800	13 500	3 400	4 500
	100	27	27	21	1.5	1.5	97 500	156 000	9 950	15 900	3 400	4 500
	110	34	34	26.5	1.5	1.5	148 000	218 000	15 100	22 200	3 200	4 300
	120	24.75	23	20	2	1.5	122 000	151 000	12 500	15 400	3 000	4 000
	120	32.75	31	27	2	1.5	157 000	202 000	16 000	20 600	3 000	4 000
	120	41	41	32	2	1.5	202 000	282 000	20 600	28 800	3 000	4 000
	140	36	33	28	3	2.5	200 000	233 000	20 400	23 800	2 600	3 600
	140	36	33	23	3	2.5	173 000	205 000	17 700	20 900	2 400	3 400
	140 140	36 51	33 48	23 39	3	2.5 2.5	173 000 267 000	205 000 340 000	17 700 27 300	20 900 35 000	2 400 2 800	3 400 3 800

Remarks The suffix C represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix C.





Dynamic Equivalent Load $P = XF_r + YF_a$

$r = \Lambda$	$\Gamma_{\rm r}$ + $I \Gamma_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

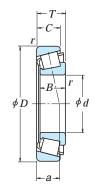
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}>$ 0.5 $F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

	ISO355		Abutment and Fillet Dimensions (mm) Cone Cup								Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	i	$r_{ m a}$	(mm) a	e	Y_1	Y_0	арргох.
HR 32911 J	2BC	64	60	74	73	76	4	3	1	1	14.6	0.31	1.9	1.1	0.282
HR 32011 XJ	3CC	66	62	81	80	86	4	5.5	1.5	1.5	19.7	0.41	1.5	0.81	0.568
HR 33011 J	2CE	66	62	81	80	86	5	6	1.5	1.5	19.2	0.31	1.9	1.1	0.657
HR 33111 J	3CE	66	62	86	82	91	5	7	1.5	1.5	22.4	0.37	1.6	0.88	0.877
HR 30211 J	3DB	67	64	91	89	94	4	4.5	2	1.5	20.9	0.41	1.5	0.81	0.736
HR 32211 J	3DC	67	63	91	87	95	4	5.5	2	1.5	22.7	0.41	1.5	0.81	0.859
HR 33211 J	3DE	67	62	91	86	96	6	8	2	1.5	25.2	0.40	1.5	0.83	1.18
T 7 FC055	7FC	73	66	101	86	109	4	10.5	2.5	2.5	39.0	0.87	0.69	0.38	1.58
HR 30311 J	2FB	70	71	110	104	111	4	6.5	2	2	24.6	0.35	1.7	0.96	1.63
HR 30311 DJ	7FB	75	67	110	94	114	4	10.5	2	2	37.0	0.83	0.73	0.40	1.58
HR 31311 J	7FB	75	67	110	94	114	4	10.5	2	2	37.0	0.83	0.73	0.40	1.58
HR 32311 J	2FD	73	67	110	99	111	4	10.5	2	2	29.9	0.35	1.7	0.96	2.39
HR 32311 CJ	5FD	73	65	110	91	112	4	10.5	2	2	35.8	0.55	1.1	0.60	2.47
HR 32912 J	2BC	69	65	79	78	81	4	3	1	1	15.5	0.33	1.8	1.0	0.306
HR 32012 XJ	4CC	71	66	86	85	91	4	5.5	1.5	1.5	20.9	0.43	1.4	0.77	0.608
HR 33012 J	2CE	71	66	86	85	90	5	6	1.5	1.5	20.0	0.33	1.8	1.0	0.713
HR 33112 J	3CE	71	68	91	88	96	5	7	1.5	1.5	23.6	0.40	1.5	0.83	0.91
HR 30212 J	3EB	72	69	101	96	103	4	4.5	2	1.5	22.0	0.41	1.5	0.81	0.930
HR 32212 J	3EC	72	68	101	95	104	4	5.5	2	1.5	24.1	0.41	1.5	0.81	1.18
HR 33212 J	3EE	72	68	101	94	105	6	9	2	1.5	27.6	0.40	1.5	0.82	1.56
T 7 FC060	7FC	78	72	111	94	119	4	11	2.5	2.5	41.4	0.82	0.73	0.40	2.03
HR 30312 J	2FB	78	77	118	112	120	4	7.5	2.5	2	26.0	0.35	1.7	0.96	2.03
HR 30312 DJ	7FB	84	74	118	103	125	4	11.5	2.5	2	40.3	0.83	0.73	0.40	1.98
HR 31312 J	7FB	84	74	118	103	125	4	11.5	2.5	2	40.3	0.83	0.73	0.40	1.98
HR 32312 J	2FD	81	74	118	107	120	4	11.5	2.5	2	31.4	0.35	1.7	0.96	2.96
32312 C	—	81	74	116	102	125	4	13.5	2.5	2	39.9	0.58	1.0	0.57	2.86
HR 32913 J	2BC	74	70	84	82	86	4	3	1	1	16.8	0.35	1.7	0.93	0.323
HR 32013 XJ	4CC	76	71	91	90	97	4	5.5	1.5	1.5	22.4	0.46	1.3	0.72	0.646
HR 33013 J	2CE	76	71	91	90	96	5	6	1.5	1.5	21.1	0.35	1.7	0.95	0.76
HR 33113 J	3DE	76	73	101	96	106	6	7.5	1.5	1.5	26.0	0.39	1.5	0.85	1.32
HR 30213 J	3EB	77	78	111	106	113	4	4.5	2	1.5	23.8	0.41	1.5	0.81	1.18
HR 32213 J	3EC	77	75	111	104	115	4	5.5	2	1.5	27.1	0.41	1.5	0.81	1.55
HR 33213 J	3EE	77	74	111	102	115	6	9	2	1.5	29.2	0.39	1.5	0.85	2.04
HR 30313 J	2GB	83	83	128	121	130	4	8	2.5	2	27.9	0.35	1.7	0.96	2.51
HR 30313 DJ	7GB	89	80	128	111	133	4	13	2.5	2	43.2	0.83	0.73	0.40	2.43
HR 31313 J HR 32313 J	7GB 2GD	89 86	80 80	128 128	111 116	133 130	4	13 12	2.5 2.5	2	43.2 34.0	0.83 0.35	0.73 1.7	0.40 0.96	2.43 3.6

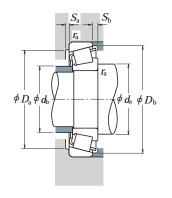
Bore Diameter 70 – 80 mm



		Bounda	ary Dimens	sions				Basic Load	Ratings		Limiting 5	
			(mm)		Cone	Cup	1)	۷)	{kg	f}	(min	ı ⁻¹)
d	D	T	В	С		$oldsymbol{r}$ nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
70	100	20	20	16	1	1	70 000	113 000	7 150	11 500	3 200	4 500
	110	25	25	19	1.5	1.5	104 000	158 000	10 600	16 100	3 200	4 300
	110	31	31	25.5	1.5	1.5	127 000	204 000	12 900	20 800	3 000	4 300
	120	37	37	29	2	1.5	177 000	262 000	18 100	26 700	3 000	4 000
	125	26.25	24	21	2	1.5	132 000	163 000	13 500	16 700	2 800	4 000
	125	33.25	31	27	2	1.5	157 000	205 000	16 100	20 900	2 800	4 000
	125	41	41	32	2	1.5	209 000	299 000	21 300	30 500	2 800	4 000
	140	39	35.5	27	3	3	177 000	229 000	18 000	23 400	2 400	3 400
	150	38	35	30	3	2.5	227 000	268 000	23 200	27 400	2 400	3 400
	150	38	35	25	3	2.5	192 000	229 000	19 600	23 300	2 200	3 200
	150	38	35	25	3	2.5	192 000	229 000	19 600	23 300	2 200	3 200
	150	54	51	42	3	2.5	300 000	390 000	30 500	39 500	2 600	3 400
	150	54	51	42	3	2.5	280 000	390 000	28 600	39 500	2 400	3 400
75	105	20	20	16	1	1	72 500	120 000	7 400	12 300	3 200	4 300
	115	25	25	19	1.5	1.5	109 000	171 000	11 100	17 400	3 000	4 000
	115	31	31	25.5	1.5	1.5	133 000	220 000	13 500	22 500	3 000	4 000
	125	37	37	29	2	2	182 000	275 000	18 600	28 100	2 800	3 800
	130	27.25	25	22	2	1.5	143 000	182 000	14 600	18 500	2 800	3 800
	130	33.25	31	27	2	1.5	165 000	219 000	16 900	22 400	2 800	3 800
	130	41	41	31	2	1.5	215 000	315 000	21 900	32 000	2 800	3 800
	160	40	37	31	3	2.5	253 000	300 000	25 800	30 500	2 400	3 200
	160	40	37	26	3	2.5	211 000	251 000	21 500	25 600	2 200	3 000
	160	40	37	26	3	2.5	211 000	251 000	21 500	25 600	2 200	3 000
	160	58	55	45	3	2.5	340 000	445 000	35 000	45 500	2 400	3 200
	160	58	55	43	3	2.5	310 000	420 000	32 000	43 000	2 200	3 200
80	110	20	20	16	1	1	75 000	128 000	7 650	13 100	3 000	4 000
	125	29	29	22	1.5	1.5	140 000	222 000	14 300	22 700	2 800	3 600
	125	36	36	29.5	1.5	1.5	172 000	282 000	17 500	28 800	2 800	3 600
	130	37	37	29	2	1.5	186 000	289 000	19 000	29 400	2 600	3 600
	140	28.25	26	22	2.5	2	157 000	195 000	16 000	19 900	2 600	3 400
	140	28.25	26	20	2.5	2	147 000	190 000	15 000	19 400	2 400	3 400
	140	35.25	33	28	2.5	2	192 000	254 000	19 600	25 900	2 600	3 400
	140	46	46	35	2.5	2	256 000	385 000	26 200	39 000	2 600	3 400
	170	42.5	39	33	3	2.5	276 000	330 000	28 200	33 500	2 200	3 000
	170	42.5	39	27	3	2.5	235 000	283 000	24 000	28 900	2 000	2 800
	170	42.5	39	27	3	2.5	235 000	283 000	24 000	28 900	2 000	2 800
	170	61.5	58	48	3	2.5	385 000	505 000	39 000	51 500	2 200	3 000
	170	61.5	58	48	3	2.5	365 000	530 000	37 500	54 000	2 200	3 000
D-		Th		A control Pro-				C! H		I 6!	4.	

Remarks The suffix CA represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix CA.





Dynamic Equivalent Load P = XF + VF

P = X	$F_{\rm r} + Y F_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

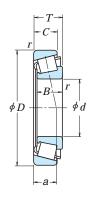
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}>$ 0.5 $F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

B	ISO355		Abutment and Fillet Dimensions (mm) Cone Cu								Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	e Cup r _a nax.	(mm) a	e	<i>Y</i> ₁	Y_0	approx.
HR 32914 J	2BC	79	76	94	93	96	4	4	1	1	17.6	0.32	1.9	1.1	0.494
HR 32014 XJ	4CC	81	77	101	98	105	5	6	1.5	1.5	23.7	0.43	1.4	0.76	0.869
HR 33014 J	2CE	81	78	101	100	105	5	5.5	1.5	1.5	22.2	0.28	2.1	1.2	1.11
HR 33114 J	3DE	82	79	111	104	115	6	8	2	1.5	27.9	0.38	1.6	0.87	1.71
HR 30214 J	3EB	82	81	116	110	118	4	5	2	1.5	25.6	0.42	1.4	0.79	1.3
HR 32214 J	3EC	82	80	116	108	119	4	6	2	1.5	28.6	0.42	1.4	0.79	1.66
HR 33214 J	3EE	82	78	116	107	120	7	9	2	1.5	30.4	0.41	1.5	0.81	2.15
T 7 FC070	7FC	88	79	126	106	133	5	12	2.5	2.5	46.4	0.87	0.69	0.38	2.55
HR 30314 J	2GB	88	89	138	132	140	4	8	2.5	2	29.7	0.35	1.7	0.96	3.03
HR 30314 DJ	7GB	94	85	138	118	142	4	13	2.5	2	45.8	0.83	0.73	0.40	2.94
HR 31314 J	7GB	94	85	138	118	142	4	13	2.5	2	45.8	0.83	0.73	0.40	2.94
HR 32314 J	2GD	91	86	138	124	140	4	12	2.5	2	36.1	0.35	1.7	0.96	4.35
HR 32314 CJ	5GD	91	84	138	115	141	4	12	2.5	2	43.3	0.55	1.1	0.60	4.47
HR 32915 J	2BC	84	81	99	98	101	4	4	1	1	18.7	0.33	1.8	0.99	0.53
HR 32015 XJ	4CC	86	82	106	103	110	5	6	1.5	1.5	25.1	0.46	1.3	0.72	0.925
HR 33015 J	2CE	86	83	106	104	110	6	5.5	1.5	1.5	23.0	0.30	2.0	1.1	1.18
HR 33115 J	3DE	87	83	115	109	120	6	8	2	2	29.2	0.40	1.5	0.83	1.8
HR 30215 J	4DB	87	85	121	115	124	4	5	2	1.5	27.0	0.44	1.4	0.76	1.43
HR 32215 J	4DC	87	84	121	113	125	4	6	2	1.5	29.8	0.44	1.4	0.76	1.72
HR 33215 J	3EE	87	83	121	111	125	7	10	2	1.5	31.6	0.43	1.4	0.77	2.25
HR 30315 J	2GB	93	95	148	141	149	4	9	2.5	2	31.8	0.35	1.7	0.96	3.63
HR 30315 DJ	7GB	99	91	148	129	152	6	14	2.5	2	48.8	0.83	0.73	0.40	3.47
HR 31315 J	7GB	99	91	148	129	152	6	14	2.5	2	48.8	0.83	0.73	0.40	3.47
HR 32315 J	2GD	96	91	148	134	149	4	13	2.5	2	38.9	0.35	1.7	0.96	5.31
32315 CA	—	96	90	148	124	153	4	15	2.5	2	47.7	0.58	1.0	0.57	5.3
HR 32916 J	2BC	89	85	104	102	106	4	4	1	1	19.8	0.35	1.7	0.94	0.56
HR 32016 XJ	3CC	91	89	116	112	120	6	7	1.5	1.5	26.9	0.42	1.4	0.78	1.32
HR 33016 J	2CE	91	88	116	112	119	6	6.5	1.5	1.5	25.5	0.28	2.2	1.2	1.66
HR 33116 J	3DE	82	88	121	113	126	6	8	2	1.5	30.4	0.42	1.4	0.79	1.88
HR 30216 J	3EB	95	91	130	124	132	4	6	2	2	28.1	0.42	1.4	0.79	1.68
30216 CA	—	95	92	130	122	133	4	8	2	2	33.8	0.58	1.0	0.57	1.66
HR 32216 J	3EC	95	90	130	122	134	4	7	2	2	30.6	0.42	1.4	0.79	2.13
HR 33216 J	3EE	95	89	130	119	135	7	11	2	2	34.8	0.43	1.4	0.78	2.93
HR 30316 J	2GB	98	102	158	150	159	4	9.5	2.5	2	34.0	0.35	1.7	0.96	4.27
HR 30316 DJ	7GB	104	97	158	136	159	6	15.5	2.5	2	51.8	0.83	0.73	0.40	4.07
HR 31316 J	7GB	104	97	158	136	159	6	15.5	2.5	2	51.8	0.83	0.73	0.40	4.07
HR 32316 J	2GD	101	98	158	143	159	4	13.5	2.5	2	41.4	0.35	1.7	0.96	6.35
HR 32316 CJ	5GD	101	95	158	132	160	4	13.5	2.5	2	49.3	0.55	1.1	0.60	6.59

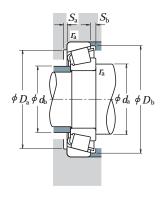




		Bound	dary Dimens (mm)	ions				Basic Load	0		Limiting	
ı	D	TT.	` '	a	Cone		(1)	,	{kṛ		(min	n-') Oil
d	D	T	В	С	r	$m{r}$ nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	UII
85	120 130 130 140 150 150	23 29 36 41 30.5 30.5 38.5	23 29 36 41 28 28	18 22 29.5 32 24 22 30	1.5 1.5 1.5 2.5 2.5 2.5 2.5	1.5 1.5 1.5 2 2 2	93 500 143 000 180 000 230 000 184 000 171 000 210 000	157 000 231 000 305 000 365 000 233 000 226 000 277 000	9 550 14 600 18 400 23 500 18 700 17 500 21 400	16 000 23 600 31 000 37 000 23 800 23 000 28 200	2 800 2 600 2 600 2 400 2 400 2 200 2 200	3 800 3 600 3 600 3 400 3 200 3 200 3 200
	150 180 180 180 180	49 44.5 44.5 44.5 63.5	49 41 41 41 60	37 34 28 28 49	2.5 4 4 4 4	2 2 3 3 3 3	281 000 310 000 261 000 261 000 410 000	415 000 375 000 315 000 315 000 535 000	28 700 31 500 26 600 26 600 42 000	42 500 38 000 32 000 32 000 54 500	2 400 2 000 1 900 1 900 2 000	3 200 2 800 2 600 2 600 2 800
90	125 140 140 150 160 160	23 32 39 45 32.5 42.5 46.5	23 32 39 45 30 40 43	18 24 32.5 35 26 34 36	1.5 2 2 2.5 2.5 2.5 2.5	1.5 1.5 1.5 2 2 2	97 000 170 000 220 000 259 000 201 000 256 000 345 000	167 000 273 000 360 000 405 000 256 000 350 000 425 000	9 850 17 300 22 400 26 500 20 500 26 100 35 500	17 000 27 800 37 000 41 500 26 100 35 500 43 000	2 600 2 400 2 400 2 400 2 200 2 200 1 900	3 600 3 200 3 200 3 200 3 000 3 000 2 600
95	190 190 190 130	46.5 46.5 67.5 23	43 43 64 23	30 30 53 18	4 4 4 1.5	3 3 3 1.5	264 000 264 000 450 000 98 000	315 000 315 000 590 000 172 000	26 900 26 900 46 000 10 000	32 000 32 000 60 500 17 500	1 800 1 800 2 000 2 400	2 400 2 400 2 600 3 400
	145 145 160 170 170 200 200 200	32 39 46 34.5 45.5 49.5 49.5	32 39 46 32 43 45 45	24 32.5 38 27 37 38 36 32	2 2 3 3 4 4 4	1.5 1.5 3 2.5 2.5 3 3	173 000 231 000 283 000 223 000 289 000 370 000 350 000 310 000	283 000 390 000 445 000 286 000 400 000 455 000 435 000 375 000	17 600 23 500 28 800 22 800 29 500 38 000 35 500 31 500	28 900 39 500 45 500 29 200 40 500 46 500 44 000 38 500	2 400 2 400 2 200 2 200 2 200 1 900 1 800 1 700	3 200 3 200 3 000 2 800 2 800 2 600 2 400 2 400
100	200 200 140 145 150 150 165	49.5 71.5 25 24 32 39 52	45 67 25 22.5 32 39 52	32 55 20 17.5 24 32.5	4 4 1.5 3 2 2 2.5	3 3 1.5 3 1.5 1.5	310 000 525 000 117 000 113 000 176 000 235 000 315 000	375 000 710 000 205 000 163 000 294 000 405 000 515 000	31 500 53 500 12 000 11 500 17 900 24 000 32 500	38 500 72 500 20 900 16 600 30 000 41 500 52 500	1 700 1 900 2 200 2 200 2 200 2 200 2 200 2 000	2 400 2 600 3 200 3 000 3 000 3 000 2 800
	180 180 180 215 215 215	37 49 63 51.5 56.5 77.5	34 46 63 47 51 73	29 39 48 39 35 60	3 3 3 4 4 4	2.5 2.5 2.5 3 3	255 000 325 000 410 000 425 000 385 000 565 000	330 000 450 000 635 000 525 000 505 000 755 000	26 000 33 000 42 000 43 000 39 000 57 500	34 000 46 000 65 000 53 500 51 500 77 000	2 000 2 000 2 000 2 000 1 700 1 500 1 700	2 600 2 600 2 600 2 600 2 400 2 200 2 400

Remarks The suffix CA represents medium-angle tapered roller bearings. Since they are designed for specific applications, please consult NSK when using bearings with suffix CA.





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

Static Equivalent Load

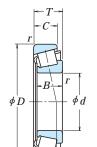
 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}>$ 0.5 $F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $\emph{e}_{\mbox{\tiny \prime}} \emph{Y}_{1}$, and \emph{Y}_{0} are

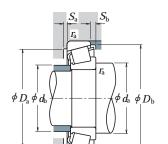
given in the table below.

Danie w November	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	sions	0	0	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	Cone $m{r}_{ m a}$ max		(mm) a	e	Y_1	Y_0	approx.
HR 32917 J	2BC	96	92	111	111	115	5	5	1.5	1.5	20.9	0.33	1.8	1.0	0.8
HR 32017 XJ	4CC	96	94	121	116	125	6	7		1.5	28.2	0.44	1.4	0.75	1.38
HR 33017 J	2CE	96	94	121	117	125	6	6.5		1.5	26.5	0.29	2.1	1.1	1.75
HR 33117 J HR 30217 J 30217 CA	3DE 3EB	100 100 100	94 97 98	130 140 140	122 133 131	135 141 142	7 5 5	9 6.5 8.5	2	2 2 2	32.7 30.3 36.2	0.41 0.42 0.58	1.5 1.4 1.0	0.81 0.79 0.57	2.51 2.12 2.07
HR 32217 J	3EC	100	96	140	131	142	5	8.5	2 3	2	33.9	0.42	1.4	0.79	2.64
HR 33217 J	3EE	100	95	140	129	144	7	12		2	37.3	0.42	1.4	0.79	3.57
HR 30317 J	2GB	106	108	166	157	167	5	10.5		2.5	35.8	0.35	1.7	0.96	5.08
HR 30317 DJ	7GB	113	103	166	144	169	6	16.5	3 :	2.5	55.4	0.83	0.73	0.40	4.88
HR 31317 J	7GB	113	103	166	144	169	6	16.5		2.5	55.4	0.83	0.73	0.40	4.88
HR 32317 J	2GD	110	104	166	151	167	5	14.5		2.5	43.6	0.35	1.7	0.96	7.31
HR 32918 J	2BC	101	97	116	116	120	5	5	2	1.5	22.0	0.34	1.8	0.96	0.838
HR 32018 XJ	3CC	102	99	131	124	134	6	8		1.5	29.7	0.42	1.4	0.78	1.78
HR 33018 J	2CE	102	99	131	129	135	7	6.5		1.5	27.9	0.27	2.2	1.2	2.21
HR 33118 J	3DE	105	100	140	132	144	7	10	2 2	2	35.2	0.40	1.5	0.83	3.14
HR 30218 J	3FB	105	103	150	141	150	5	6.5		2	31.7	0.42	1.4	0.79	2.6
HR 32218 J	3FC	105	102	150	139	152	5	8.5		2	36.2	0.42	1.4	0.79	3.41
HR 30318 J	2GB	111	114	176	176	176	5	10.5	3	2.5	37.3	0.35	1.7	0.96	5.91
HR 30318 DJ	7GB	118	110	176	152	179	6	16.5		2.5	58.7	0.83	0.73	0.40	5.52
HR 31318 J	7GB	118	110	176	152	179	6	16.5		2.5	58.7	0.83	0.73	0.40	5.52
HR 32318 J	2GD	115	109	176	158	177	5	14.5		2.5	46.5	0.35	1.7	0.96	8.6
HR 32919 J	2BC	106	102	121	121	125	5	5	2	1.5	23.2	0.36	1.7	0.92	0.877
HR 32019 XJ	4CC	107	104	136	131	140	6	8		1.5	31.2	0.44	1.4	0.75	1.88
HR 33019 J	2CE	107	103	136	133	139	7	6.5		1.5	28.6	0.28	2.2	1.2	2.3
T 2 ED095 HR 30219 J HR 32219 J	2ED 3FB 3FC	113 113 113	108 110 108	146 158 158	141 150 147	152 159 161	6 5 5	8 7.5 8.5	2.5 2.5	2.5 2 2	34.5 33.7 39.3	0.34 0.42 0.42	1.8 1.4 1.4	0.97 0.79 0.79	3.74 3.13 4.22
HR 30319 J	2GB	116	119	186	172	184	5	11.5	3	2.5	38.6	0.35	1.7	0.96	6.92
30319 CA	—	116	119	186	168	188	5	13.5		2.5	48.6	0.54	1.1	0.61	6.71
HR 30319 DJ	7GB	123	115	186	158	187	6	17.5		2.5	61.9	0.83	0.73	0.40	6.64
HR 31319 J	7GB	123	115	186	158	187	6	17.5	3 :	2.5	61.9	0.83	0.73	0.40	6.64
HR 32319 J	2GD	120	115	186	167	186	5	16.5		2.5	48.6	0.35	1.7	0.96	10.4
HR 32920 J	2CC	111	109	132	132	134	5	5		1.5	24.2	0.33	1.8	1.0	1.18
T 4 CB100	4CB	118	108	135	135	142	6	6.5	2	2.5	30.1	0.47	1.3	0.70	1.18
HR 32020 XJ	4CC	112	109	141	136	144	6	8		1.5	32.5	0.46	1.3	0.72	1.95
HR 33020 J	2CE	112	107	141	137	143	7	6.5		1.5	29.3	0.29	2.1	1.2	2.38
HR 33120 J	3EE	115	110	155	144	159	8	12	2.5	2	40.5	0.41	1.5	0.81	4.32
HR 30220 J	3FB	118	116	168	158	168	5	8		2	36.1	0.42	1.4	0.79	3.78
HR 32220 J	3FC	118	115	168	155	171	5	10		2	41.5	0.42	1.4	0.79	5.05
HR 33220 J	3FE	118	113	168	152	172	10	15	3	2	46.0	0.40	1.5	0.82	6.76
HR 30320 J	2GB	121	128	201	185	197	5	12.5		2.5	41.4	0.35	1.7	0.96	8.41
HR 31320 J	7GB	136	125	201	169	202	7	21.5		2.5	67.7	0.83	0.73	0.40	9.02
HR 32320 J	2GD	125	125	201	178	202	5	17.5		2.5	53.2	0.83	1.7	0.40	12.7

B 126 B 127 Bore Diameter 105 – 130 mm



		Boundary Dimensions (mm) Con D T B C						Basic Load I	3		Limiting	
,	_	_	. ,	_	Cone	Cup	,	N)	{kg		(mir	,
d	D	T	В	С	n	r nin.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
105	145	25	25	20	1.5	1.5	119 000	212 000	12 100	21 600	2 200	3 000
	160	35	35	26	2.5	2	204 000	340 000	20 800	34 500	2 000	2 800
	160	43	43	34	2.5	2	256 000	435 000	26 100	44 000	2 000	2 800
	190	39	36	30	3	2.5	280 000	365 000	28 500	37 500	1 900	2 600
	190	53	50	43	3	2.5	360 000	510 000	37 000	52 000	1 900	2 600
	225	53.5	49	41	4	3	455 000	565 000	46 500	57 500	1 600	2 200
	225 225	58 81.5	53 77	36 63	4	3	415 000 670 000	540 000 925 000	42 000 68 000	55 000 94 500	1 500 1 700	2 000 2 200
110	150	25	25	20	1.5	1.5	123 000	224 000	12 500	22 800	2 200	2 800
	170	38	38	29	2.5	2	236 000	390 000	24 000	40 000	2 000	2 600
	170	47	47	37	2.5	2	294 000	515 000	30 000	52 500	2 000	2 600
	180	56	56	43	2.5	2	365 000	610 000	37 500	62 000	1 900	2 600
	200	41	38	32	3	2.5	315 000	420 000	32 000	43 000	1 800	2 400
	200	56	53	46	3	2.5	400 000	565 000	40 500	57 500	1 800	2 400
	240	54.5	50	42	4	3	485 000	595 000	49 500	60 500	1 500	2 000
	240	63	57	38	4	3	470 000	605 000	48 000	62 000	1 400	1 900
	240	84.5	80	65	4	3	675 000	910 000	68 500	93 000	1 500	2 000
120	165	29	29	23	1.5	1.5	161 000	291 000	16 400	29 700	1 900	2 600
	170	27	25	19.5	3	3	153 000	243 000	51 600	24 800	1 800	2 600
	180	38	38	29	2.5	2	242 000	405 000	24 600	41 000	1 800	2 400
	180	48	48	38	2.5	2	300 000	540 000	30 500	55 000	1 800	2 600
	200	62	62	48	2.5	2	460 000	755 000	46 500	77 000	1 700	2 400
	215	43.5	40	34	3	2.5	335 000	450 000	34 000	46 000	1 600	2 200
	215	61.5	58	50	3	2.5	440 000	635 000	44 500	65 000	1 600	2 200
	260	59.5	55	46	4	3	535 000	655 000	54 500	67 000	1 400	1 900
	260	68	62	42	4	3	560 000	730 000	57 000	74 500	1 300	1 800
	260	90.5	86	69	4	3	770 000	1 060 000	78 500	108 000	1 400	1 900
130	180	32	30	26	2	1.5	167 000	281 000	17 000	28 600	1 800	2 400
	180	32	32	25	2	1.5	200 000	365 000	20 400	37 500	1 800	2 400
	185	29	27	21	3	3	183 000	296 000	18 600	30 000	1 700	2 400
	200	45	45	34	2.5	2	320 000	535 000	32 500	54 500	1 600	2 200
	200	55	55	43	2.5	2	395 000	715 000	40 500	73 000	1 700	2 200
	230	43.75	40	34	4	3	375 000	505 000	38 000	51 500	1 500	2 000
	230	67.75	64	54	4	3	530 000	790 000	54 000	80 500	1 500	2 000
	280	63.75	58	49	5	4	545 000	675 000	56 000	68 500	1 300	1 800
	280	63.75	58	49	5	4	650 000	820 000	66 000	83 500	1 300	1 800
	280 280	72 98.75	66 93	44 78	5 5	4	625 000 830 000	820 000 1 150 000	63 500 84 500	83 500 117 000	1 200 1 300	1 700 1 800



Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	7 _r e	$F_{\rm a}/I$	$F_{\rm r}$ e		
X	Y	X	Y		
1	0	0.4	Y ₁		

NSK

Static Equivalent Load

 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$

When $F_{\rm r}=$ 0.5 $F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

	ISO355			Abutn	nent ar	nd Fillet (mm)	Dimens	ions			Eff. Load Centers	Constant	Axial Fac		Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	P Cup $r_{ m a}$ Nax.	(mm) a	e	Y_1	Y_0	арргох.
HR 32921 J	2CC	116	114	137	137	140	5	5	1.5	1.5	25.3	0.34	1.8	0.96	1.23
HR 32021 XJ	4DC	120	115	150	144	154	6	9	2	2	34.3	0.44	1.4	0.74	2.48
HR 33021 J	2DE	120	115	150	146	153	7	9	2	2	30.9	0.28	2.1	1.2	3.03
HR 30221 J	3FB	123	123	178	166	177	6	9	2.5	2	38.1	0.42	1.4	0.79	4.51
HR 32221 J	3FC	123	120	178	162	180	5	10	2.5	2	44.8	0.42	1.4	0.79	6.25
HR 30321 J	2GB	126	133	211	195	206	6	12.5	3	2.5	43.3	0.35	1.7	0.96	9.52
HR 31321 J	7GB	141	130	211	177	211	7	22	3	2.5	70.2	0.83	0.73	0.40	10
HR 32321 J	2GD	130	129	211	186	209	6	18.5		2.5	55.2	0.35	1.7	0.96	14.9
HR 32922 J	2CC	121	119	142	142	145	5	5	1.5	1.5	26.5	0.36	1.7	0.93	1.29
HR 32022 XJ	4DC	125	121	160	153	163	7	9	2	2	35.9	0.43	1.4	0.77	3.09
HR 33022 J	2DE	125	121	160	153	161	7	10	2	2	33.7	0.29	2.1	1.2	3.84
HR 33122 J	3EE	125	121	170	156	174	9	13	2	2	44.1	0.42	1.4	0.79	5.54
HR 30222 J	3FB	128	129	188	175	187	6	9	2.5	2	40.2	0.42	1.4	0.79	5.28
HR 32222 J	3FC	128	127	188	171	190	5	10	2.5	2	47.2	0.42	1.4	0.79	7.35
HR 30322 J	2GB	131	143	226	208	220	6	12.5	3	2.5	45.1	0.35	1.7	0.96	11
HR 31322 J	7GB	146	136	226	191	224	7	25	3	2.5	74.8	0.83	0.73	0.40	12.3
HR 32322 J	2GD	135	139	226	201	222	6	19.5	3	2.5	58.6	0.35	1.7	0.96	17.1
HR 32924 J	2CC	131	129	156	155	160	6	6	1.5	1.5	29.2	0.35	1.7	0.95	1.8
T 4 CB120	4CB	138	129	158	158	164	7	7.5	2.5	2.5	35.0	0.47	1.3	0.70	1.78
HR 32024 XJ	4DC	135	131	170	162	173	7	9	2	2	39.7	0.46	1.3	0.72	3.27
HR 33024 J	2DE	135	130	168	161	171	6	10	2	2	36.0	0.31	2.0	1.1	4.2
HR 33124 J	3FE	135	133	190	173	192	9	14	2	2	47.9	0.40	1.5	0.83	7.67
HR 30224 J	4FB	138	141	203	190	201	6	9.5	2.5	2	44.4	0.44	1.4	0.76	6.28
HR 32224 J	4FD	138	137	203	181	204	6	11.5	2.5	2	52.1	0.44	1.4	0.76	9.0
HR 30324 J	2GB	141	154	246	223	237	6	13.5	3	2.5	50.0	0.35	1.7	0.96	13.9
HR 31324 J	7GB	156	148	246	206	244	9	26	3	2.5	81.7	0.83	0.73	0.40	15.6
HR 32324 J	2GD	145	149	246	216	239	6	21.5	3	2.5	62.5	0.35	1.7	0.96	21.8
32926 HR 32926 J T 4 CB130	2CC 4CB	142 142 148	141 140 141	171 170 171	168 168 171	175 173 179	6 6 8	6 7 8	2 2 2.5	1.5 1.5 2.5	34.7 31.4 37.5	0.36 0.34 0.47	1.7 1.8 1.3	0.92 0.97 0.70	2.25 2.46 2.32
HR 32026 XJ	4EC	145	144	190	179	192	8	11	2	2	43.9	0.43	1.4	0.76	5.06
HR 33026 J	2EE	145	144	188	179	192	8	12	2	2	42.4	0.34	1.8	0.97	6.25
HR 30226 J	4FB	151	151	216	205	217	7	9.5	3	2.5	45.9	0.44	1.4	0.76	7.25
HR 32226 J	4FD	151	147	216	196	219	7	13.5	3	2.5	57.0	0.44	1.4	0.76	11.3
30326	—	157	168	262	239	255	8	14.5	4	3	53.9	0.36	1.7	0.92	16.6
HR 30326 J	2GB	157	166	262	241	255	8	14.5	4	3	52.8	0.35	1.7	0.96	17.2
HR 31326 J 32326	7GB —	174 162	159 165	262 262	220 233	261 263	9 8	28 20.5	4	3	87.1 69.2	0.83 0.36	0.73 1.7	0.40 0.92	18.8 26.6

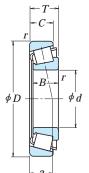
Bore Diameter 140 - 170 mm

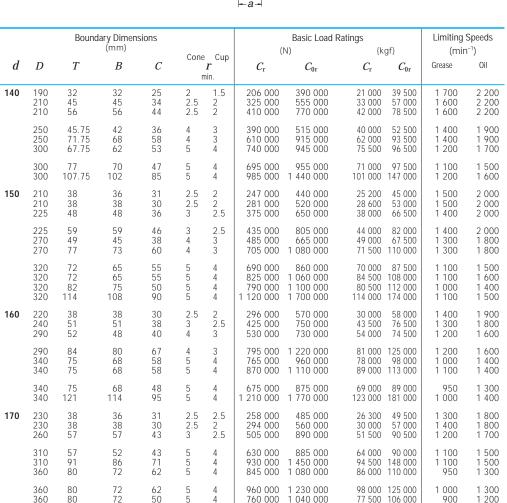
360

127

120

100



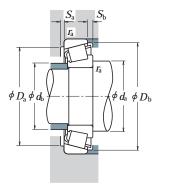


370 000 2 050 000

140 000 209 000

1 000

1 300



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}$	$F_{\rm r} \leq e$	$F_{\rm a}/I$	$F_{\rm r} > e$
X	Y	X	Y
1	0	0.4	Y_1

NSK

Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

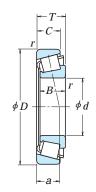
When $F_{\rm r}\!>\!$ 0.5 $F_{\rm r}$ + Y_0 $F_{\rm a}$, use P_0 = $F_{\rm r}$ The values of e, Y_1 , and Y_0 are

given in the table below.

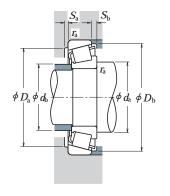
Bearing Numbers	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	sions		_	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.		$r_{ m a}$	(mm) a	e	<i>Y</i> ₁	Y_0	approx.
HR 32928 J	2CC	152	150	180	178	184	6	7	2	1.5	33.6	0.36	1.7	0.92	2.64
HR 32028 XJ	4DC	155	152	200	189	202	8	11	2	2	46.6	0.46	1.3	0.72	5.32
HR 33028 J	2DE	155	153	198	189	202	7	12	2	2	45.5	0.36	1.7	0.92	6.74
HR 30228 J	4FB	161	164	236	221	234	7	9.5	3	2.5	48.9	0.44	1.4	0.76	8.74
HR 32228 J	4FD	161	159	236	213	238	9	13.5	3	2.5	60.5	0.44	1.4	0.76	14.3
HR 30328 J	2GB	167	177	282	256	273	9	14.5	4	3	55.7	0.35	1.7	0.96	21.1
HR 31328 J	7GB	184	174	282	236	280	9	30	4	3	92.9	0.83	0.73	0.40	28.5
32328	—	172	177	282	246	281	9	22.5	4		76.4	0.37	1.6	0.88	33.9
32930	—	165	162	200	195	201	7	7	2	2	36.7	0.33	1.8	1.0	3.8
HR 32930 J	2DC	165	163	198	196	202	7	8	2	2	36.5	0.33	1.8	1.0	4.05
HR 32030 XJ	4EC	168	164	213	202	216	8	12	2.5	2	49.8	0.46	1.3	0.72	6.6
HR 33030 J	2EE	168	165	213	203	217	8	13	2.5	2	48.7	0.36	1.7	0.90	8.07
HR 30230 J	2GB	171	175	256	236	250	7	11	3	2.5	51.3	0.44	1.4	0.76	11.2
HR 32230 J	4GD	171	171	256	228	254	8	17	3	2.5	64.7	0.44	1.4	0.76	17.8
30330	—	177	193	302	275	292	8	17	4	3	61.4	0.36	1.7	0.92	24.2
HR 30330 J	2GB	177	190	302	276	292	8	17	4	3	60.0	0.35	1.7	0.96	25
HR 31330 J	7GB	194	187	302	253	300	9	32	4	3	99.3	0.83	0.73	0.40	28.5
32330	—	182	191	302	262	297	8	24	4	3	81.5	0.37	1.6	0.88	41.4
HR 32932 J	2DC	175	173	208	206	212	7	8	2	2	38.7	0.35	1.7	0.95	4.32
HR 32032 XJ	4EC	178	175	228	216	231	8	13	2.5	2	53.0	0.46	1.3	0.72	7.93
HR 30232 J	4GB	181	189	276	253	269	8	12	3	2.5	55.0	0.44	1.4	0.76	13.7
HR 32232 J	4GD	181	184	276	243	274	10	17	3	2.5	70.5	0.44	1.4	0.76	22.7
30332	—	187	205	322	293	311	10	17	4	3	64.6	0.36	1.7	0.92	28.4
HR 30332 J	2GB	187	201	322	293	310	10	17	4	3	62.9	0.35	1.7	0.96	29.2
30332 D 32332	_	196 192	198 202	322 322	270 281	313 319	9 10	27 26	4 4	3	99.4 87.1	0.81 0.37	0.74 1.6	0.41 0.88	27.5 48.3
32934 HR 32934 J HR 32034 XJ	3DC 4EC	185 185 188	183 180 187	220 218 248	216 215 232	223 222 249	7 7 10	7 8 14	2 2 2.5	2 2 2	41.6 41.7 56.6	0.36 0.38 0.44	1.7 1.6 1.4	0.90 0.86 0.74	4.3 4.44 10.6
HR 30234 J	4GB	197	202	292	273	288	8	14	4	3	59.4	0.44	1.4	0.76	17.1
HR 32234 J	4GD	197	197	292	262	294	10	20	4	3	76.4	0.44	1.4	0.76	28
30334	—	197	221	342	312	332	10	18	4	3	70.1	0.37	1.6	0.90	33.5
HR 30334 J	2GB	197	214	342	310	329	10	18	4	3	67.3	0.35	1.7	0.96	34.5
30334 D	—	206	215	342	288	332	10	30	4	3	107.3	0.81	0.74	0.41	33.4
32334	—	202	213	342	297	337	10	27	4	3	91.3	0.37	1.6	0.88	57

B 130 B 131

Bore Diameter 180 – 240 mm



		Bour	ndary Dimer	nsions				Basic Load R	5		Limiting	•
			(mm)		Cone	Cup		N)		gf}	(mir	,
d	D	T	В	С	n	r nin.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
180	250 280 320	45 64 57	45 64 52	34 48 43	2.5 3 5	2 2.5 4	350 000 640 000 650 000	685 000 1 130 000 930 000	36 000 65 000 66 000	69 500 115 000 95 000	1 300 1 200 1 100	1 700 1 600 1 400
	320 380 380 380	91 83 83 134	86 75 75 126	71 64 53 106	5 5 5 5	4 4 4 4	960 000 935 000 820 000 1 520 000	1 540 000 1 230 000 1 120 000 2 290 000	95 500 83 500	157 000 126 000 114 000 234 000	1 100 900 850 950	1 400 1 300 1 200 1 300
190	260 290 340	45 64 60	45 64 55	34 48 46	2.5 3 5	2 2.5 4	365 000 650 000 715 000	715 000 1 170 000 1 020 000		73 000 119 000 104 000	1 200 1 100 1 000	1 600 1 500 1 300
	340 400 400	97 86 140	92 78 132	75 65 109	5 6 6	4 5 5	1 110 000 1 010 000 1 660 000	1 770 000 1 340 000 2 580 000	103 000	181 000 136 000 263 000	1 000 850 850	1 400 1 200 1 200
200	280 280 310	51 51 70	48 51 70	41 39 53	3 3 3	2.5 2.5 2.5	410 000 480 000 760 000	780 000 935 000 1 370 000	42 000 48 500 77 500	80 000 95 000 139 000	1 100 1 100 1 000	1 500 1 500 1 400
	360 360 420	64 104 89	58 98 80	48 82 67	5 5 6	4 4 5	795 000 1 210 000 1 030 000	1 120 000 1 920 000 1 390 000	123 000	114 000 196 000 142 000	950 950 850	1 300 1 300 1 200
	420 420	89 146	80 138	56 115	6 6	5 5	965 000 1 820 000	1 330 000 2 870 000		136 000 292 000	750 800	1 000 1 100
220	300 340 400	51 76 72	51 76 65	39 57 54	3 4 5	2.5 3 4	490 000 885 000 810 000	990 000 1 610 000 1 150 000	90 500	101 000 164 000 117 000	1 000 950 850	1 400 1 300 1 100
	400 460 460	114 97 154	108 88 145	90 73 122	5 6 6	4 5 5	1 340 000 1 430 000 2 020 000	2 210 000 1 990 000 3 200 000		225 000 203 000 325 000	850 750 750	1 100 1 000 1 000
240	320 360 440	51 76 79	51 76 72	39 57 60	3 4 5	2.5 3 4	500 000 920 000 990 000	1 040 000 1 730 000 1 400 000	94 000	107 000 177 000 142 000	950 850 750	1 300 1 200 1 000
	440 500 500	127 105 165	120 95 155	100 80 132	5 6 6	4 5 5	1 630 000 1 660 000 2 520 000	2 730 000 2 340 000 4 100 000	169 000	278 000 238 000 415 000	750 670 670	1 000 950 900



Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}$	$F_{\rm r} \leq e$	$F_{\rm a}/I$	$F_{\rm r} > e$
X	Y	X	Y
1	0	0.4	Y_1

Static Equivalent Load

 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$

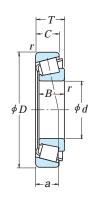
When $F_{\rm r}\!>\!0.5\,F_{\rm r}+Y_0\,F_{\rm a}$, use P_0 = $F_{\rm r}$ The values of $\emph{e},~Y_1$, and Y_0 are

given in the table below.

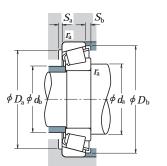
Decrine Number	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	ions	0	0	Centers	Constant	Axial Fact		Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	$D_{ m a}$ min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	e Cup r _a ax.	(mm) a	e	Y_1	Y_0	арргох.
HR 32936 J	4DC	195	192	240	227	241	8	11	2	2	53.9	0.48	1.3	0.69	6.56
HR 32036 XJ	3FD	198	199	268	248	267	10	16	2.5	2	60.4	0.42	1.4	0.78	14.3
HR 30236 J	4GB	207	210	302	281	297	9	14	4	3	61.8	0.45	1.3	0.73	17.8
HR 32236 J	4GD	207	205	302	270	303	10	20	4	3	78.9	0.45	1.3	0.73	29.8
30336	—	207	233	362	324	345	10	19	4	3	72.5	0.36	1.7	0.92	39.3
30336 D	—	216	229	362	304	352	10	30	4	3	113.1	0.81	0.74	0.41	38.5
32336	—	212	225	362	310	353	10	28	4	3	96.6	0.37	1.6	0.88	66.8
HR 32938 J	4DC	205	201	250	237	251	8	11	2	2	55.3	0.48	1.3	0.69	6.83
HR 32038 XJ	4FD	208	209	278	258	279	10	16	2.5	2	63.4	0.44	1.4	0.75	14.9
HR 30238 J	4GB	217	223	322	302	318	9	14	4	3	65.6	0.44	1.4	0.76	21.4
HR 32238 J	4GD	217	216	322	290	323	10	22	4	3	80.5	0.44	1.4	0.76	35.2
30338	—	223	248	378	346	366	11	21	5	4	76.1	0.36	1.7	0.92	46
32338	—	229	243	378	332	375	11	31	5	4	102.7	0.37	1.6	0.88	78.9
32940	—	218	217	268	256	269	9	10	2.5	2	53.4	0.37	1.6	0.88	9.26
HR 32940 J	3EC	218	216	268	258	271	9	12	2.5	2	54.2	0.39	1.5	0.84	9.65
HR 32040 XJ	4FD	218	221	298	277	297	11	17	2.5	2	67.4	0.43	1.4	0.77	18.9
HR 30240 J HR 32240 J 30340	4GB 3GD	227 227 233	236 230 253	342 342 398	318 305 346	336 340 368	10 11 11	16 22 22	4 4 5	3 3 4	69.1 85.1 81.4	0.44 0.41 0.37	1.4 1.5 1.6	0.76 0.81 0.88	25.5 42.6 52.3
30340 D	_	244	253	398	336	385	11	33	5	4	122.9	0.81	0.74	0.41	49.6
32340		239	253	398	346	392	11	31	5	4	106.7	0.37	1.6	0.88	90.9
HR 32944 J	3EC	238	235	288	278	293	9	12	2.5	2	59.2	0.43	1.4	0.78	10.3
HR 32044 XJ	4FD	241	244	326	303	326	12	19	3	2.5	73.6	0.43	1.4	0.77	24.4
30244	—	247	267	382	350	367	11	18	4	3	74.7	0.40	1.5	0.82	33.6
32244	_	247	260	382	340	377	12	24	4	3	93.0	0.40	1.5	0.82	57.4
30344	_	253	283	438	390	414	12	24	5	4	85.4	0.36	1.7	0.92	72.4
32344	_	259	274	438	372	421	12	32	5	4	114.9	0.37	1.6	0.88	114
HR 32948 J	4EC	258	255	308	297	314	9	12	2.5	2	65.1	0.46	1.3	0.72	11.1
HR 32048 XJ	4FD	261	262	346	321	346	12	19	3	2.5	79.1	0.46	1.3	0.72	26.2
30248	—	267	288	422	384	408	11	19	4	3	85.1	0.44	1.4	0.74	45.2
32248	_	267	285	422	374	416	12	27	4	3	102.5	0.40	1.5	0.82	78
30348	_	273	308	478	422	447	12	25	5	4	92.8	0.36	1.7	0.92	92.6
32348	_	279	301	478	410	464	12	33	5	4	123.2	0.37	1.6	0.88	145

Bore Diameter 260 – 440 mm





		Boundary Dimensions (mm) Cone					1)	Basic Load F	Ratings {kc	ıf\	Limiting : (min	
d	D	T	В	С		Cup r in.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
260	360 400 480	63.5 87 89	63.5 87 80	48 65 67	3 5 6	2.5 4 5	730 000 1 160 000 1 190 000	1 450 000 2 160 000 1 700 000	74 500 118 000 121 000		850 800 670	1 100 1 100 900
	480 540 540	137 113 176	130 102 165	106 85 136	6 6 6	5 6 6	1 900 000 1 870 000 2 910 000	3 300 000 2 640 000 4 800 000	194 000 190 000 297 000	269 000	670 630 630	950 850 850
280	380 420 500	63.5 87 89	63.5 87 80	48 65 67	3 5 6	2.5 4 5	765 000 1 180 000 1 240 000	1 580 000 2 240 000 1 900 000	78 000 120 000 127 000		800 710 630	1 100 1 000 850
	500 580	137 187	130 175	106 145	6 6	5 6	1 950 000 3 300 000	3 450 000 5 400 000	199 000 335 000		630 560	850 800
300	420 420 460	76 76 100	72 76 100	62 57 74	4 4 5	3 3 4	895 000 1 010 000 1 440 000	1 820 000 2 100 000 2 700 000	91 000 103 000 147 000		710 710 670	950 950 900
	540 540	96 149	85 140	71 115	6 6	5 5	1 440 000 2 220 000	2 100 000 3 700 000	147 000 226 000		600 600	800 800
320	440 440 480	76 76 100	72 76 100	63 57 74	4 4 5	3 3 4	900 000 1 040 000 1 510 000	1 880 000 2 220 000 2 910 000	92 000 106 000 153 000		970 670 630	900 900 850
	580 580 670	104 159 210	92 150 200	75 125 170	6 6 7.5	5 5 7.5	1 640 000 2 860 000 4 200 000	2 420 000 5 050 000 7 100 000	168 000 292 000 430 000	515 000	530 530 480	750 750 670
340	460 460 520	76 76 112	72 76 106	63 57 92	4 4 6	3 3 5	910 000 1 050 000 1 650 000	1 940 000 2 220 000 3 400 000	93 000 107 000 168 000		630 630 560	850 850 750
360	480 480 540	76 76 112	72 76 106	62 57 92	4 4 6	3 3 5	945 000 1 080 000 1 680 000	2 100 000 2 340 000 3 500 000	96 500 110 000 171 000		600 560 530	800 800 750
380	520	87	82	71	5	4	1 210 000	2 550 000	124 000	260 000	560	750
400	540 600	87 125	82 118	71 100	5 6	4 5	1 250 000 1 960 000	2 700 000 4 050 000	128 000 200 000		530 480	710 670
420	560 620	87 125	82 118	72 100	5 6	4 5	1 300 000 2 000 000	2 810 000 4 200 000	132 000 204 000		500 450	670 630
440	650	130	122	104	6	6	2 230 000	4 600 000	227 000	470 000	430	600



Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	$F_{\rm r} > e$		
X	Y	X	Y		
1	0	0.4	Y ₁		

NSK

Static Equivalent Load

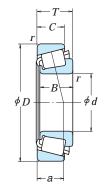
 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$

When $F_{\rm r}\!>\!0.5\,F_{\rm r}+Y_0\,F_{\rm a}$, use P_0 = $F_{\rm r}$ The values of $\emph{e},~Y_1$, and Y_0 are

given in the table below.

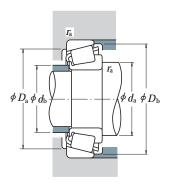
	_				_		_		_				_	_	
Dogring Numbers	ISO355			Abutn	nent ar	nd Fillet ((mm)	Dimens	ions	0	C	Eff. Load Centers	Constant	Axial Fact		Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	1 max.	O _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	Cup r _a ax.	(mm) a	e	Y_1	Y_0	арргох.
HR 32952 J HR 32052 XJ 30252	3EC 4FC	278 287 293	278 287 316	348 382 458	333 357 421	347 383 447	11 14 12	15.5 22 22	2.5 4 5	2 3 4	69.8 86.3 94.6	0.41 0.43 0.44	1.5 1.4 1.4	0.81 0.76 0.74	18.6 38.5 60.7
32252	_	293	305	458	394	446	14	31	5	4	116.0	0.45	1.3	0.73	103
30352	_	293	336	512	460	487	16	28	5	5	101.6	0.36	1.7	0.92	114
32352	_	293	328	512	441	495	13	40	5	5	130.5	0.37	1.6	0.88	188
HR 32956 J	4EC	298	297	368	352	368	12	15.5	2.5	2	75.3	0.43	1.4	0.76	20
HR 32056 XJ	4FC	307	305	402	374	402	14	22	4	3	91.6	0.46	1.3	0.72	40.6
30256	—	313	339	478	436	462	12	22	5	4	98.5	0.44	1.4	0.74	66.3
32256	_	313	325	478	412	467	14	31	5	4	123.1	0.47	1.3	0.70	109
32356		319	353	552	475	532	14	42	5	5	139.6	0.37	1.6	0.89	224
32960	—	321	326	406	386	405	13	14	3	2.5	79.3	0.37	1.6	0.88	30.5
HR 32960 J	3FD	321	324	406	387	405	13	19	3	2.5	79.9	0.39	1.5	0.84	31.4
HR 32060 XJ	4GD	327	330	442	408	439	15	26	4	3	98.4	0.43	1.4	0.76	56.6
30260 32260	_	333 333	355 352	518 518	470 458	499 514	14 15	25 34	5 5	4	105.1 131.7	0.44 0.46	1.4 1.3	0.74 0.72	80.6 132
32964	—	341	345	426	404	425	13	13	3	2.5	84.3	0.39	1.5	0.84	32
HR 32964 J	3FD	341	344	426	406	426	13	19	3	2.5	85.0	0.42	1.4	0.79	33.3
HR 32064 XJ	4GD	347	350	462	430	461	15	26	4	3	104.5	0.46	1.3	0.72	60
30264	_	353	381	558	503	533	14	29	5	4	113.7	0.44	1.4	0.74	99.3
32264	_	353	383	558	487	550	15	34	5	4	141.7	0.46	1.3	0.72	175
32364	_	383	412	634	547	616	14	42	6	6	157.5	0.37	1.6	0.88	343
32968		361	364	446	426	446	13	13	3	2.5	89.2	0.41	1.5	0.80	33.6
HR 32968 J	4FD	361	362	446	427	446	13	19	3	2.5	91.0	0.44	1.4	0.75	34.3
32068		373	386	498	464	496	3.5	22	5	4	104.5	0.37	1.6	0.89	83.7
32972	—	381	386	466	445	465	14	14	3	2.5	91.4	0.40	1.5	0.82	35.8
HR 32972 J	4FD	381	381	466	445	466	13	19	3	2.5	96.8	0.46	1.3	0.72	36.1
32072	—	393	402	518	480	514	5.5	22	5	4	108.6	0.38	1.6	0.86	86.5
32976	_	407	406	502	478	501	16	16	4	3	95.2	0.39	1.6	0.86	49.5
32980	_	427	428	522	499	524	16	16	4	3	100.8	0.40	1.5	0.82	52.7
32080		433	443	578	533	565	5	25	5	4	115.3	0.36	1.7	0.92	116
32984	_	447	448	542	521	544	3.5	15	4	3	106.1	0.41	1.5	0.81	54.8
32084		453	463	598	552	586	6.5	25	5	4	120.0	0.37	1.6	0.88	121
32088	_	473	487	622	582	616	5	26	5	5	126.3	0.36	1.7	0.92	136

Bore Diameter 12.000 – 22.225 mm



			Dimension	S				Basic Loa	nd Ratings		Limiting	Speeds
		(m	nm)		Cone	Cup	(N)	{k	gf}	(mi	n ⁻¹)
d	D	T	В	С	<i>I</i> mir	• '	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
12.000	31.991	10.008	10.785	7.938	0.8	1.3	10 300	8 900	1 050	905	13 000	18 000
12.700	34.988	10.998	10.988	8.730	1.3	1.3	11 700	10 900	1 200	1 110	12 000	16 000
15.000	34.988	10.998	10.988	8.730	0.8	1.3	11 700	10 900	1 200	1 110	12 000	16 000
15.875	34.988	10.998	10.998	8.712	1.3	1.3	13 800	13 400	1 410	1 360	11 000	15 000
	39.992	12.014	11.153	9.525	1.3	1.3	14 900	15 700	1 520	1 600	9 500	13 000
	41.275	14.288	14.681	11.112	1.3	2.0	21 300	19 900	2 170	2 030	10 000	13 000
	42.862	14.288	14.288	9.525	1.5	1.5	17 300	17 200	1 770	1 750	8 500	12 000
	42.862	16.670	16.670	13.495	1.5	1.5	26 900	26 300	2 750	2 680	9 500	13 000
	44.450	15.494	14.381	11.430	1.5	1.5	23 800	23 900	2 430	2 440	8 500	11 000
	49.225	19.845	21.539	14.288	0.8	1.3	37 500	37 000	3 800	3 800	8 500	11 000
16.000	47.000	21.000	21.000	16.000	1.0	2.0	35 000	36 500	3 600	3 750	9 000	12 000
16.993	39.992	12.014	11.153	9.525	0.8	1.3	14 900	15 700	1 520	1 600	9 500	13 000
17.455	36.525	11.112	11.112	7.938	1.5	1.5	11 600	11 000	1 190	1 120	10 000	14 000
17.462	39.878	13.843	14.605	10.668	1.3	1.3	22 500	22 500	2 290	2 290	10 000	13 000
	47.000	14.381	14.381	11.112	0.8	1.3	23 800	23 900	2 430	2 440	8 500	11 000
19.050	39.992	12.014	11.153	9.525	1.0	1.3	14 900	15 700	1 520	1 600	9 500	13 000
	45.237	15.494	16.637	12.065	1.3	1.3	28 500	28 900	2 910	2 950	9 000	12 000
	47.000	14.381	14.381	11.112	1.3	1.3	23 800	23 900	2 430	2 440	8 500	11 000
	49.225	18.034	19.050	14.288	1.3	1.3	37 500	37 000	3 800	3 800	8 500	11 000
	49.225	19.845	21.539	14.288	1.2	1.3	37 500	37 000	3 800	3 800	8 500	11 000
	49.225	21.209	19.050	17.462	1.3	1.5	37 500	37 000	3 800	3 800	8 500	11 000
	49.225	23.020	21.539	17.462	C1.5	3.5	37 500	37 000	3 800	3 800	8 500	11 000
	53.975	22.225	21.839	15.875	1.5	2.3	40 500	39 500	4 150	4 000	7 500	10 000
19.990	47.000	14.381	14.381	11.112	1.5	1.3	23 800	23 900	2 430	2 440	8 500	11 000
20.000	51.994	15.011	14.260	12.700	1.5	1.3	26 000	27 900	2 650	2 840	7 500	10 000
20.625	49.225	23.020	21.539	17.462	1.5	1.5	37 500	37 000	3 800	3 800	8 500	11 000
20.638	49.225	19.845	19.845	15.875	1.5	1.5	36 000	37 000	3 650	3 750	8 000	11 000
21.430	50.005	17.526	18.288	13.970	1.3	1.3	38 500	40 000	3 950	4 100	8 000	11 000
22.000	45.237	15.494	16.637	12.065	1.3	1.3	29 200	33 500	2 980	3 400	8 500	11 000
	45.975	15.494	16.637	12.065	1.3	1.3	29 200	33 500	2 980	3 400	8 500	11 000
22.225	50.005	13.495	14.260	9.525	1.3	1.0	26 000	27 900	2 650	2 840	7 500	10 000
	50.005	17.526	18.288	13.970	1.3	1.3	38 500	40 000	3 950	4 100	8 000	11 000
	52.388	19.368	20.168	14.288	1.5	1.5	40 500	43 000	4 100	4 400	7 500	10 000
	53.975	19.368	20.168	14.288	1.5	1.5	40 500	43 000	4 100	4 400	7 500	10 000
	56.896	19.368	19.837	15.875	1.3	1.3	38 000	40 500	3 900	4 150	7 100	9 500
	57.150	22.225	22.225	17.462	0.8	1.5	48 000	50 000	4 850	5 100	7 100	9 500





Dynamic Equivalent Load

 $P = XF_{r} + YF_{a}$ $F_{a}/F_{r} \le e$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$						
X	Y	X	Y					
1	0	0.4	Y ₁					

Static Equivalent Load

$$\begin{split} P_0 = 0.5 F_r + Y_0 \, F_a \\ \text{When } F_r > 0.5 F_r + Y_0 \, F_a \text{, use } P_0 = F_r \end{split}$$

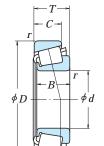
The values of e, Y_1 , and Y_0 are given in the table below.

Bearing	g Numbers	Al	outment	and Fille (mm)			2	Eff. Load Constant Centers			Load tors	Mass (kg)
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\rm a}$	$D_{ m b}$	Cone r ma	a	(mm) a	e	Y_1	Y_0	approx. CONE CUP
*A 2047	A 2126	16.5	15.5	26	29	0.8	1.3	6.8	0.41	1.5	0.81	0.023 0.017
A 4050	A 4138	18.5	17	29	32	1.3	1.3	8.2	0.45	1.3	0.73	0.033 0.022
*A 4059	A 4138	19.5	19	29	32	0.8	1.3	8.2	0.45	1.3	0.73	0.029 0.022
L 21549	L 21511	21.5	19.5	29	32.5	1.3	1.3	7.7	0.32	1.9	1.0	0.031 0.018
A 6062	A 6157	22	20.5	34	37	1.3	1.3	10.3	0.53	1.1	0.63	0.044 0.031
03062	03162	21.5	20	34	37.5	1.3	2	9.1	0.31	1.9	1.1	0.061 0.035
11590	11520	24.5	22.5	34.5	39.5	1.5	1.5	13.0	0.70	0.85	0.47	0.061 0.040
17580	17520	23	21	36.5	39	1.5	1.5	10.6	0.33	1.8	1.0	0.075 0.048
05062	05175	23.5	21	38	42	1.5	1.5	11.2	0.36	1.7	0.93	0.081 0.039
09062	09195	22	21.5	42	44.5	0.8	1.3	10.7	0.27	2.3	1.2	0.139 0.065
*HM 81649	**HM 81610	27.5	23	37.5	43	1	2	14.9	0.55	1.1	0.60	0.115 0.082
A 6067	A 6157	22	21	34	37	0.8	1.3	10.3	0.53	1.1	0.63	0.042 0.031
A 5069	A 5144	23.5	21.5	30	33.5	1.5	1.5	8.9	0.49	1.2	0.68	0.030 0.020
† LM 11749 05068	† LM 11710 05185	23 23	21.5 22.5	34 40.5	37 42.5	1.3	1.3	8.7	0.29	2.1 1.7	1.2 0.93	0.055 0.028 0.082 0.047
A 6075	A 6157	24	23	34	37	1	1.3	10.3	0.53	1.1	0.63	0.037 0.031
† LM 11949	† LM 11910	25	23.5	39.5	41.5	1.3	1.3	9.5	0.30	2.0	1.1	0.081 0.044
05075	05185	25	23.5	40.5	42.5	1.3	1.3	10.1	0.36	1.7	0.93	0.077 0.047
09067	09195	25.5	24	42	44.5	1.3	1.3	10.7	0.27	2.3	1.2	0.115 0.065
09078	09195	25.5	24	42	44.5	1.2	1.3	10.7	0.27	2.3	1.2	0.124 0.065
09067	09196	25.5	24	41.5	44.5	1.3	1.5	13.8	0.27	2.3	1.2	0.115 0.085
09074	09194	26	24	39	44.5	1.5	3.5	13.8	0.27	2.3	1.2	0.124 0.082
21075	21212	31.5	26	43	50	1.5	2.3	16.3	0.59	1.0	0.56	0.156 0.097
05079	05185	26.5	24	40.5	42.5	1.5	1.3	10.1	0.36	1.7	0.93	0.073 0.047
07079	07204	27.5	27	45	48	1.5	1.3	12.1	0.40	1.5	0.82	0.105 0.061
09081	09196	27.5	25.5	41.5	44.5	1.5	1.5	13.8	0.27	2.3	1.2	0.115 0.085
12580	12520	28.5	26	42.5	45.5	1.5	1.5	12.9	0.32	1.9	1.0	0.114 0.067
† M 12649	† M 12610	27.5	25.5	44	46	1.3	1.3	10.9	0.28	2.2	1.2	0.115 0.059
*† LM 12749	† LM 12710	27.5	26	39.5	42.5	1.3	1.3	10.0	0.31	2.0	1.1	0.078
*† LM 12749	† LM 12711	27.5	26	40	42.5	1.3	1.3	10.0	0.31	2.0	1.1	
07087	07196	28.5	27	44.5	47	1.3	1	10.6	0.40	1.5	0.82	0.097 0.035
† M 12648	† M 12610	28.5	26.5	44	46	1.3	1.3	10.9	0.28	2.2	1.2	0.111 0.059
1380	1328	29.5	27	45	48.5	1.5	1.5	11.3	0.29	2.1	1.1	0.137 0.067
1380	1329	29.5	27	46	49	1.5	1.5	11.3	0.29	2.1	1.1	0.137 0.082
1755	1729	29	27.5	49	51	1.3	1.3	12.2	0.31	2.0	1.1	0.152 0.102
1280	1220	29.5	29	49	52	0.8	1.5	15.1	0.35	1.7	0.95	0.183 0.106

Notes

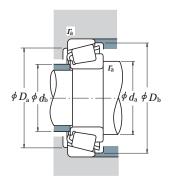
- * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- † The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).
- * † The tolerance for the bore diameter is 0 to $-20~\mu m$, and for overall bearing width is +356 to 0 μm .

Bore Diameter 22.606 – 28.575 mm



			Dimension	S					oad Ratings		Limiting	
_		,	nm)		Cone	Cup	,	N)		gf}	(mi	,
d	D	T	В	С	<i>1</i> mi		$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
22.606	47.000	15.500	15.500	12.000	1.5	1.0	26 300	30 000	2 680	3 100	8 000	11 000
23.812	50.292	14.224	14.732	10.668	1.5	1.3	27 600	32 000	2 820	3 250	7 100	10 000
	56.896	19.368	19.837	15.875	0.8	1.3	38 000	40 500	3 900	4 150	7 100	9 500
24.000	55.000	25.000	25.000	21.000	2.0	2.0	49 500	55 000	5 050	5 650	7 100	9 500
24.981	51.994	15.011	14.260	12.700	1.5	1.3	26 000	27 900	2 650	2 840	7 500	10 000
	52.001	15.011	14.260	12.700	1.5	2.0	26 000	27 900	2 650	2 840	7 500	10 000
	62.000	16.002	16.566	14.288	1.5	1.5	37 000	39 500	3 750	4 000	6 300	8 500
25.000	50.005	13.495	14.260	9.525	1.5	1.0	26 000	27 900	2 650	2 840	7 500	10 000
	51.994	15.011	14.260	12.700	1.5	1.3	26 000	27 900	2 650	2 840	7 500	10 000
25.400	50.005	13.495	14.260	9.525	3.3	1.0	26 000	27 900	2 650	2 840	7 500	10 000
	50.005	13.495	14.260	9.525	1.0	1.0	26 000	27 900	2 650	2 840	7 500	10 000
	50.292	14.224	14.732	10.668	1.3	1.3	27 600	32 000	2 820	3 250	7 100	10 000
	57.150	17.462	17.462	13.495	1.3	1.5	39 500	45 500	4 050	4 650	6 700	9 000
	57.150	19.431	19.431	14.732	1.5	1.5	42 500	49 000	4 300	5 000	6 700	9 000
	59.530	23.368	23.114	18.288	0.8	1.5	50 000	58 000	5 100	5 900	6 300	9 000
	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	63.500	20.638	20.638	15.875	3.5	1.5	46 000	53 000	4 700	5 400	6 000	8 000
	64.292	21.433	21.433	16.670	1.5	1.5	51 000	64 500	5 200	6 600	5 600	8 000
	65.088	22.225	21.463	15.875	1.5	1.5	45 000	47 500	4 600	4 850	5 600	8 000
	68.262	22.225	22.225	17.462	0.8	1.5	55 000	64 000	5 600	6 550	5 600	7 500
	72.233	25.400	25.400	19.842	0.8	2.3	63 500	83 500	6 500	8 500	5 000	7 100
	72.626	24.608	24.257	17.462	2.3	1.5	60 000	58 000	6 100	5 900	5 600	7 500
26.988	50.292	14.224	14.732	10.668	3.5	1.3	27 600	32 000	2 820	3 250	7 100	10 000
	57.150	19.845	19.355	15.875	3.3	1.5	40 000	44 500	4 100	4 500	6 700	9 000
	60.325	19.842	17.462	15.875	3.5	1.5	39 500	45 500	4 050	4 650	6 700	9 000
	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
28.575	57.150	19.845	19.355	15.875	3.5	1.5	40 000	44 500	4 100	4 500	6 700	9 000
	59.131	15.875	16.764	11.811	spec.	1.3	34 500	41 500	3 550	4 200	6 300	8 500
	62.000	19.050	20.638	14.288	3.5	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	64.292	21.433	21.433	16.670	1.5	1.5	51 000	64 500	5 200	6 600	5 600	8 000
	68.262	22.225	22.225	17.462	0.8	1.5	55 000	64 000	5 600	6 550	5 600	7 500
	72.626	24.608	24.257	17.462	4.8	1.5	60 000	58 000	6 100	5 900	5 600	7 500
	72.626	24.608	24.257	17.462	1.5	1.5	60 000	58 000	6 100	5 900	5 600	7 500
	73.025	22.225	22.225	17.462	0.8	3.3	54 500	64 500	5 550	6 600	5 300	7 100





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$					
X	Y	X	Y				
1	0	0.4	Y ₁				

Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}>$ 0.5 $F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are

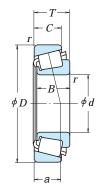
given in the table below.

Bearing Nu	mbers	Ak	outment			sions		Eff. Load	Constant	Axial		Mass	-
				(mm)		Cone	Cup	Centers (mm)		Fac	tors	(kg)	
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{ m b}$	$r_{ m a}$	1	``a'	e	Y_1	Y_0	approx. CONE CUP	
LM 72849	LM 72810	29	27	40.5	44.5	1.5	1	12.2	0.47	1.3	0.70	0.086 0.046	_
† L 44640	† L 44610	30.5	28.5	44.5	47	1.5	1.3	10.9	0.37	1.6	0.88	0.097 0.039	
1779	1729	29.5	28.5	49	51	0.8	1.3	12.2	0.31	2.0	1.1	0.143 0.102	
▲JHM 33449	▲JHM 33410	35	30	47	52	2	2	15.8	0.35	1.7	0.93	0.181 0.107	
07098	07204	31	29	45	48	1.5	1.3	12.1	0.40	1.5	0.82	0.085 0.061	
07098	07205	31	29	44.5	48	1.5	2	12.1	0.40	1.5	0.82	0.085 0.061	
17098	17244	33	30.5	54	57	1.5	1.5	12.8	0.38	1.6	0.86	0.165 0.091	
07097	07196	31	29	44.5	47	1.5	1	10.6	0.40	1.5	0.82	0.085 0.035	
07097	07204	31	29	45	48	1.5	1.3	12.1	0.40	1.5	0.82	0.085 0.061	
07100 SA	07196	35	29.5	44.5	47	3.3	1	10.6	0.40	1.5	0.82	0.082 0.035	
07100	07196	30.5	29.5	44.5	47	1	1	10.6	0.40	1.5	0.82	0.084 0.035	
† L 44643	† L 44610	31.5	29.5	44.5	47	1.3	1.3	10.9	0.37	1.6	0.88	0.090 0.039	
15578	15520	32.5	30.5	51	53	1.3	1.5	12.4	0.35	1.7	0.95	0.151 0.070	
M 84548	M 84510	36	33	48.5	54	1.5	1.5	16.1	0.55	1.1	0.60	0.156 0.089	
M 84249	M 84210	36	32.5	49.5	56	0.8	1.5	18.3	0.55	1.1	0.60	0.194 0.13	
15101	15245	32.5	31.5	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.222 0.081	
15100	15250 X	38	31.5	55	59	3.5	1.5	14.9	0.35	1.7	0.94	0.22 0.113	
M 86643	M 86610	38	36.5	54	61	1.5	1.5	17.7	0.55	1.1	0.60	0.246 0.128	
23100	23256	39	34.5	53	61	1.5	1.5	20.0	0.73	0.82	0.45	0.214 0.142	
02473	02420	34.5	33.5	59	63	0.8	1.5	16.9	0.42	1.4	0.79	0.28 0.152	
HM 88630	HM 88610	39.5	39.5	60	69	0.8	2.3	20.7	0.55	1.1	0.60	0.398 0.188	
41100	41286	41	36.5	61	68	2.3	1.5	20.7	0.60	1.0	0.55	0.32 0.177	
† L 44649	† L 44610	37.5	31	44.5	47	3.5	1.3	10.9	0.37	1.6	0.88	0.081 0.039	
1997 X	1922	37.5	31.5	51	53.5	3.3	1.5	13.9	0.33	1.8	1.0	0.152 0.077	
15580	15523	38.5	32	51	54	3.5	1.5	14.7	0.35	1.7	0.95	0.141 0.123	
15106	15245	33.5	33	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.211 0.081	
1988	1922	39.5	33.5	51	53.5	3.5	1.5	13.9	0.33	1.8	1.0	0.141 0.077	
† LM 67043	† LM 67010	40	33.5	52	56	3.5	1.3	12.6	0.41	1.5	0.80	0.147 0.062	
15112	15245	40	34	55	58	3.5	1.3	13.3	0.35	1.7	0.94	0.199 0.081	
15113	15245	34.5	34	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.20 0.081	
M 86647	M 86610	40	38	54	61	1.5	1.5	17.7	0.55	1.1	0.60	0.223 0.128	
02474	02420	36.5	36	59	63	0.8	1.5	16.9	0.42	1.4	0.79	0.257 0.152	
41125	41286	48	36.5	61	68	4.8	1.5	20.7	0.60	1.0	0.55	0.292 0.177	_
41126	41286	41.5	36.5	61	68	1.5	1.5	20.7	0.60	1.0	0.55	0.295 0.177	
02872	02820	37.5	37	62	68	0.8	3.3	18.3	0.45	1.3	0.73	0.321 0.16	

† The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).

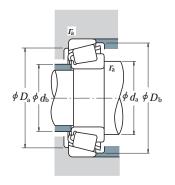
The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 29.000 - 32.000 mm



			Dimension	S				Basic Load	9		Limiting	•
		,	nm)		Cone	Cup	,	N)	{k	gf}	(mir	,
d	D	T	В	С		$oldsymbol{r}$ in.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
29.000	50.292	14.224	14.732	10.668	3.5	1.3	26 800	34 000	2 730	3 500	7 100	9 500
29.367	66.421	23.812	25.433	19.050	3.5	1.3	65 000	73 000	6 600	7 450	6 000	8 000
30.000	62.000	16.002	16.566	14.288	1.5	1.5	37 000	39 500	3 750	4 000	6 300	8 500
	62.000	19.050	20.638	14.288	1.3	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	63.500	20.638	20.638	15.875	1.3	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	72.000	19.000	18.923	15.875	1.5	1.5	52 000	56 000	5 300	5 700	5 600	7 500
30.112	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
30.162	58.738	14.684	15.080	10.716	3.5	1.0	28 800	33 500	2 940	3 450	6 000	8 000
	64.292	21.433	21.433	16.670	1.5	1.5	51 000	64 500	5 200	6 600	5 600	8 000
	68.262	22.225	22.225	17.462	2.3	1.5	55 500	70 500	5 650	7 200	5 300	7 500
	69.850	23.812	25.357	19.050	2.3	1.3	71 000	84 000	7 200	8 550	5 600	7 500
	69.850	23.812	25.357	19.050	0.8	1.3	71 000	84 000	7 200	8 550	5 600	7 500
	76.200	24.608	24.074	16.670	1.5	C3.3	67 500	69 500	6 850	7 100	5 000	6 700
30.213	62.000	19.050	20.638	14.288	3.5	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	62.000	19.050	20.638	14.288	1.5	1.3	46 000	53 000	4 700	5 400	6 000	8 000
30.955	64.292	21.433	21.433	16.670	1.5	1.5	51 000	64 500	5 200	6 600	5 600	8 000
31.750	58.738	14.684	15.080	10.716	1.0	1.0	28 800	33 500	2 940	3 450	6 000	8 000
	59.131	15.875	16.764	11.811	spec.	1.3	34 500	41 500	3 550	4 200	6 300	8 500
	62.000	18.161	19.050	14.288	spec.	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	62.000	19.050	20.638	14.288	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	62.000	19.050	20.638	14.288	3.5	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	63.500	20.638	20.638	15.875	0.8	1.3	46 000	53 000	4 700	5 400	6 000	8 000
	68.262	22.225	22.225	17.462	3.5	1.5	55 000	64 000	5 600	6 550	5 600	7 500
	68.262	22.225	22.225	17.462	1.5	1.5	55 500	70 500	5 650	7 200	5 300	7 500
	69.012	19.845	19.583	15.875	3.5	1.3	47 000	56 000	4 800	5 700	5 600	7 500
	69.012	26.982	26.721	15.875	4.3	3.3	47 000	56 000	4 800	5 700	5 600	7 500
	69.850	23.812	25.357	19.050	0.8	1.3	71 000	84 000	7 200	8 550	5 600	7 500
	69.850	23.812	25.357	19.050	3.5	1.3	71 000	84 000	7 200	8 550	5 600	7 500
	72.626	30.162	29.997	23.812	0.8	3.3	79 500	90 000	8 100	9 200	5 300	7 500
	73.025	29.370	27.783	23.020	1.3	3.3	74 000	100 000	7 550	10 200	5 000	7 100
	80.000	21.000	22.403	17.826	0.8	1.3	68 500	75 500	6 950	7 700	4 500	6 300
32.000	72.233	25.400	25.400	19.842	3.3	2.3	63 500	83 500	6 500	8 500	5 000	7 100





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$						
X	Y	X	Y					
1	0	0.4	Y ₁					

Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$ When $F_{
m r}\!>\!0.5F_{
m r}+Y_0\,F_{
m a}$, use P_0 = $F_{
m r}$ The values of e, Y_1 , and Y_0 are

given in the table below.

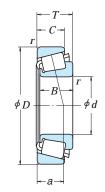
Bearing Nur	mbers	Ab	outment a	and Fille		nsions		Eff. Load Centers	Constant		Load tors		Mass (kg)	
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{\scriptscriptstyle m b}$	$D_{\rm a}$	$D_{ m b}$	Cone r ; ma	a '	(mm) a	e	Y_1	Y_0		rox. CUP	
† L 45449	† L 45410	39.5	33	44.5	48	3.5	1.3	10.8	0.37	1.6	0.89	0.079	0.036	
2690	2631	41	35	58	60	3.5	1.3	14.3	0.25	2.4	1.3	0.242	0.165	
* 17118	17244	37	34.5	54	57	1.5	1.5	12.8	0.38	1.6	0.86	0.136	0.091	
* 15117	15245	36.5	35	55	58	1.3	1.3	13.3	0.35	1.7	0.94	0.189	0.081	
* 15117	15250	36.5	35	56	59	1.3	1.3	14.9	0.35	1.7	0.94	0.189	0.113	
* 26118	26283	38	36	62	65	1.5	1.5	14.8	0.36	1.7	0.92	0.225	0.163	
15116	15245	36	35.5	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.189	0.081	
08118	08231	41.5	35	52	55	3.5	1	13.3	0.47	1.3	0.70	0.12	0.057	
M 86649	M 86610	41	38	54	61	1.5	1.5	17.7	0.55	1.1	0.60	0.211	0.128	
M 88043	M 88010	43.5	39.5	58	65	2.3	1.5	19.1	0.55	1.1	0.60	0.263	0.146	
2558	2523	40	36.5	61	64	2.3	1.3	14.5	0.27	2.2	1.2	0.297	0.169	
2559	2523	37	36.5	61	64	0.8	1.3	14.5	0.27	2.2	1.2	0.298	0.169	
43118	43300	45	42	64	73	1.5	3.3	22.9	0.67	0.90	0.49	0.383	0.146	
15118	15245	41.5	35.5	55	58	3.5	1.3	13.3	0.35	1.7	0.94	0.186	0.081	
15120	15245	36	35.5	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.188	0.081	
15119	15245	37.5	35.5	55	58	1.5	1.3	13.3	0.35	1.7	0.94	0.188	0.081	
M 86648 A	M 86610	42	38	54	61	1.5	1.5	17.7	0.55	1.1	0.60	0.205	0.128	
08125	08231	37.5	36	52	55	1	1	13.3	0.47	1.3	0.70	0.113	0.057	
† LM 67048	† LM 67010	42.5	36	52	56	3.5	1.3	12.6	0.41	1.5	0.80	0.127	0.062	
15123	15245	42.5	36.5	55	58	3.5	1.3	13.3	0.35	1.7	0.94	0.165	0.081	
15126	15245	37	36.5	55	58	0.8	1.3	13.3	0.35	1.7	0.94	0.176	0.081	
15125	15245	42.5	36.5	55	58	3.5	1.3	13.3	0.35	1.7	0.94	0.174	0.081	
15126	15250	37	36.5	56	59	0.8	1.3	14.9	0.35	1.7	0.94	0.176	0.113	
02475	02420	44.5	38.5	59	63	3.5	1.5	16.9	0.42	1.4	0.79	0.229	0.152	
M 88046	M 88010	43	40.5	58	65	1.5	1.5	19.1	0.55	1.1	0.60	0.25	0.146	
14125 A	14276	44	37.5	60	63	3.5	1.3	15.3	0.38	1.6	0.86	0.219	0.135	
14123 A	14274	41.5	37.5	59	63	4.3	3.3	15.1	0.38	1.6	0.87	0.289	0.132	
2580	2523	38.5	37.5	61	64	0.8	1.3	14.5	0.27	2.2	1.2	0.282	0.169	
2582	2523	44	37.5	61	64	3.5	1.3	14.5	0.27	2.2	1.2	0.28	0.169	
3188	3120	39.5	39.5	61	67	0.8	3.3	19.6	0.33	1.8	0.99	0.368	0.225	
HM 88542	HM 88510	45.5	42.5	59	70	1.3	3.3	23.5	0.55	1.1	0.60	0.379	0.242	
346	332	40	39.5	73	75	0.8	1.3	14.6	0.27	2.2	1.2	0.419	0.146	
*HM 88638	HM 88610	48.5	42.5	60	69	3.3	2.3	20.7	0.55	1.1	0.60	0.337	0.188	

* The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

† The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).

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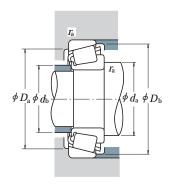
Bore Diameter 33.338 - 35.000 mm



			Dimension	S				Basic Loa		Limiting Speeds		
d	D	T	В	С	Cone <i>I</i>		$C_{ m r}$	N) $C_{0\mathrm{r}}$	$C_{ m r}^{\{ m k}$	$C_{0 m r}$	(mir Grease	Oil
33.338	66.675	20.638	20.638	15.875	3.5	1.5	46 000	53 500	4 650	5 450	5 600	7 500
	68.262	22.225	22.225	17.462	0.8	1.5	55 500	70 500	5 650	7 200	5 300	7 500
	69.012	19.845	19.583	15.875	3.5	3.3	47 000	56 000	4 800	5 700	5 600	7 500
	69.012	19.845	19.583	15.875	0.8	1.3	47 000	56 000	4 800	5 700	5 600	7 500
	69.850	23.812	25.357	19.050	3.5	1.3	71 000	84 000	7 200	8 550	5 600	7 500
	72.000	19.000	18.923	15.875	3.5	1.5	52 000	56 000	5 300	5 700	5 600	7 500
	72.626	30.162	29.997	23.812	0.8	3.3	79 500	90 000	8 100	9 200	5 300	7 500
	73.025	29.370	27.783	23.020	0.8	3.3	74 000	100 000	7 550	10 200	5 000	7 100
	76.200	29.370	28.575	23.020	3.8	0.8	78 500	106 000	8 000	10 800	4 800	6 700
	76.200	29.370	28.575	23.020	0.8	3.3	78 500	106 000	8 000	10 800	4 800	6 700
	79.375	25.400	24.074	17.462	3.5	1.5	67 500	69 500	6 850	7 100	5 000	6 700
34.925	65.088	18.034	18.288	13.970	spec.	1.3	47 500	57 500	4 850	5 900	5 600	7 500
	65.088	20.320	18.288	16.256	spec.	1.3	47 500	57 500	4 850	5 900	5 600	7 500
	66.675	20.638	20.638	16.670	3.5	2.3	53 000	62 500	5 400	6 400	5 600	7 500
	69.012	19.845	19.583	15.875	3.5	1.3	47 000	56 000	4 800	5 700	5 600	7 500
	69.012	19.845	19.583	15.875	1.5	1.3	47 000	56 000	4 800	5 700	5 600	7 500
	72.233	25.400	25.400	19.842	2.3	2.3	63 500	83 500	6 500	8 500	5 000	7 100
	73.025	22.225	22.225	17.462	0.8	3.3	54 500	64 500	5 550	6 600	5 300	7 100
	73.025	22.225	23.812	17.462	3.5	3.3	63 500	77 000	6 500	7 850	5 300	7 100
	73.025	23.812	24.608	19.050	1.5	0.8	71 000	86 000	7 250	8 750	5 300	7 100
	73.025	23.812	24.608	19.050	3.5	2.3	71 000	86 000	7 250	8 750	5 300	7 100
	76.200	29.370	28.575	23.020	0.8	0.8	78 500	106 000	8 000	10 800	4 800	6 700
	76.200	29.370	28.575	23.020	3.5	0.8	78 500	106 000	8 000	10 800	4 800	6 700
	76.200	29.370	28.575	23.020	3.5	3.3	78 500	106 000	8 000	10 800	4 800	6 700
	76.200	29.370	28.575	23.812	1.5	3.3	80 500	96 500	8 200	9 850	5 000	6 700
	79.375	29.370	29.771	23.812	3.5	3.3	88 000	106 000	8 950	10 800	4 800	6 700
34.976	68.262	15.875	16.520	11.908	1.5	1.5	45 000	53 500	4 600	5 450	5 300	7 100
	72.085	22.385	19.583	18.415	1.3	2.3	47 000	56 000	4 800	5 700	5 600	7 500
	80.000	21.006	20.940	15.875	1.5	1.5	56 500	64 500	5 750	6 600	5 000	6 700
35.000	59.131	15.875	16.764	11.938	spec.	1.3	35 000	47 000	3 550	4 750	6 000	8 000
	59.975	15.875	16.764	11.938	spec.	1.3	35 000	47 000	3 550	4 750	6 000	8 000
	62.000	16.700	17.000	13.600	spec.	1.0	38 000	50 000	3 900	5 100	5 600	8 000
	62.000	16.700	17.000	13.600	spec.	1.5	38 000	50 000	3 900	5 100	5 600	8 000
	65.987	20.638	20.638	16.670	3.5	2.3	53 000	62 500	5 400	6 400	5 600	7 500
	73.025	26.988	26.975	22.225	3.5	0.8	75 500	88 500	7 650	9 050	5 300	7 500



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Dynamic Equivalent Load

 $P = XF_{r} + YF_{a}$ $F / F \le a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0\,F_a$ When $F_{\rm r}>0.5F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are

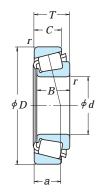
given in the table below.

Bearing Nu	ımbers	Al	outment	and Fille (mm)				Eff. Load Centers	Constant		Load tors	Ma: (kg	
CONE	CUP	$d_{\rm a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{\scriptscriptstyle m b}$	Cone r a ma:	a	(mm) a	e	Y_1	Y_0	appr CONE	ox. CUP
1680	1620	44.5	38.5	58	61	3.5	1.5	15.2	0.37	1.6	0.89	0.236	0.121
M 88048	M 88010	42.5	41	58	65	0.8	1.5	19.0	0.55	1.1	0.60		0.146
14130	14274	45	38.5	59	63	3.5	3.3	15.3	0.38	1.6	0.86		0.132
14131	14276	39.5	38.5	60	63	0.8	1.3	15.3	0.38	1.6	0.86	0.263	0.135
2585	2523	45	39	61	64	3.5	1.3	14.5	0.27	2.2	1.2		0.169
26131	26283	44.5	38.5	62	65	3.5	1.5	14.7	0.36	1.7	0.92		0.163
3197	3120	41.5	40.5	61	67	0.8	3.3	19.6	0.33	1.8	0.99	0.362	0.225
HM 88547	HM 88510	45.5	42.5	59	70	0.8	3.3	23.5	0.55	1.1	0.60		0.242
HM 89444	HM 89411	53	44.5	65	73	3.8	0.8	23.6	0.55	1.1	0.60		0.261
HM 89443	HM 89410	46.5	44.5	62	73	0.8	3.3	23.6	0.55	1.1	0.60		0.257
43131	43312	51	42	67	74	3.5	1.5	23.7	0.67	0.90	0.49		0.22
† LM 48548	† LM 48510	46	40	58	61	3.5	1.3	14.1	0.38	1.6	0.88	0.172	0.087
† LM 48548	† LM 48511	46	40	58	61	3.5	1.3	16.4	0.38	1.6	0.88		0.108
M 38549	M 38510	46.5	40	58	62	3.5	2.3	15.2	0.35	1.7	0.94		0.112
14138 A	14276	46	40	60	63	3.5	1.3	15.3	0.38	1.6	0.86	0.196	0.135
14137 A	14276	42	40	60	63	1.5	1.3	15.1	0.38	1.6	0.86		0.135
HM 88649	HM 88610	48.5	42.5	60	69	2.3	2.3	20.7	0.55	1.1	0.60		0.188
02878	02820	42.5	42	62	68	0.8	3.3	18.3	0.45	1.3	0.73	0.291	0.16
2877	2820	47	41.5	63	68	3.5	3.3	16.1	0.37	1.6	0.90		0.15
25877	25821	43	40.5	65	68	1.5	0.8	15.7	0.29	2.1	1.1		0.167
25878	25820	47	40.5	64	68	3.5	2.3	15.7	0.29	2.1	1.1	0.403	0.165
HM 89446 A	HM 89411	47.5	44.5	65	73	0.8	0.8	23.6	0.55	1.1	0.60		0.261
HM 89446	HM 89411	53	44.5	65	73	3.5	0.8	23.6	0.55	1.1	0.60		0.261
HM 89446	HM 89410	53	44.5	62	73	3.5	3.3	23.6	0.55	1.1	0.60	0.404	0.257
31594	31520	46	43.5	64	72	1.5	3.3	21.6	0.40	1.5	0.82		0.235
3478	3420	50	43.5	67	74	3.5	3.3	20.0	0.37	1.6	0.90		0.259
19138	19268	42.5	40.5	61	65	1.5	1.5	14.5	0.44	1.4	0.74	0.198	0.073
14139	14283	41.5	40	60	65	1.3	2.3	17.7	0.38	1.6	0.87		0.21
28138	28315	43.5	41	69	73	1.5	1.5	16.0	0.40	1.5	0.82		0.199
*† L 68149	† L 68110	45.5	39	52	56	3.5	1.3	13.2	0.42	1.4	0.79	0.117	0.056
*† L 68149	† L 68111	45.5	39	53	56	3.5	1.3	13.2	0.42	1.4	0.79		0.064
* LM 78349	** LM 78310	46	40	55	59	3.5	1	14.4	0.44	1.4	0.74		0.074
* LM 78349	** LM 78310 A	46	40	54	59	3.5	1.5	14.4	0.44	1.4	0.74	0.193	0.073
M 38547	M 38511	46	39.5	59	61	3.5	2.3	15.2	0.35	1.7	0.94		0.103
23691	23621	49	42	63	68	3.5	0.8	18.1	0.37	1.6	0.89		0.212

Notes

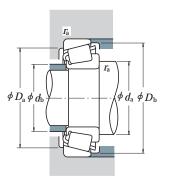
- * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- † The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).
- * † The tolerance for the bore diameter is 0 to $-20~\mu m$, and for overall bearing width is +356 to 0 μm .

Bore Diameter 35.717 – 41.275 mm



			Dimension	S			,	Basic Loa	E)	Limiting Speeds (min ⁻¹)		
d	D	T	В	C	Cone <i>I</i> mi		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	gf $ brace$ $C_{0 m r}$	Grease	Oil
35.717	72.233	25.400	25.400	19.842	3.5	2.3	63 500	83 500	6 500	8 500	5 000	7 100
36.487	73.025	23.812	24.608	19.050	1.5	0.8	71 000	86 000	7 250	8 750	5 300	7 100
36.512	76.200	29.370	28.575	23.020	3.5	3.3	78 500	106 000	8 000	10 800	4 800	6 700
	79.375	29.370	29.771	23.812	0.8	3.3	88 000	106 000	8 950	10 800	4 800	6 700
	88.501	25.400	23.698	17.462	2.3	1.5	73 000	81 000	7 450	8 250	4 000	5 600
	93.662	31.750	31.750	26.195	1.5	3.3	110 000	142 000	11 200	14 400	4 000	5 600
38.000	63.000	17.000	17.000	13.500	spec.	1.3	38 500	52 000	3 900	5 300	5 600	7 500
38.100	63.500	12.700	11.908	9.525	1.5	0.8	24 100	30 500	2 460	3 100	5 300	7 100
	65.088	18.034	18.288	13.970	2.3	1.3	42 500	55 000	4 300	5 650	5 300	7 500
	65.088	18.034	18.288	13.970	spec.	1.3	42 500	55 000	4 300	5 650	5 300	7 500
	65.088	19.812	18.288	15.748	2.3	1.3	42 500	55 000	4 300	5 650	5 300	7 500
	68.262	15.875	16.520	11.908	1.5	1.5	45 000	53 500	4 600	5 450	5 300	7 100
	69.012	19.050	19.050	15.083	2.0	2.3	49 000	61 000	4 950	6 250	5 300	7 100
	69.012	19.050	19.050	15.083	3.5	0.8	49 000	61 000	4 950	6 250	5 300	7 100
	72.238	20.638	20.638	15.875	3.5	1.3	48 500	59 500	4 950	6 050	5 300	7 100
	73.025	23.812	25.654	19.050	3.5	0.8	73 500	91 000	7 500	9 300	5 000	6 700
	76.200	23.812	25.654	19.050	3.5	3.3	73 500	91 000	7 500	9 300	5 000	6 700
	76.200	23.812	25.654	19.050	3.5	0.8	73 500	91 000	7 500	9 300	5 000	6 700
	79.375	29.370	29.771	23.812	3.5	3.3	88 000	106 000	8 950	10 800	4 800	6 700
	80.035	24.608	23.698	18.512	0.8	1.5	69 000	84 500	7 000	8 600	4 500	6 300
	82.550	29.370	28.575	23.020	0.8	3.3	87 000	117 000	8 850	11 900	4 500	6 000
	88.501	25.400	23.698	17.462	2.3	1.5	73 000	81 000	7 450	8 250	4 000	5 600
	88.501	26.988	29.083	22.225	3.5	1.5	96 500	109 000	9 800	11 100	4 500	6 000
	95.250	30.958	28.301	20.638	1.5	0.8	87 500	97 000	8 950	9 850	3 600	5 300
39.688	73.025	25.654	22.098	21.336	0.8	2.3	62 500	80 000	6 400	8 150	5 000	6 700
	76.200	23.812	25.654	19.050	3.5	3.3	73 500	91 000	7 500	9 300	5 000	6 700
	80.167	29.370	30.391	23.812	0.8	3.3	92 500	108 000	9 450	11 000	4 800	6 300
40.000	80.000	21.000	22.403	17.826	3.5	1.3	68 500	75 500	6 950	7 700	4 500	6 300
	80.000	21.000	22.403	17.826	0.8	1.3	68 500	75 500	6 950	7 700	4 500	6 300
	88.501	25.400	23.698	17.462	2.3	1.5	73 000	81 000	7 450	8 250	4 000	5 600
41.000	68.000	17.500	18.000	13.500	spec.	1.5	43 500	58 000	4 450	5 950	5 300	7 100
41.275	73.025	16.667	17.462	12.700	3.5	1.5	44 500	54 000	4 550	5 500	4 800	6 700
	73.431	19.558	19.812	14.732	3.5	0.8	54 500	67 000	5 550	6 850	4 800	6 700
	73.431	21.430	19.812	16.604	3.5	0.8	54 500	67 000	5 550	6 850	4 800	6 700





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

 P_0 = 0.5 $F_{\rm r}$ + Y_0 $F_{\rm a}$ When $F_{\rm r}$ > 0.5 $F_{\rm r}$ + Y_0 $F_{\rm a}$, use P_0 = $F_{\rm r}$

The values of e, Y_1 , and Y_0 are given in the table below.

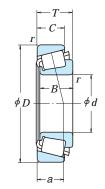
Bearing N	Numbers	Al	outment	and Fille		nsions		Eff. Load Centers	Constant		Load tors		ass (g)
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{\scriptscriptstyle m b}$	$D_{ m a}$	$D_{ m b}$	Cone r ma	a	(mm) a	e	Y_1	Y_0		orox. CUP
HM 88648	HM 88610	52	43	60	69	3.5	2.3	20.7	0.55	1.1	0.60	0.298	0.188
25880	25821	44	42	65	68	1.5	0.8	15.7	0.29	2.1	1.1	0.291	0.167
HM 89449	HM 89410	54	44.5	62	73	3.5	3.3	23.6	0.55	1.1	0.60	0.38	0.257
3479	3420	45.5	44.5	67	74	0.8	3.3	20.0	0.37	1.6	0.90	0.429	0.259
44143	44348	54	50	75	84	2.3	1.5	27.9	0.78	0.77	0.42	0.502	0.245
46143	46368	48.5	46.5	79	87	1.5	3.3	24.0	0.40	1.5	0.82	0.765	0.405
▲ JL 69349	▲ JL 69310	49	42.5	56	60	3.5	1.3	14.6	0.42	1.4	0.79	0.132	0.071
13889	13830	45	42.5	59	60	1.5	0.8	11.9	0.35	1.7	0.95	0.109	0.046
LM 29749	LM 29710	46	42.5	59	62	2.3	1.3	13.7	0.33	1.8	0.99	0.16	0.079
LM 29748	LM 29710	49	42.5	59	62	3.5	1.3	13.7	0.33	1.8	0.99	0.158	0.079
LM 29749	LM 29711	46	42.5	58	62	2.3	1.3	15.5	0.33	1.8	0.99	0.16	0.094
19150	19268	45	43	61	65	1.5	1.5	14.5	0.44	1.4	0.74	0.173	0.073
13687	13621	46.5	43	61	65	2	2.3	15.8	0.40	1.5	0.82	0.193	0.104
13685	13620	49.5	43	62	65	3.5	0.8	15.8	0.40	1.5	0.82	0.191	0.105
16150	16284	49.5	43	63	67	3.5	1.3	16.0	0.40	1.5	0.82	0.212	0.146
2788	2735 X	50	43.5	66	69	3.5	0.8	15.9	0.30	2.0	1.1	0.312	0.135
2788	2720	50	43.5	66	70	3.5	3.3	15.9	0.30	2.0	1.1	0.312	0.187
2788	2729	50	43.5	68	70	3.5	0.8	15.9	0.30	2.0	1.1	0.312	0.191
3490	3420	52	45.5	67	74	3.5	3.3	20.0	0.37	1.6	0.90	0.404	0.259
27880	27820	48	47	68	75	0.8	1.5	21.5	0.56	1.1	0.59	0.362	0.209
HM 801346	HM 801310	51	49	68	78	0.8	3.3	24.2	0.55	1.1	0.60	0.483	0.282
44150	44348	55	51	75	84	2.3	1.5	27.9	0.78	0.77	0.42	0.484	0.245
418	414	51	44.5	77	80	3.5	1.5	17.1	0.26	2.3	1.3	0.50	0.329
53150	53375	55	53	81	89	1.5	0.8	30.7	0.74	0.81	0.45	0.665	0.365
M 201047	M 201011	45.5	48	64	69	0.8	2.3	19.7	0.33	1.8	0.99	0.266	0.169
2789	2720	52	45	66	70	3.5	3.3	15.9	0.30	2.0	1.1	0.292	0.187
3386	3320	46.5	45.5	70	75	0.8	3.3	18.4	0.27	2.2	1.2	0.442	0.217
344	332	52	45.5	73	75	3.5	1.3	14.5	0.27	2.2	1.2	0.338	0.146
344 A	332	46	45.5	73	75	0.8	1.3	14.5	0.27	2.2	1.2	0.339	0.146
44157	44348	56	51	75	84	2.3	1.5	27.9	0.78	0.77	0.42	0.463	0.245
* LM 300849	** LM 300811	52	45	61	65	3.5	1.5	13.9	0.35	1.7	0.95	0.16	0.082
18590	18520	53	46	66	69	3.5	1.5	14.0	0.35	1.7	0.94	0.199	0.086
LM 501349	LM 501310	53	46.5	67	70	3.5	0.8	16.3	0.40	1.5	0.83	0.226	0.108
LM 501349	LM 501314	53	46.5	66	70	3.5	0.8	18.2	0.40	1.5	0.83	0.226	0.129

tes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- ▲ The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

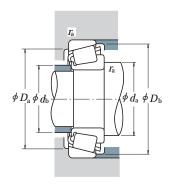
B 144 B 145

Bore Diameter 41.275 – 44.450 mm



		Boundary	Dimension	S			(2)	Basic Loa	5		Limiting Speeds		
d	D	T	B	С	Cone 1	Cup	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	gf $}$ C_{0r}	(mir Grease	oil	
<u>u</u>	D	1	Ъ	C	mi		01 001		$c_{\rm r}$	Cor	0.0000	0	
41.275	76.200	18.009	17.384	14.288	1.5	1.5	42 500	51 000	4 350	5 200	4 500	6 300	
	76.200	22.225	23.020	17.462	3.5	0.8	66 000	82 000	6 700	8 400	4 800	6 700	
	76.200	25.400	23.020	20.638	3.5	2.3	66 000	82 000	6 700	8 400	4 800	6 700	
	79.375	23.812	25.400	19.050	3.5	0.8	77 000	98 500	7 850	10 000	4 800	6 300	
	80.000	21.000	22.403	17.826	0.8	1.3	68 500	75 500	6 950	7 700	4 500	6 300	
	80.000	21.000	22.403	17.826	3.5	1.3	68 500	75 500	6 950	7 700	4 500	6 300	
	80.167	25.400	25.400	20.638	3.5	3.3	77 000	98 500	7 850	10 000	4 800	6 300	
	82.550	26.543	25.654	20.193	3.5	3.3	78 500	102 000	8 000	10 400	4 300	6 000	
	85.725	30.162	30.162	23.812	3.5	3.3	91 000	115 000	9 300	11 700	4 300	6 000	
	87.312	30.162	30.886	23.812	0.8	3.3	96 000	120 000	9 800	12 200	4 300	6 000	
	88.501	25.400	23.698	17.462	2.3	1.5	73 000	81 000	7 450	8 250	4 000	5 600	
	88.900	30.162	29.370	23.020	3.5	3.3	96 500	129 000	9 800	13 200	4 000	5 600	
	88.900	30.162	29.370	23.020	0.8	3.3	96 500	129 000	9 800	13 200	4 000	5 600	
	90.488	39.688	40.386	33.338	3.5	3.3	139 000	180 000	14 200	18 400	4 300	5 600	
	93.662	31.750	31.750	26.195	0.8	3.3	110 000	142 000	11 200	14 400	4 000	5 600	
	95.250	30.162	29.370	23.020	3.5	3.3	106 000	143 000	10 800	14 500	3 800	5 300	
	98.425	30.958	28.301	20.638	1.5	0.8	87 500	97 000	8 950	9 850	3 600	5 300	
42.862	76.992	17.462	17.145	11.908	1.5	1.5	44 000	54 000	4 450	5 500	4 500	6 000	
	82.550	19.842	19.837	15.080	2.3	1.5	58 500	69 000	5 950	7 050	4 500	6 300	
	82.931	23.812	25.400	19.050	2.3	0.8	76 500	99 000	7 800	10 100	4 500	6 000	
	82.931	26.988	25.400	22.225	2.3	2.3	76 500	99 000	7 800	10 100	4 500	6 000	
42.875	76.200	25.400	25.400	20.638	3.5	1.5	77 000	98 500	7 850	10 000	4 800	6 300	
	80.000	21.000	22.403	17.826	3.5	1.3	68 500	75 500	6 950	7 700	4 500	6 300	
	82.931	26.988	25.400	22.225	3.5	2.3	76 500	99 000	7 800	10 100	4 500	6 000	
	83.058	23.812	25.400	19.050	3.5	3.3	76 500	99 000	7 800	10 100	4 500	6 000	
43.000	74.988	19.368	19.837	14.288	1.5	1.3	52 500	68 000	5 350	6 900	4 800	6 300	
44.450	80.962	19.050	17.462	14.288	0.3	1.5	45 000	57 000	4 600	5 800	4 300	6 000	
	82.931	23.812	25.400	19.050	3.5	0.8	76 500	99 000	7 800	10 100	4 500	6 000	
	83.058	23.812	25.400	19.050	3.5	3.3	76 500	99 000	7 800	10 100	4 500	6 000	
	87.312	30.162	30.886	23.812	3.5	3.3	96 000	120 000	9 800	12 200	4 300	6 000	
	88.900	30.162	29.370	23.020	3.5	3.3	96 500	129 000	9 800	13 200	4 000	5 600	
	93.264	30.162	30.302	23.812	3.5	3.2	103 000	136 000	10 500	13 900	3 800	5 300	
	93.662	31.750	31.750	25.400	0.8	3.3	120 000	147 000	12 200	15 000	4 000	5 600	
	93.662	31.750	31.750	25.400	3.5	3.3	120 000	147 000	12 200	15 000	4 000	5 600	
	93.662	31.750	31.750	26.195	3.5	3.3	110 000	142 000	11 200	14 400	4 000	5 600	
	95.250	27.783	29.901	22.225	3.5	2.3	106 000	126 000	10 800	12 900	4 300	5 600	





Dynamic Equivalent Load

P = X	$F_{\rm r}$ + $YF_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	V

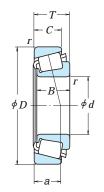
Static Equivalent Load

 $P_0=0.5\,F_r+Y_0\,F_a$ When $F_r>0.5\,F_r+Y_0\,F_a$, use $P_0=F_r$ The values of $e,\ Y_1$, and Y_0 are given in the table below.

Bearing Nu	umbers	Al	outment	and Fille (mm)				Eff. Load Centers	Constant	Axial Load Factors		Mass (kg)	
CONE	CUP	$d_{\rm a}$	$d_{\scriptscriptstyle m b}$	$D_{\rm a}$	$D_{ m b}$	Cone r a max	1	(mm) a	e	Y_1	Y_0	app CONE	rox. CUP
11162	11300	49	46.5	67	71	1.5	1.5	17.4	0.49	1.2	0.68	0.212	0.129
24780	24720	53	47.5	68	72	3.5	0.8	17.0	0.39	1.5	0.84	0.279	0.15
24780	24721	54	47	66	72	3.5	2.3	20.2	0.39	1.5	0.84	0.279	0.189
26882	26822	54	47	71	74	3.5	0.8	16.4	0.32	1.9	1.0	0.349	0.186
336	332	47	46	73	75	0.8	1.3	14.5	0.27	2.2	1.2	0.325	0.146
342	332	53	46	73	75	3.5	1.3	14.5	0.27	2.2	1.2	0.323	0.146
26882	26820	54	47	69	74	3.5	3.3	18.0	0.32	1.9	1.0	0.349	0.219
M 802048	M 802011	57	51	70	79	3.5	3.3	22.9	0.55	1.1	0.60	0.406	0.23
3877	3820	57	50	73	81	3.5	3.3	21.8	0.40	1.5	0.82	0.506	0.285
3576	3525	49	48	75	81	0.8	3.3	19.5	0.31	2.0	1.1	0.532	0.304
44162	44348	57	51	75	84	2.3	1.5	28.0	0.78	0.77	0.42	0.447	0.245
HM 803146	HM 803110	60	53	74	85	3.5	3.3	25.6	0.55	1.1	0.60	0.579	0.322
HM 803145	HM 803110	54	53	74	85	0.8	3.3	25.6	0.55	1.1	0.60	0.582	0.322
4388	4335	57	51	77	85	3.5	3.3	24.6	0.28	2.1	1.2	0.789	0.459
46162	46368	52	51	79	87	0.8	3.3	24.0	0.40	1.5	0.82	0.695	0.405
HM 804840	HM 804810	61	54	81	91	3.5	3.3	26.1	0.55	1.1	0.60	0.726	0.354
53162	53387	57	53	82	91	1.5	0.8	30.7	0.74	0.81	0.45	0.618	0.442
12168	12303	51	48.5	68	73	1.5	1.5	17.7	0.51	1.2	0.65	0.228	0.098
22168	22325	52	48.5	73	76	2.3	1.5	17.6	0.43	1.4	0.77	0.283	0.176
25578	25520	53	49.5	74	77	2.3	0.8	17.6	0.33	1.8	0.99	0.383	0.203
25578	25523	53	49.5	72	77	2.3	2.3	20.8	0.33	1.8	0.99	0.383	0.248
26884	26823	55	48.5	69	73	3.5	1.5	18.0	0.32	1.9	1.0	0.337	0.136
342 S	332	54	47.5	73	75	3.5	1.3	14.5	0.27	2.2	1.2	0.305	0.146
25577	25523	55	49	72	77	3.5	2.3	20.8	0.33	1.8	0.99	0.381	0.248
25577	25521	55	49	72	77	3.5	3.3	17.6	0.33	1.8	0.99	0.381	0.201
* 16986	16929	51	48.5	67	71	1.5	1.3	17.2	0.44	1.4	0.74	0.24	0.106
13175	13318	50	50	72	76	0.3	1.5	20.1	0.53	1.1	0.63	0.252	0.144
25580	25520	57	50	74	77	3.5	0.8	17.6	0.33	1.8	0.99	0.359	0.203
25580	25521	56	51	72	78	3.5	3.3	17.6	0.33	1.8	0.99	0.359	0.201
3578	3525	57	51	75	81	3.5	3.3	19.5	0.31	2.0	1.1	0.477	0.304
HM 803149	HM 803110	62	53	74	85	3.5	3.3	25.6	0.55	1.1	0.60	0.528	0.322
3782	3720	58	52	82	88	3.5	3.2	22.4	0.34	1.8	0.97	0.678	0.292
49176	49368	54	53	82	87	0.8	3.3	21.6	0.36	1.7	0.92	0.648	0.371
49175	49368	59	53	82	87	3.5	3.3	21.6	0.36	1.7	0.92	0.645	0.371
46176	46368	60	54	79	87	3.5	3.3	24.0	0.40	1.5	0.82	0.635	0.405
438	432	57	51	83	87	3.5	2.3	18.6	0.28	2.1	1.2	0.555	0.384

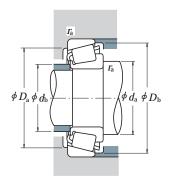
Note * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

Bore Diameter 44.450 – 47.625 mm



			Dimension	S			,	Basic Loa			Limiting	
d	D	T	B	С	Cone 1	Cup	$C_{\rm r}$	N) $C_{0\mathrm{r}}$	$C_{ m r}$	gf} C_{0r}	(mir Grease	n=') Oil
<u>u</u>		1	ь		mi		O _r	Cur	O _r	Cor		
44.450	95.250	30.162	29.370	23.020	3.5	3.3	106 000	143 000	10 800	14 500	3 800	5 300
	95.250	30.958	28.301	20.638	3.5	0.8	87 500	97 000	8 950	9 850	3 600	5 300
	95.250	30.958	28.301	20.638	1.3	0.8	87 500	97 000	8 950	9 850	3 600	5 300
	95.250	30.958	28.301	20.638	2.0	0.8	87 500	97 000	8 950	9 850	3 600	5 300
	95.250	30.958	28.301	22.225	1.3	0.8	100 000	122 000	10 200	12 500	3 600	5 000
	95.250	30.958	28.575	22.225	3.5	0.8	100 000	122 000	10 200	12 500	3 600	5 000
	98.425	30.958	28.301	20.638	3.5	0.8	87 500	97 000	8 950	9 850	3 600	5 300
	103.188	43.658	44.475	36.512	1.3	3.3	178 000	238 000	18 100	24 300	3 800	5 000
	104.775	36.512	36.512	28.575	3.5	3.3	139 000	192 000	14 200	19 600	3 400	4 800
	107.950	27.783	29.317	22.225	3.5	0.8	116 000	149 000	11 800	15 200	3 400	4 800
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450	11 200	3 200	4 300
	114.300	44.450	44.450	34.925	3.5	3.3	172 000	205 000	17 500	20 900	3 600	4 800
44.983	82.931	23.812	25.400	19.050	1.5	0.8	76 500	99 000	7 800	10 100	4 500	6 000
45.000	93.264	20.638	22.225	15.082	0.8	1.3	77 000	93 000	7 900	9 500	3 800	5 300
45.230	79.985	19.842	20.638	15.080	2.0	1.3	62 000	78 500	6 300	8 000	4 500	6 000
45.242	73.431	19.558	19.812	15.748	3.5	8.0	53 500	75 000	5 450	7 650	4 800	6 300
	77.788	19.842	19.842	15.080	3.5	8.0	56 000	71 000	5 700	7 250	4 500	6 300
	77.788	21.430	19.842	16.667	3.5	8.0	56 000	71 000	5 700	7 250	4 500	6 300
45.618	82.931	23.812	25.400	19.050	3.5	0.8	76 500	99 000	7 800	10 100	4 500	6 000
	82.931	26.988	25.400	22.225	3.5	2.3	76 500	99 000	7 800	10 100	4 500	6 000
46.000	75.000	18.000	18.000	14.000	2.3	1.5	51 000	71 500	5 200	7 300	4 500	6 300
46.038	79.375	17.462	17.462	13.495	2.8	1.5	46 000	57 000	4 700	5 800	4 500	6 000
	80.962	19.050	17.462	14.288	0.8	1.5	45 000	57 000	4 600	5 800	4 300	6 000
	85.000	20.638	21.692	17.462	2.3	1.3	71 500	81 500	7 300	8 300	4 300	6 000
	85.000	25.400	25.608	20.638	3.5	1.3	79 500	105 000	8 100	10 700	4 300	6 000
	95.250	27.783	29.901	22.225	3.5	0.8	106 000	126 000	10 800	12 900	4 300	5 600
47.625	88.900	20.638	22.225	16.513	3.5	1.3	73 000	85 000	7 450	8 650	4 000	5 600
	88.900	25.400	25.400	19.050	3.5	3.3	86 000	107 000	8 750	10 900	4 000	5 600
	95.250	30.162	29.370	23.020	3.5	3.3	106 000	143 000	10 800	14 500	3 800	5 300
	101.600	34.925	36.068	26.988	3.5	3.3	137 000	169 000	14 000	17 200	3 800	5 000
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450	11 200	3 200	4 300
	112.712	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450	11 200	3 200	4 300
	117.475	33.338	31.750	23.812	3.5	3.3	137 000	156 000	13 900	15 900	3 200	4 300
	123.825	36.512	32.791	25.400	3.5	3.3	143 000	160 000	14 600	16 400	3 000	4 000





Dynamic Equivalent Load

P = X	$F_{\rm r}$ + $YF_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

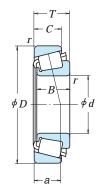
 $P_0=0.5F_{\rm r}+Y_0\,F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,\,Y_1$, and Y_0 are given in the table below.

Bearing N	lumbers	A	outmen	t and Fille (mm				Eff. Load Centers	Constant	Axial Fac	Load tors	Mass (kg)	
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{\scriptscriptstyle m b}$	Cone r ma	a	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
HM 804843	HM 804810	63	57	81	91	3.5	3.3	26.1	0.55	1.1	0.60	0.677	0.354
53177	53375	63	53	81	89	3.5	0.8	30.7	0.74	0.81	0.45	0.572	0.365
53176	53375	59	53	81	89	1.3	0.8	30.7	0.74	0.81	0.45	0.574	0.365
53178	53375	60	53	81	89	2	0.8	30.7	0.74	0.81	0.45	0.574	0.365
HM 903247	HM 903210	61	54	81	91	1.3	0.8	31.5	0.74	0.81	0.45	0.651	0.389
HM 903249	HM 903210	65	54	81	91	3.5	0.8	31.5	0.74	0.81	0.45	0.635	0.389
53177	53387	63	53	82	91	3.5	0.8	30.7	0.74	0.81	0.45	0.568	0.442
5356	5335	58	56	89	97	1.3	3.3	27.0	0.30	2.0	1.1	1.23	0.637
HM 807040	HM 807010	66	59	89	100	3.5	3.3	29.7	0.49	1.2	0.68	1.14	0.502
460	453 A	60	54	97	100	3.5	0.8	20.7	0.34	1.8	0.98	0.93	0.42
55175	55437	67	60	92	105	3.5	3.3	37.3	0.88	0.68	0.37	0.867	0.514
65385	65320	65	59	97	107	3.5	3.3	32.2	0.43	1.4	0.77	1.39	0.894
25584	25520	53	51	74	77	1.5	0.8	17.6	0.33	1.8	0.99	0.354	0.203
376	374	54	54	85	88	0.8	1.3	17.1	0.34	1.8	0.97	0.492	0.174
17887	17831	57	52	68	74	2	1.3	15.9	0.37	1.6	0.90	0.274	0.136
LM 102949	LM 102910	56	50	68	70	3.5	0.8	14.6	0.31	2.0	1.1	0.213	0.102
LM 603049	LM 603011	57	50	71	74	3.5	0.8	17.2	0.43	1.4	0.77	0.249	0.119
LM 603049	LM 603012	57	50	70	74	3.5	0.8	18.8	0.43	1.4	0.77	0.249	0.137
25590	25520	58	51	74	77	3.5	0.8	17.6	0.33	1.8	0.99	0.343	0.203
25590	25523	58	51	72	77	3.5	2.3	20.8	0.33	1.8	0.99	0.343	0.248
* LM 503349	** LM 503310	55	51	67	71	2.3	1.5	15.9	0.40	1.5	0.82	0.209	0.096
18690	18620	56	51	71	74	2.8	1.5	15.5	0.37	1.6	0.88	0.211	0.126
13181	13318	52	52	72	76	0.8	1.5	20.1	0.53	1.1	0.63	0.236	0.144
359 S	354 A	55	51	77	80	2.3	1.3	15.4	0.31	2.0	1.1	0.343	0.162
2984	2924	58	52	76	80	3.5	1.3	19.0	0.35	1.7	0.95	0.397	0.223
436	432 A	59	52	84	87	3.5	0.8	18.6	0.28	2.1	1.2	0.536	0.381
369 A	362 A	60	53	81	84	3.5	1.3	16.6	0.32	1.9	1.0	0.381	0.166
M 804049	M 804010	63	56	77	85	3.5	3.3	23.8	0.55	1.1	0.60	0.455	0.218
HM 804846	HM 804810	66	57	81	91	3.5	3.3	26.1	0.55	1.1	0.60	0.626	0.354
528	522	62	55	89	95	3.5	3.3	22.1	0.29	2.1	1.2	0.894	0.416
55187	55437	69	62	92	105	3.5	3.3	37.3	0.88	0.68	0.37	0.817	0.514
55187	55443	69	62	92	106	3.5	3.3	37.3	0.88	0.68	0.37	0.816	0.554
66187	66462	66	62	100	111	3.5	3.3	32.1	0.63	0.96	0.53	1.19	0.552
72187	72487	72	66	102	116	3.5	3.3	37.0	0.74	0.81	0.45	1.29	0.79

* The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

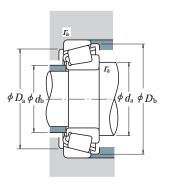
** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).

Bore Diameter 48.412 – 52.388 mm



Boundary Dimensions (mm)									Limiting Speeds			
_		,	,		Cone	Cup	,	N)		gf}	(mir	,
d	D	T	В	C	<i>I</i> mi		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
48.412	95.250	30.162	29.370	23.020	3.5	3.3	106 000	143 000	10 800	14 500	3 800	5 300
40.412	95.250	30.162	29.370	23.020	2.3	3.3	106 000	143 000	10 800	14 500	3 800	5 300
49.212	104.775 114.300	36.512 44.450	36.512 44.450	28.575 36.068	3.5 3.5	0.8	139 000 196 000	192 000 243 000	14 200 20 000	19 600 24 800	3 400 3 400	4 800 4 800
50.000	82.000	21.500	21.500	17.000	3.0	3.3	71 000	96 000	7 250	9 800	4 300	5 600
00.000	82.550 88.900	21.590	22.225	16.510	0.5 2.3	1.3	71 000 73 000	96 000	7 250 7 450	9 800 8 650	4 300 4 000	5 600 5 600
	90.000	20.638	22.225 28.000	16.513 23.000	3.0	2.5	104 000	85 000 136 000	10 600	13 900	4 000	5 600
	105.000	37.000	36.000	29.000	3.0	2.5	139 000	192 000	14 200	19 600	3 400	4 800
50.800	80.962 82.550	18.258 23.622	18.258 22.225	14.288 18.542	1.5 3.5	1.5 0.8	53 000 71 000	81 000 96 000	5 400 7 250	8 250 9 800	4 300 4 300	5 600 5 600
	82.931	21.590	22.225	16.510	3.5	1.3	71 000	96 000	7 250	9 800	4 300	5 600
	85.000 85.725	17.462 19.050	17.462 18.263	13.495 12.700	3.5 1.5	1.5 1.5	48 500 42 500	63 000 54 000	4 950 4 350	6 450 5 500	4 300 4 000	5 600 5 300
	88.900	20.638	22.225	16.513	3.5	1.3	73 000	85 000	7 450	8 650	4 000	5 600
	88.900 92.075	20.638 24.608	22.225 25.400	16.513 19.845	1.5 3.5	1.3 0.8	73 000 84 500	85 000 117 000	7 450 8 600	8 650 11 900	4 000 4 000	5 600 5 300
	93.264	30.162	30.302	23.812	0.8	0.8	103 000	136 000	10 500	13 900	3 800	5 300
	93.264 95.250	30.162 27.783	30.302 28.575	23.812 22.225	3.5 3.5	0.8	103 000 110 000	136 000 144 000	10 500 11 200	13 900 14 700	3 800 3 800	5 300 5 300
	101.600	31.750	31.750	25.400	3.5	3.3	118 000	150 000	12 100	15 200	3 600	5 000
	101.600 101.600	34.925 34.925	36.068 36.068	26.988 26.988	0.8 3.5	3.3	137 000 137 000	169 000 169 000	14 000 14 000	17 200 17 200	3 800 3 800	5 000 5 000
	104.775	36.512	36.512	28.575	3.5	0.8	139 000	192 000	14 200	19 600	3 400	4 800
	104.775	36.512 34.925	36.512 36.512	28.575 26.988	3.5 3.5	3.3	139 000 145 000	192 000 181 000	14 200 14 700	19 600 18 500	3 400	4 800 4 800
	108.966 111.125	34.925	26.909	20.638	3.5	3.3	113 000	152 000	11 500	15 400	3 600 3 000	4 300
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450	11 200	3 200	4 300
	123.825 123.825	36.512 36.512	32.791 32.791	25.400 25.400	3.5 3.5	3.3 3.3	162 000 143 000	199 000 160 000	16 500 14 600	20 300 16 400	2 800 3 000	4 000 4 000
	127.000	44.450	44.450	34.925	3.5	3.3	199 000	258 000	20 200	26 300	3 000	4 000
52.388	127.000 92.075	50.800	52.388 25.400	41.275 19.845	3.5 3.5	3.3	236 000 84 500	300 000 117 000	24 000 8 600	31 000 11 900	3 200 4 000	4 300 5 300
32.300	100.000	25.000	22.225	21.824	2.3	2.0	77 000	93 000	7 900	9 500	3 800	5 300
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450	11 200	3 200	4 300





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	$F_{\rm r} > e$		
X	Y	X	Y		
1	0	0.4	Y ₁		

Static Equivalent Load

 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$ When $F_{\rm r} > 0.5F_{\rm r} + Y_0 F_{\rm a}$, use $P_0 = F_{\rm r}$ The values of e, $Y_{\rm r}$ and $Y_{\rm r}$ are

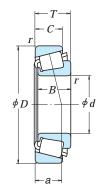
The values of e, Y_1 , and Y_0 are given in the table below.

Bearing N	Numbers	А	butmen	t and Fill (mm		nsions		Eff. Load Centers	Constant		Load tors		ass (g)
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone r ma	a	(mm) a	e	Y_1	Y_0		orox. CUP
HM 804849	HM 804810	66	57	81	91	3.5	3.3	26.1	0.55	1.1	0.60	0.61	0.354
HM 804848	HM 804810	63	57	81	91	2.3	3.3	26.1	0.55	1.1	0.60	0.614	0.354
HM 807044	HM 807011	69	63	91	100	3.5	0.8	29.7	0.49	1.2	0.68	1.03	0.508
HH 506348	HH 506310	71	61	97	107	3.5	3.3	30.8		1.5	0.82	1.43	0.837
▲ JLM 104948	▲ JLM 104910	60	55	76	78	3	0.5	16.1	0.31	2.0	1.1	0.306	0.129
* LM 104947 A	LM 104911	55	55	75	78	0.5	1.3	15.7	0.31	2.0	1.1	0.316	0.133
366	362 A	59	55	81	84	2.3	1.3	16.6	0.32	1.9	1.0	0.351	0.166
▲ JM 205149	▲ JM 205110	62	57	80	85	3	2.5	19.9	0.33	1.8	1.0	0.507	0.246
▲ JHM 807045	▲ JHM 807012	69	63	90	100		2.5	29.7	0.49	1.2	0.68	1.01	0.523
L 305649	L 305610	58	56	73	77	1.5	1.5	15.7	0.36	1.7	0.93	0.239	0.119
LM 104949	LM 104911 A	62	55	75	78	3.5	0.8	17.8	0.31	2.0	1.1	0.303	0.156
LM 104949	LM 104912	62	55	75	78	3.5	1.3	15.7	0.31	2.0	1.1	0.301	0.14
18790	18720	62	56	77	80	3.5	1.5	16.7	0.41	1.5	0.81	0.239	0.136
18200	18337	59	56	76	81	1.5	1.5	21.0	0.57	1.1	0.58	0.268	0.136
368 A	362 A	62	56	81	84	3.5	1.3	16.6	0.32	1.9	1.0	0.338	0.166
368	362 A	58	56	81	84	1.5	1.3	16.6	0.32	1.9	1.0	0.341	0.166
28580	28521	63	57	83	87	3.5	0.8	20.0	0.38	1.6	0.87	0.46	0.247
3775	3730	58	58	84	88	0.8	0.8	22.4	0.34	1.8	0.97	0.568	0.297
3780	3730	64	58	84	88	3.5	0.8	22.4	0.34	1.8	0.97	0.564	0.297
33889	33821	64	58	85	90	3.5	2.3	19.8	0.33	1.8	1.0	0.601	0.267
49585	49520	66	59	88	96	3.5	3.3	23.4	0.40	1.5	0.82	0.744	0.389
529	522	59	58	89	95	0.8	3.3	22.1	0.29	2.1	1.2	0.822	0.416
529 X	522	65	58	89	95	3.5	3.3	22.1	0.29	2.1	1.2	0.819	0.416
HM 807046	HM 807011	70	63	91	100	3.5	0.8	29.7	0.49	1.2	0.68	0.992	0.508
HM 807046	HM 807010	70	63	89	100	3.5	3.3	29.7	0.49	1.2	0.68	0.993	0.502
59200	59429	68	61	93	101	3.5	3.3	25.4	0.40	1.5	0.82	0.943	0.594
55200 C	55437	71	65	92	105	3.5	3.3	37.6	0.88	0.68	0.37	0.845	0.514
55200	55437	71	64	92	105	3.5	3.3	37.3	0.88	0.68	0.37	0.767	0.514
72200 C	72487	77	67	102	116	3.5	3.3	38.0	0.74	0.81	0.45	1.33	0.79
72200	72487	74	66	102	116	3.5	3.3	37.0	0.74	0.81	0.45	1.22	0.79
65200	65500	75	69	107	119	3.5	3.3	35.0	0.49	1.2	0.68	1.86	1.03
6279	6220	71	65	108	117	3.5	3.3	30.7	0.30	2.0	1.1	2.08	1.22
28584	28521	65	58	83	87	3.5	0.8	20.0	0.38	1.6	0.87	0.435	0.247
377	372	62	58	86	90	2.3	2	21.4	0.34	1.8	0.97	0.392	0.435
55206	55437	72	64	92	105	3.5	3.3	37.3	0.88	0.68	0.37	0.737	0.514

* The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

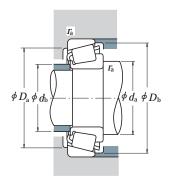
The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 53.975 – 58.738 mm



			Dimension	S				Basic Loa		Limiting Speeds		
,	_	,	nm) _	_	Cone	Cup		N)		gf} -	(min	,
d	D	T	В	С	<i>I</i> ' mir		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
53.975	104.775	39.688	40.157	33.338	3.5	3.3	148 000	207 000	15 100	21 100	3 600	4 800
	107.950	36.512	36.957	28.575	3.5	3.3	144 000	182 000	14 700	18 500	3 600	4 800
	122.238	33.338	31.750	23.812	3.5	3.3	135 000	156 000	13 800	15 900	3 000	4 000
	123.825	36.512	32.791	25.400	3.5	3.3	143 000	160 000	14 600	16 400	3 000	4 000
	123.825	36.512	32.791	25.400	3.5	3.3	162 000	199 000	16 500	20 300	2 800	4 000
	123.825	38.100	36.678	30.162	3.5	3.3	161 000	221 000	16 400	22 500	3 000	4 000
	127.000	44.450	44.450	34.925	3.5	3.3	199 000	258 000	20 200	26 300	3 000	4 000
	127.000	50.800	52.388	41.275	3.5	3.3	236 000	300 000	24 000	31 000	3 200	4 300
	130.175	36.512	33.338	23.812	3.5	3.3	133 000	154 000	13 600	15 700	2 600	3 600
55.000	90.000	23.000	23.000	18.500	1.5	0.5	79 000	111 000	8 050	11 300	3 800	5 300
	95.000	29.000	29.000	23.500	1.5	2.5	111 000	152 000	11 300	15 500	3 800	5 000
	96.838	21.000	21.946	15.875	2.3	0.8	80 500	100 000	8 200	10 200	3 600	5 000
	110.000	39.000	39.000	32.000	3.0	2.5	177 000	225 000	18 000	23 000	3 400	4 500
	115.000	41.021	41.275	31.496	3.0	3.0	172 000	214 000	17 500	21 800	3 200	4 500
55.562	97.630	24.608	24.608	19.446	3.5	0.8	89 000	129 000	9 100	13 100	3 600	5 000
	122.238	43.658	43.764	36.512	1.3	3.3	198 000	292 000	20 200	29 700	3 000	4 000
	123.825	36.512	32.791	25.400	3.5	3.3	143 000	160 000	14 600	16 400	3 000	4 000
	123.825	36.512	32.791	25.400	3.5	3.3	162 000	199 000	16 500	20 300	2 800	4 000
57.150	96.838	21.000	21.946	15.875	3.5	0.8	80 500	100 000	8 200	10 200	3 600	5 000
	96.838	21.000	21.946	15.875	2.3	0.8	80 500	100 000	8 200	10 200	3 600	5 000
	96.838	25.400	21.946	20.275	3.5	2.3	80 500	100 000	8 200	10 200	3 600	5 000
	98.425	21.000	21.946	17.826	3.5	0.8	80 500	100 000	8 200	10 200	3 600	5 000
	104.775	30.162	29.317	24.605	3.5	3.3	116 000	149 000	11 800	15 200	3 400	4 800
	104.775	30.162	29.317	24.605	2.3	3.3	116 000	149 000	11 800	15 200	3 400	4 800
	104.775	30.162	30.958	23.812	0.8	3.3	130 000	170 000	13 300	17 400	3 400	4 800
	104.775	30.162	30.958	23.812	0.8	0.8	130 000	170 000	13 300	17 400	3 400	4 800
	122.238	33.338	31.750	23.812	3.5	3.3	135 000	156 000	13 800	15 900	3 000	4 000
	123.825	36.512	32.791	25.400	3.5	3.3	162 000	199 000	16 500	20 300	2 800	4 000
	123.825	38.100	36.678	30.162	3.5	3.3	161 000	221 000	16 400	22 500	3 000	4 000
	140.030	36.512	33.236	23.520	3.5	2.3	152 000	183 000	15 500	18 700	2 600	3 600
	144.983	36.000	33.236	23.007	3.5	3.5	152 000	183 000	15 500	18 700	2 600	3 600
	149.225	53.975	54.229	44.450	3.5	3.3	287 000	410 000	29 300	41 500	2 600	3 400
57.531	96.838	21.000	21.946	15.875	3.5	0.8	80 500	100 000	8 200	10 200	3 600	5 000
58.738	112.712	33.338	30.048	26.988	3.5	3.3	120 000	173 000	12 200	17 700	3 200	4 300





Dynamic Equivalent Load

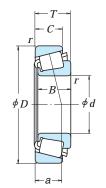
P = X	$F_{\rm r}$ + $YF_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y

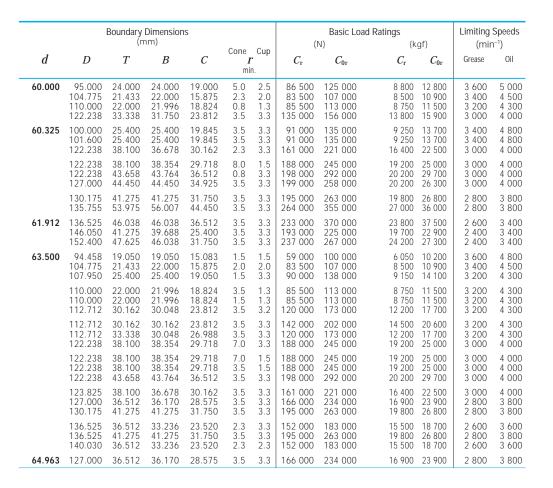
Static Equivalent Load

 $P_0=0.5\,F_{\rm r}+Y_0\,F_{\rm a}$ When $F_{\rm r}>0.5\,F_{\rm r}+Y_0\,F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

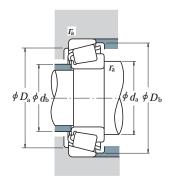
Bearing No	umbers	A	outmen	t and Fille (mm				Eff. Load Centers	Constant		Load tors		ass (g)
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone r a max	·	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
4595	4535	70	63	90	99	3.5	3.3	27.4	0.34	1.79	0.98	0.989	0.589
539	532 X	68	61	94	100	3.5	3.3	24.3	0.30	2.0	1.1	0.88	0.57
66584	66520	75	68	105	116	3.5	3.3	34.3	0.67	0.90	0.50	1.2	0.558
72212	72487	77	66	102	116	3.5	3.3	37.0	0.74	0.81	0.45	1.16	0.79
72212 C	72487	79	67	102	116	3.5	3.3	38.0	0.74	0.81	0.45	1.27	0.79
557 S	552 A	71	65	109	116	3.5	3.3	28.8	0.35	1.7	0.95	1.49	0.764
65212	65500	77	71	107	119	3.5	3.3	35.0	0.49	1.2	0.68	1.76	1.03
6280	6220	74	67	108	117	3.5	3.3	30.7	0.30	2.0	1.1	1.97	1.22
HM911242	HM911210	79	74	109	124	3.5	3.3	42.2	0.82	0.73	0.40	1.45	0.725
▲ JLM506849	▲ JLM506810	63	61	82	86	1.5	0.5	19.7	0.40	1.5	0.82	0.378	0.186
▲ JM207049	▲ JM207010	64	62	85	91	1.5	2.5	21.3	0.33	1.8	0.99	0.59	0.26
385	382 A	65	61	89	92	2.3	0.8	17.6	0.35	1.7	0.93	0.455	0.179
▲ JH307749	▲ JH307710	71	64	97	104	3	2.5	27.2	0.35	1.7	0.95	1.13	0.567
622 X	614 X	70	64	101	108		3	26.6	0.31	1.9	1.1	1.3	0.597
28680	28622	68	62	88	92	3.5	0.8	21.3	0.40	1.5	0.82	0.499	0.27
5566	5535	70	68	106	116	1.3	3.3	29.9	0.36	1.7	0.92	1.76	0.815
72218	72487	78	66	102	116	3.5	3.3	37.0	0.74	0.81	0.45	1.12	0.79
72218 C	72487	80	67	102	116	3.5	3.3	38.0	0.74	0.81	0.45	1.23	0.79
387 A	382 A	69	62	89	92	3.5	0.8	17.6	0.35	1.7	0.93	0.42	0.179
387	382 A	66	62	89	92	2.3	0.8	17.6	0.35	1.7	0.93	0.423	0.179
387 A	382 S	69	62	87	91	3.5	2.3	22.0	0.35	1.7	0.93	0.42	0.249
387 A	382	69	62	90	92	3.5	0.8	17.6	0.35	1.7	0.93	0.42	0.226
469	453 X	70	63	92	98	3.5	3.3	23.1	0.34	1.8	0.98	0.692	0.376
462	453 X	67	63	92	98	2.3	3.3	23.1	0.34	1.8	0.98	0.694	0.376
45289	45220	65	65	93	99	0.8	3.3	21.9	0.33	1.8	0.99	0.752	0.347
45289	45221	65	65	95	99	0.8	0.8	21.9	0.33	1.8	0.99	0.76	0.35
66587	66520	77	71	105	116	3.5	3.3	34.3	0.67	0.90	0.50	1.14	0.558
72225 C	72487	81	67	102	116	3.5	3.3	38.0	0.74	0.81	0.45	1.19	0.79
555 S	552 A	83	68	109	116	3.5	3.3	28.8	0.35	1.7	0.95	1.41	0.764
78225	78551	83	77	117	132	3.5	2.3	44.2	0.87	0.69	0.38	1.67	0.926
78225	78571	83	77	118	132	3.5	3.5	43.6	0.87	0.69	0.38	1.68	1.08
6455	6420	81	75	129	140	3.5	3.3	39.0	0.36	1.7	0.91	3.49	1.63
388 A	382 A	69	63	89	92	3.5	0.8	17.6	0.35	1.7	0.93	0.416	0.179
3981	3926	73	67	98	106	3.5		28.7	0.40	1.5	0.82	0.899	0.541

Bore Diameter 60.000 - 64.963 mm









Dynamic Equivalent Load

Static Equivalent Load

 $P_0=0.5F_r+Y_0F_a$ When $F_r>0.5F_r+Y_0F_a$, use $P_0=F_r$ The values of $e,\ Y_1$, and Y_0 are given in the table below.

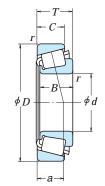
Bearing	Numbers	Al	outmen	t and Fill (mm				Eff. Load Centers	Constant		Load tors		ass (g)
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone $m{r}_{a}$ max	1	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
▲ JLM 508748	▲ JLM 508710	75	66	85	91	5	2.5	21.6	0.40	1.5	0.82	0.43	0.20
* 39236	39412	71	67	96	100	2.3	2	20.0	0.39	1.5	0.85	0.559	0.186
397	394 A	69	68	101	104	0.8	1.3	20.9	0.40	1.5	0.82	0.642	0.263
66585	66520	79	73	105	116	3.5	3.3	34.3	0.67	0.90	0.50	1.07	0.558
28985	28921	73	67	89	96	3.5	3.3	22.9	0.43	1.4	0.78	0.538	0.232
28985	28920	73	67	90	97	3.5	3.3	22.9	0.43	1.4	0.78	0.538	0.272
558	553 X	73	69	108	115	2.3	3.3	28.8	0.35	1.7	0.95	1.33	0.692
HM 212044	HM 212010	85	70	110	116	8	1.5	27.0	0.34	1.8	0.98	1.43	0.604
5582	5535	73	72	106	116	0.8	3.3	29.9	0.36	1.7	0.92	1.61	0.815
65237	65500	82	71	107	119	3.5	3.3	35.0	0.49	1.2	0.68	1.56	1.03
637	633	78	72	116	124	3.5	3.3	29.9	0.36	1.7	0.91	1.87	0.712
6376	6320	81	74	117	126	3.5	3.3	35.0	0.32	1.8	1.0	2.45	1.39
H 715334	H 715311	84	78	119	132	3.5	3.3	37.1	0.47	1.3	0.70	2.51	0.961
H 913842	H 913810	90	82	124	138	3.5	3.3	44.4	0.78	0.77	0.42	2.2	0.898
9180	9121	90	81	130	145	3.5	3.3	44.3	0.66	0.92	0.50	2.77	1.21
L 610549	L 610510	71	69	86	91	1.5	1.5	19.6	0.42	1.4	0.78	0.306	0.154
39250	39412	73	69	96	100	2	2	20.0	0.39	1.5	0.85	0.501	0.186
29586	29520	73	71	96	103	1.5	3.3	24.0	0.46	1.3	0.72	0.661	0.281
395	394 A	77	70	101	104	3.5	1.3	20.9	0.40	1.5	0.82	0.58	0.263
390 A	394 A	73	70	101	104	1.5	1.3	20.9	0.40	1.5	0.82	0.583	0.263
3982	3920	77	71	99	106	3.5	3.2	25.5	0.40	1.5	0.82	0.789	0.454
39585	39520	77	71	101	107	3.5	3.3	23.5	0.34	1.8	0.97	0.899	0.359
3982	3926	78	71	98	106	3.5	3.3	28.7	0.40	1.5	0.82	0.789	0.541
HM 212047	HM 212011	87	73	108	116	7	3.3	26.9	0.34	1.8	0.98	1.34	0.598
HM 212047	HM 212010	87	73	110	116	7	1.5	26.9	0.34	1.8	0.98	1.34	0.604
HM 212046	HM 212010	80	73	110	116	3.5	1.5	26.9	0.34	1.8	0.98	1.35	0.604
5584	5535	81	75	106	116	3.5	3.3	29.9	0.36	1.7	0.92	1.5	0.815
559	522 A	78	73	109	116	3.5	3.3	28.8	0.35	1.7	0.95	1.23	0.764
565	563	80	73	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.46	0.655
639	633	81	74	116	124	3.5	3.3	29.9	0.36	1.7	0.91	1.77	0.712
78250	78537	85	79	115	130	2.3	3.3	44.2	0.87	0.69	0.38	1.51	0.782
639	632	79	76	119	125	3.5	3.3	29.9	0.36	1.7	0.91	1.77	1.04
78250	78551	85	79	117	132	2.3	2.3	44.2	0.87	0.69	0.38	1.51	0.926
569 Notes *	563 The maximum bore diar	81	74 listed at	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.41	0.655

Notes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

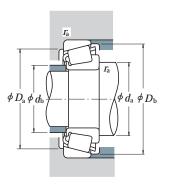
B 154 B 155

Bore Diameter 65.000 – 69.850 mm



	Boundary Dimensions (mm)								nd Ratings		Limiting Speeds		
ı	Б	,	,	0	Cone Cup		,	N)		gf}	(mir	,	
d	D	T	В	С	<i>I</i> mi		$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	
65.000	105.000	24.000	23.000	18.500	3.0	1.0	93 000	126 000	9 500	12 900	3 400	4 500	
	110.000	28.000	28.000	22.500	3.0	2.5	120 000	173 000	12 200	17 700	3 200	4 300	
	120.000	29.002	29.007	23.444	2.3	3.3	123 000	169 000	12 500	17 200	3 000	4 000	
	120.000	39.000	38.500	32.000	3.0	2.5	185 000	249 000	18 800	25 400	3 000	4 000	
65.088	135.755	53.975	56.007	44.450	3.5	3.3	264 000	355 000	27 000	36 000	2 800	3 800	
	136.525	46.038	46.038	36.512	3.5	3.3	233 000	370 000	23 800	37 500	2 600	3 400	
66.675	110.000	22.000	21.996	18.824	0.8	1.3	85 500	113 000	8 750	11 500	3 200	4 300	
	110.000	22.000	21.996	18.824	3.5	1.3	85 500	113 000	8 750	11 500	3 200	4 300	
	112.712	30.162	30.048	23.812	3.5	3.2	120 000	173 000	12 200	17 700	3 200	4 300	
	112.712	30.162	30.048	23.812	5.5	3.2	120 000	173 000	12 200	17 700	3 200	4 300	
	112.712	30.162	30.162	23.812	3.5	0.8	142 000	202 000	14 500	20 600	3 200	4 300	
	112.712	30.162	30.162	23.812	3.5	3.3	142 000	202 000	14 500	20 600	3 200	4 300	
	117.475	30.162	30.162	23.812	3.5	3.3	119 000	179 000	12 200	18 300	3 000	4 000	
	122.238	38.100	36.678	30.162	3.5	3.3	161 000	221 000	16 400	22 500	3 000	4 000	
	122.238	38.100	38.354	29.718	3.5	1.5	188 000	245 000	19 200	25 000	3 000	4 000	
	122.238	38.100	38.354	29.718	3.5	3.3	188 000	245 000	19 200	25 000	3 000	4 000	
	123.825	38.100	36.678	30.162	3.5	3.3	161 000	221 000	16 400	22 500	3 000	4 000	
	136.525	46.038	46.038	36.512	3.5	3.3	233 000	370 000	23 800	37 500	2 600	3 400	
68.262	110.000	22.000	21.996	18.824	2.3	1.3	85 500	113 000	8 750	11 500	3 200	4 300	
	120.000	29.795	29.007	24.237	3.5	2.0	123 000	169 000	12 500	17 200	3 000	4 000	
	122.238	38.100	36.678	30.162	3.5	3.3	161 000	221 000	16 400	22 500	3 000	4 000	
	127.000	36.512	36.170	28.575	3.5	3.3	166 000	234 000	16 900	23 900	2 800	3 800	
	136.525	41.275	41.275	31.750	3.5	3.3	229 000	297 000	23 300	30 500	2 600	3 600	
	136.525	46.038	46.038	36.512	3.5	3.3	233 000	370 000	23 800	37 500	2 600	3 400	
	152.400	47.625	46.038	31.750	3.5	3.3	237 000	267 000	24 200	27 300	2 400	3 400	
69.850	112.712	22.225	21.996	15.875	1.5	0.8	85 000	113 000	8 650	11 500	3 000	4 000	
	112.712	25.400	25.400	19.050	1.5	3.3	96 000	152 000	9 800	15 500	2 800	4 000	
	117.475	30.162	30.162	23.812	3.5	3.3	119 000	179 000	12 200	18 300	3 000	4 000	
	120.000	32.545	32.545	26.195	3.5	3.3	152 000	225 000	15 500	22 900	3 000	4 000	
	120.650	25.400	25.400	19.050	1.5	3.3	96 000	152 000	9 800	15 500	2 800	4 000	
	127.000	36.512	36.170	28.575	3.5	0.8	166 000	234 000	16 900	23 900	2 800	3 800	
	130.175	41.275	41.275	31.750	3.5	3.3	195 000	263 000	19 800	26 800	2 800	3 800	
	146.050	41.275	39.688	25.400	3.5	3.3	193 000	225 000	19 700	22 900	2 400	3 400	
	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200	
	149.225	53.975	54.229	44.450	5.0	3.3	287 000	410 000	29 300	41 500	2 600	3 400	
	150.089	44.450	46.672	36.512	3.5	3.3	265 000	370 000	27 000	37 500	2 400	3 200	





Dynamic Equivalent Load

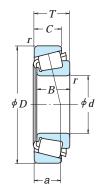
P = X	$F_{\rm r} + Y F_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	7>
X	Y	X	

Static Equivalent Load

$$\begin{split} P_0 &= 0.5F_{\rm r} + Y_0\,F_{\rm a} \\ \text{When } F_{\rm r} &> 0.5F_{\rm r} + Y_0\,F_{\rm a}, \text{ use } P_0 = F_{\rm r} \end{split}$$
 The values of $e,~Y_1$, and Y_0 are given in the table below.

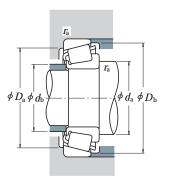
Bearing N	umbers	A	butmen	t and Fill (mm		nsions Cone	C	Eff. Load Constant Centers			Load tors	Mass (kg)	
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{\scriptscriptstyle m b}$	Cone $oldsymbol{r_{ m a}}$	1	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
▲ JLM 710949	▲ JLM 710910	77	71	96	101	3	1	23.7	0.45	1.3	0.73	0.526	0.237
▲ JM 511946	▲ JM 511910	78	72	99	105	3	2.5	24.5	0.40	1.5	0.82	0.72	0.342
478	472 A	77	73	106	114	2.3	3.3	24.3	0.38	1.6	0.86	0.942	0.466
▲ JH 211749	▲ JH 211710	80	74	107	114	3	2.5	27.9	0.34	1.8	0.98	1.25	0.625
6379	6320	84	77	117	126	3.5	3.3	35.0	0.32	1.8	1.0	2.25	1.39
H 715340	H 715311	88	82	118	132	3.5	3.3	37.1	0.47	1.3	0.70	2.4	0.961
395 A	394 A	73	73	101	104	0.8	1.3	20.9	0.40	1.5	0.82	0.528	0.263
395 S	394 A	79	73	101	104	3.5	1.3	20.9	0.40	1.5	0.82	0.524	0.263
3984	3920	80	74	99	106	3.5	3.2	25.5	0.40	1.5	0.82	0.712	0.454
3994	3920	84	74	99	106	5.5	3.2	25.5	0.40	1.5	0.82	0.706	0.454
39590	39521	80	74	103	107	3.5	0.8	23.5	0.34	1.8	0.97	0.822	0.365
39590	39520	80	74	101	107	3.5	3.3	23.5	0.34	1.8	0.97	0.822	0.359
33262	33462	81	75	104	112	3.5	3.3	26.8	0.44	1.4	0.76	0.911	0.442
560	553 X	81	75	108	115	3.5	3.3	28.8	0.35	1.7	0.95	1.14	0.692
HM 212049	HM 212010	82	75	110	116	3.5	1.5	26.9	0.34	1.8	0.98	1.25	0.604
HM 212049	HM 212011	81	74	108	116	3.5	3.3	26.9	0.34	1.8	0.98	1.25	0.598
560	552 A	81	75	109	116	3.5	3.3	28.8	0.35	1.7	0.95	1.14	0.764
H 715341	H 715311	89	83	118	132	3.5	3.3	37.1	0.47	1.3	0.70	2.34	0.961
399 A	394 A	78	74	101	104	2.3	1.3	20.9	0.40	1.5	0.82	0.497	0.263
480	472	83	76	106	113	3.5	2	25.1	0.38	1.6	0.86	0.862	0.493
560 S	553 X	83	76	108	115	3.5	3.3	28.8	0.35	1.7	0.95	1.09	0.692
570	563	83	77	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.32	0.655
H 414245	H 414210	86	82	121	129	3.5	3.3	30.6	0.36	1.7	0.92	1.95	0.796
H 715343	H 715311	90	84	118	132	3.5	3.3	37.1	0.47	1.3	0.70	2.28	0.961
9185	9121	94	81	130	145	3.5	3.3	44.3	0.66	0.92	0.50	2.53	1.21
LM 613449	LM 613410	78	76	104	107	1.5	0.8	22.1	0.42	1.4	0.79	0.562	0.238
29675	29620	80	77	101	109	1.5	3.3	26.3	0.49	1.2	0.68	0.695	0.273
33275	33462	84	77	104	112	3.5	3.3	26.8	0.44	1.4	0.76	0.83	0.442
47487	47420	84	78	107	114	3.5	3.3	26.0	0.36	1.7	0.92	1.02	0.477
29675	29630	79	78	105	113	1.5	3.3	26.3	0.49	1.2	0.68	0.695	0.489
566	563 X	85	78	114	120	3.5	0.8	28.3	0.36	1.6	0.91	1.27	0.658
643	633	86	80	116	124	3.5	3.3	29.9	0.36	1.7	0.91	1.56	0.712
H 913849	H 913810	95	82	124	138	3.5	3.3	44.4	0.78	0.77	0.42	1.95	0.898
655	653	88	82	131	139	3.5	3.3	33.2	0.41	1.5	0.81	2.35	0.891
6454	6420	94	85	129	140	5	3.3	39.0	0.36	1.7	0.91	2.95	1.63
745 A	742	88	82	134	142	3.5	3.3	32.5	0.33	1.8	1.0	2.82	1.07

Bore Diameter 70.000 – 76.200 mm



Boundary Dimensions (mm)							//	f)	Limiting Speeds (min ⁻¹)			
d	D	T	В	С	Cone 1		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	Grease	۱¬۱) Oil
					mi	n.	•	•	•			
70.000	110.000	26.000	25.000	20.500	1.0	2.5	98 500	152 000	10 000	15 500	3 000	4 000
	115.000	29.000	29.000	23.000	3.0	2.5	126 000	177 000	12 900	18 100	3 000	4 000
	120.000	29.795	29.007	24.237	2.0	2.0	123 000	169 000	12 500	17 200	3 000	4 000
71.438	117.475	30.162	30.162	23.812	3.5	3.3	119 000	179 000	12 200	18 300	3 000	4 000
	120.000	32.545	32.545	26.195	3.5	3.3	152 000	225 000	15 500	22 900	3 000	4 000
	127.000	36.512	36.170	28.575	6.4	3.3	166 000	234 000	16 900	23 900	2 800	3 800
	127.000	36.512	36.170	28.575	3.5	3.3	166 000	234 000	16 900	23 900	2 800	3 800
	130.175	41.275	41.275	31.750	6.4	3.3	195 000	263 000	19 800	26 800	2 800	3 800
	136.525	41.275	41.275	31.750	3.5	3.3	195 000	263 000	19 800	26 800	2 800	3 800
	136.525	41.275	41.275	31.750	3.5	3.3	229 000	297 000	23 300	30 500	2 600	3 600
	136.525	46.038	46.038	36.512	3.5	3.3	233 000	370 000	23 800	37 500	2 600	3 400
73.025	112.712	25.400	25.400	19.050	3.5	3.3	96 000	152 000	9 800	15 500	2 800	4 000
	117.475	30.162	30.162	23.812	3.5	3.3	119 000	179 000	12 200	18 300	3 000	4 000
	127.000	36.512	36.170	28.575	3.5	3.3	166 000	234 000	16 900	23 900	2 800	3 800
	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200
	149.225	53.975	54.229	44.450	3.5	3.3	287 000	410 000	29 300	41 500	2 600	3 400
73.817	127.000	36.512	36.170	28.575	0.8	3.3	166 000	234 000	16 900	23 900	2 800	3 800
74.612	150.000	41.275	41.275	31.750	3.5	3.0	207 000	296 000	21 100	30 000	2 400	3 200
75.000	115.000	25.000	25.000	19.000	3.0	2.5	101 000	150 000	10 300	15 300	3 000	4 000
	120.000	31.000	29.500	25.000	3.0	2.5	129 000	198 000	13 100	20 200	2 800	3 800
	145.000	51.000	51.000	42.000	3.0	2.5	283 000	410 000	28 900	41 500	2 600	3 400
76.200	121.442	24.608	23.012	17.462	2.0	2.0	89 000	124 000	9 100	12 600	2 800	3 800
	127.000	30.162	31.000	22.225	3.5	3.3	134 000	195 000	13 700	19 900	2 800	3 800
	127.000	30.162	31.001	22.225	6.4	3.3	134 000	195 000	13 700	19 900	2 800	3 800
	133.350	33.338	33.338	26.195	0.8	3.3	154 000	237 000	15 700	24 200	2 600	3 600
	135.733	44.450	46.101	34.925	3.5	3.3	216 000	340 000	22 000	35 000	2 600	3 600
	136.525	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400
	136.525	30.162	29.769	22.225	6.4	3.3	130 000	192 000	13 300	19 600	2 600	3 400
	139.992	36.512	36.098	28.575	3.5	3.3	175 000	260 000	17 800	26 500	2 600	3 400
	149.225	53.975	54.229	44.450	3.5	3.3	287 000	410 000	29 300	41 500	2 600	3 400
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200
	152.400	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200
	161.925	49.212	46.038	31.750	3.5	3.3	248 000	290 000	25 300	29 600	2 200	3 000
	161.925	53.975	55.100	42.862	3.5	3.3	325 000	480 000	33 000	49 000	2 200	3 000
	161.925	53.975	55.100	42.862	6.4	3.3	325 000	480 000	33 000	49 000	2 200	3 000
	161.925	53.975	55.100	42.862	6.4	0.8	325 000	480 000	33 000	49 000	2 200	3 000





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$					
X	Y	X	Y				
1	0	0.4	Y ₁				

Static Equivalent Load

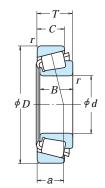
 $P_0 = 0.5F_r + Y_0 F_a$ When $F_{
m r}\!>\!0.5F_{
m r}+Y_0\,F_{
m a}$, use P_0 = $F_{
m r}$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearing Nu	umbers	Al	butment	t and Fill (mm			C	Eff. Load Constant Centers		Axial Load Factors		Mass (kg)	
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{ m b}$	Cone r ma	a '	(mm) a	e	<i>Y</i> ₁	Y_0	app CONE	prox. CUP
▲ JLM 813049	▲ JLM 813010	78	77	98	105	1	2.5	26.2	0.49	1.2	0.68	0.604	
▲ JM 612949	▲ JM 612910	83	77	103	110	3	2.5	26.4	0.43	1.4	0.77	0.800	
484	472	80	78	106	113	2	2	25.1	0.38	1.6	0.86	0.822	
33281	33462	85	79	104	112	3.5	3.3	26.8	0.44	1.4	0.76	0.789	0.655
47490	47420	86	79	107	114	3.5	3.3	26.0	0.36	1.7	0.92	0.983	
567 S	563	92	80	112	120	6.4	3.3	28.3	0.36	1.6	0.91	1.21	
567 A	563	86	80	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.23	0.655
645	633	93	81	116	124	6.4	3.3	29.9	0.36	1.7	0.91	1.49	0.712
644	632	87	81	118	125	3.5	3.3	29.9	0.36	1.7	0.91	1.5	1.04
H 414249	H 414210	89	83	121	129	3.5	3.3	30.6	0.36	1.7	0.92	1.83	0.796
H 715345	H 715311	92	84	119	132	3.5	3.3	37.1	0.47	1.3	0.70	2.15	0.961
29685	29620	86	80	101	109	3.5	3.3	26.3	0.49	1.2	0.68	0.62	0.273
33287	33462	87	80	104	112	3.5	3.3	26.8	0.44	1.4	0.76	0.746	0.442
567	563	88	81	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.17	0.655
657	653	91	85	131	139	3.5	3.3	33.2	0.41	1.5	0.81	2.24	0.891
6460	6420	93	87	129	140	3.5	3.3	39.0	0.36	1.7	0.91	2.8	1.63
568	563	83	82	112	120	0.8	3.3	28.3	0.36	1.6	0.91	1.15	0.655
658	653 X	92	86	133	141	3.5	3	33.2	0.41	1.5	0.81	2.37	0.932
▲ JLM 714149	▲ JLM 714110	87	81	104	110	3	2.5	25.3	0.46	1.3	0.72	0.638	0.272
▲ JM 714249	▲ JM 714210	88	83	108	115	3	2.5	28.8	0.44	1.4	0.74	0.863	0.436
▲ JH 415647	▲ JH 415610	94	89	129	139	3	2.5	36.7	0.36	1.7	0.91	2.64	1.19
34300	34478	86	84	111	116	2	2	26.3	0.45	1.3	0.73	0.65	0.316
42687	42620	90	84	114	121	3.5	3.3	27.3	0.42	1.4	0.79	1.03	0.438
42688	42620	94	84	114	121	6.4	3.3	27.3	0.42	1.4	0.79	1.01	0.438
47680	47620	86	85	119	128	0.8	3.3	29.0	0.40	1.5	0.82	1.39	0.577
5760	5735	94	88	119	130	3.5	3.3	32.9	0.41	1.5	0.81	1.86	0.887
495 A	493	92	86	122	130	3.5	3.3	28.7	0.44	1.4	0.74	1.27	0.55
495 AX	493	98	86	122	130	6.4	3.3	28.7	0.44	1.4	0.74	1.26	0.55
575	572	92	86	125	133	3.5	3.3	31.1	0.40	1.5	0.82	1.61	0.788
6461	6420	96	89	129	140	3.5	3.3	39.0	0.36	1.7	0.91	2.64	1.63
590 A	592 A	95	89	135	145	3.5	3.2	37.1	0.44	1.4	0.75	2.2	1.06
659	652	93	87	134	141	3.5	3.3	33.2	0.41	1.5	0.81	2.11	1.26
9285	9220	103	90	138	153	3.5	3.3	49.8	0.71	0.85	0.47	2.82	1.4
6576	6535	99	92	141	154	3.5	3.3	40.7	0.40	1.5	0.82	3.74	1.67
6575	6535	104	92	141	154	6.4	3.3	40.7	0.40	1.5	0.82	3.73	1.67
6575	6536	104	92	144	154	6.4	0.8	40.7	0.40	1.5	0.82	3.73	1.68

The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

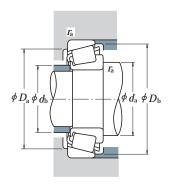
B 158 B 159

Bore Diameter 76.200 – 83.345 mm



Boundary Dimensions (mm)								Basic Load		Limiting Speeds		
		(m	nm)		Cone	Cup	(N)	{k	gf}	(min	,
d	D	T	В	С	<i>I</i> mir		$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
76.200	168.275	53.975	56.363	41.275	6.4	3.3	345 000	470 000	35 000	48 000	2 200	3 000
	168.275	53.975	56.363	41.275	0.8	3.3	345 000	470 000	35 000	48 000	2 200	3 000
	171.450	49.212	46.038	31.750	3.5	3.3	257 000	310 000	26 200	32 000	2 000	2 800
	177.800	55.562	50.800	34.925	3.5	3.3	257 000	310 000	26 200	32 000	2 000	2 800
77.788	121.442	24.608	23.012	17.462	3.5	2.0	89 000	124 000	9 100	12 600	2 800	3 800
	127.000	30.162	31.000	22.225	3.5	3.3	134 000	195 000	13 700	19 900	2 800	3 800
	135.733	44.450	46.101	34.925	3.5	3.3	216 000	340 000	22 000	35 000	2 600	3 600
79.375	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200
	150.089	44.450	46.672	36.512	3.5	3.3	265 000	370 000	27 000	37 500	2 400	3 200
80.000	130.000	35.000	34.000	28.500	3.0	2.5	166 000	251 000	17 000	25 600	2 600	3 600
80.962	136.525	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400
	139.700	36.512	36.098	28.575	3.5	3.3	175 000	260 000	17 800	26 500	2 600	3 400
	139.992	36.512	36.098	28.575	3.5	3.3	175 000	260 000	17 800	26 500	2 600	3 400
82.550	125.412	25.400	25.400	19.845	3.5	1.5	102 000	164 000	10 400	16 700	2 600	3 600
	133.350	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400
	133.350	33.338	33.338	26.195	3.5	3.3	154 000	237 000	15 700	24 200	2 600	3 600
	133.350	33.338	33.338	26.195	0.8	3.3	154 000	237 000	15 700	24 200	2 600	3 600
	133.350	33.338	33.338	26.195	6.8	3.3	154 000	237 000	15 700	24 200	2 600	3 600
	133.350	39.688	39.688	32.545	6.8	3.3	179 000	310 000	18 300	31 500	2 600	3 600
	136.525	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400
	139.700	36.512	36.098	28.575	3.5	3.3	175 000	260 000	17 800	26 500	2 600	3 400
	139.992	36.512	36.098	28.575	3.5	3.3	175 000	260 000	17 800	26 500	2 600	3 400
	139.992	36.512	36.098	28.575	6.8	3.3	175 000	260 000	17 800	26 500	2 600	3 400
	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200
	150.000	44.455	46.672	35.000	3.5	3.3	265 000	370 000	27 000	37 500	2 400	3 200
	150.089	44.450	46.672	36.512	3.5	3.3	265 000	370 000	27 000	37 500	2 400	3 200
	152.400	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200
	161.925	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000
	161.925	53.975	55.100	42.862	3.5	3.3	325 000	480 000	33 000	49 000	2 200	3 000
	168.275	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000
	168.275	53.975	56.363	41.275	3.5	3.3	345 000	470 000	35 000	48 000	2 200	3 000
83.345	125.412	25.400	25.400	19.845	3.5	1.5	102 000	164 000	10 400	16 700	2 600	3 600
	125.412	25.400	25.400	19.845	0.8	1.5	102 000	164 000	10 400	16 700	2 600	3 600





Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

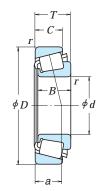
Static Equivalent Load

$$\begin{split} P_0 = 0.5 F_r + Y_0 \, F_a \\ \text{When } F_r > 0.5 F_r + Y_0 \, F_a \text{, use } P_0 = F_r \end{split}$$

The values of \emph{e}_{\imath} \emph{Y}_{1} , and \emph{Y}_{0} are given in the table below.

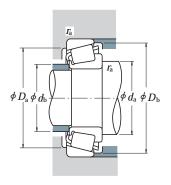
Bearing Num	nhers	ΔΙ	outment	t and Fill	et Dimer	nsions		Eff. Load	Constant	Axial	Load	M	ass
bearing Num		A	Jan 11011	(mm		Cone	Cup	Centers (mm)	Jonatuill		tors		(g)
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{ m b}$	r _a	i '	a	e	Y_1	Y_0	app CONE	CUP
843	832	101	89	149	155	6.4	3.3	35.2	0.30	2.0	1.1	4.11	1.74
837	832	90	89	149	155	0.8	3.3	35.2	0.30	2.0	1.1	4.13	1.74
9380	9321	105	98	147	164	3.5	3.3	54.1	0.76	0.79	0.43	3.47	1.51
9378	9320	105	98	148	164	3.5	3.3	57.3	0.76	0.79	0.43	3.71	2.24
34306	34478	90	84	110	116	3.5	2	26.3	0.45	1.3	0.73	0.612	0.316
42690	42620	91	85	114	121	3.5	3.3	27.3	0.42	1.4	0.79	0.976	0.438
5795	5735	96	89	119	130	3.5	3.3	32.9	0.41	1.5	0.81	1.79	0.887
661	653	96	90	131	139	3.5	3.3	33.2	0.41	1.5	0.81	1.99	0.891
750	742	96	90	134	142	3.5	3.3	32.5	0.33	1.8	1.0	2.42	1.07
▲ JM 515649	▲ JM 515610	94	88	117	125	3	2.5	29.9	0.39	1.5	0.85	1.18	0.583
496	493	95	89	122	130	3.5	3.3	28.7	0.44	1.4	0.74	1.13	0.55
581	572 X	96	90	125	133	3.5	3.3	31.1	0.40	1.5	0.82	1.44	0.774
581	572	96	90	125	133	3.5	3.3	31.1	0.40	1.5	0.82	1.44	0.788
27687	27620	96	89	115	120	3.5	1.5	25.7	0.42	1.4	0.79	0.747	0.348
495	492 A	97	90	120	128	3.5	3.3	28.7	0.44	1.4	0.74	1.08	0.434
47686	47620	97	90	119	128	3.5	3.3	29.0	0.40	1.5	0.82	1.18	0.577
47685	47620	90	90	119	128	0.8	3.3	29.0	0.40	1.5	0.82	1.18	0.577
47687	47620	103	90	119	128	6.8	3.3	29.0	0.40	1.5	0.82	1.16	0.577
HM 516448	HM 516410	105	92	118	128	6.8	3.3	32.4	0.40	1.5	0.82	1.35	0.767
495	493	97	90	122	130	3.5	3.3	28.7	0.44	1.4	0.74	1.08	0.55
580	572 X	98	91	125	133	3.5	3.3	31.1	0.40	1.5	0.82	1.39	0.774
580	572	98	91	125	133	3.5	3.3	31.1	0.40	1.5	0.82	1.39	0.788
582	572	104	91	125	133	6.8	3.3	31.1	0.40	1.5	0.82	1.37	0.788
663	653	99	92	131	139	3.5	3.3	33.2	0.41	1.5	0.81	1.85	0.891
749 A	743	99	93	134	142	3.5	3.3	32.5	0.33	1.8	1.0	2.26	1.04
749 A	742	98	93	135	143	3.5	3.3	32.5	0.33	1.8	1.0	2.26	1.07
663	652	99	92	134	141	3.5	3.3	33.2	0.41	1.5	0.81	1.85	1.26
757	752	100	94	144	150	3.5	3.3	35.6	0.34	1.8	0.97	2.79	1.61
6559	6535	104	98	141	154	3.5	3.3	40.7	0.40	1.5	0.82	3.4	1.67
757	753	100	94	147	150	3.5	3.3	35.6	0.34	1.8	0.97	2.79	2.1
842	832	101	94	149	155	3.5	3.3	35.2	0.30	2.0	1.1	3.76	1.74
27690	27620	96	90	115	120	3.5	1.5	25.7	0.42	1.4	0.79	0.727	0.348
27689	27620	90	90	115	120	0.8	1.5	25.7	0.42	1.4	0.79	0.732	0.348

Bore Diameter 84.138 – 90.488 mm



			Dimension	S				Basic Loa			Limiting Speeds		
		(m	nm)		Cone	Cup	1)	۷)	{k	gf}	(mir	,	
d	D	T	В	С	<i>I</i> mir	• '	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	
84.138	136.525	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400	
	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200	
	171.450	49.212	46.038	31.750	3.5	3.3	257 000	310 000	26 200	32 000	2 000	2 800	
85.000	130.000	30.000	29.000	24.000	6.0	2.5	138 000	222 000	14 100	22 700	2 600	3 600	
	130.000	30.000	29.000	24.000	3.0	2.5	138 000	222 000	14 100	22 700	2 600	3 600	
	140.000	39.000	38.000	31.500	3.0	2.5	202 000	305 000	20 600	31 000	2 400	3 400	
	150.000	46.000	46.000	38.000	3.0	2.5	275 000	390 000	28 000	40 000	2 400	3 200	
85.026	150.089	44.450	46.672	36.512	3.5	3.3	265 000	370 000	27 000	37 500	2 400	3 200	
	150.089	44.450	46.672	36.512	5.0	3.3	265 000	370 000	27 000	37 500	2 400	3 200	
85.725	133.350	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400	
	136.525	30.162	29.769	22.225	3.5	3.3	130 000	192 000	13 300	19 600	2 600	3 400	
	142.138	42.862	42.862	34.133	4.8	3.3	221 000	360 000	22 500	36 500	2 400	3 400	
	146.050	41.275	41.275	31.750	6.4	3.3	207 000	296 000	21 100	30 000	2 400	3 200	
	146.050	41.275	41.275	31.750	3.5	3.3	207 000	296 000	21 100	30 000	2 400	3 200	
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
	161.925	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000	
	168.275	41.275	41.275	30.162	3.5	3.3	223 000	345 000	22 700	35 000	2 000	2 800	
87.312	190.500	57.150	57.531	46.038	8.0	3.3	390 000	520 000	39 500	53 500	1 900	2 600	
88.900	149.225	31.750	28.971	24.608	3.0	3.3	140 000	218 000	14 300	22 300	2 200	3 000	
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
	152.400	39.688	39.688	30.162	6.4	3.3	253 000	365 000	25 800	37 500	2 200	3 200	
	161.925	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000	
	161.925	47.625	48.260	38.100	7.0	3.3	274 000	390 000	28 000	40 000	2 200	3 000	
	161.925	53.975	55.100	42.862	3.5	3.3	325 000	480 000	33 000	49 000	2 200	3 000	
	168.275	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000	
	168.275	53.975	56.363	41.275	3.5	3.3	345 000	470 000	35 000	48 000	2 200	3 000	
	190.500	57.150	57.531	44.450	8.0	3.3	355 000	500 000	36 000	51 000	1 900	2 600	
	190.500	57.150	57.531	46.038	8.0	3.3	390 000	520 000	39 500	53 500	1 900	2 600	
90.000	145.000	35.000	34.000	27.000	3.0	2.5	190 000	285 000	19 400	29 000	2 400	3 200	
	147.000	40.000	40.000	32.500	7.0	3.5	229 000	345 000	23 400	35 000	2 400	3 200	
	155.000	44.000	44.000	35.500	3.0	2.5	274 000	395 000	28 000	40 000	2 200	3 000	
90.488	161.925	47.625	48.260	38.100	3.5	3.3	274 000	390 000	28 000	40 000	2 200	3 000	





Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_{\rm r}>$ 0.5 $F_{\rm r}+Y_0$ $F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are

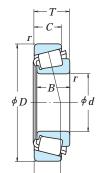
given in the table below.

Bearing Numbers		Abutmen	t and Fil	lat Diman	olono		Eff. Load	Constant	Avial	Load	N.4.	ass
Bearing Numbers		Abutmen	mn) (mn				Centers	CONSIGNI		tors		ass :g)
CONE CUP	a	$d_{ m a}$ $d_{ m b}$	$D_{\scriptscriptstyle m a}$	$D_{\scriptscriptstyle m b}$	i	e Cup r a nax.	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
498 493	98	91	122	130	3.5	3.3	28.7	0.44	1.4	0.74	1.04	0.55
664 653	99	93	131	139	3.5	3.3	33.2	0.41	1.5	0.81	1.79	0.891
9385 9321	111	98	147	164	3.5	3.3	54.1	0.76	0.79	0.43	3.11	1.51
▲ JM 716648 ▲ JM 716649 ▲ JHM 516849 ▲ JH 217249 ▲ JH 217210	104 98 100 101	92 92 94 95	117 117 125 134	125 125 134 142	6 3 3 3	2.5 2.5 2.5 2.5	29.5 29.5 33.3 33.9	0.44 0.44 0.41 0.33	1.4 1.4 1.5 1.8	0.74 0.74 0.81 0.99	0.931 0.943 1.55 2.29	0.461 0.461 0.768 1.09
749 742	101	95	134	142	3.5	3.3	32.5	0.33	1.8	1.0	2.14	1.07
749 S 742	104	95	134	142	5	3.3	32.5	0.33	1.8	1.0	2.14	1.07
497 492 <i>I</i>	99	93	120	128	3.5	3.3	28.7	0.44	1.4	0.74	0.987	0.434
497 493	99	93	122	130	3.5	3.3	28.7	0.44	1.4	0.74	0.987	0.55
HM 617049 HM 617010	106	95	125	137	4.8	3.3	35.4	0.43	1.4	0.76	1.77	0.911
665 A 653	107	95	131	139	6.4	3.3	33.2	0.41	1.5	0.81	1.71	0.891
665 653	102	95	131	139	3.5	3.3	33.2	0.41	1.5	0.81	1.72	0.891
596 592 A	102	96	135	144	3.5	3.2	37.1	0.44	1.4	0.75	1.85	1.06
758 752	103	97	144	150	3.5	3.3	35.6	0.34	1.8	0.97	2.63	1.61
677 672	105	99	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.91	1.24
HH 221432 HH 221410	118	103	171	179	8	3.3	42.3	0.33	1.8	0.99	5.51	2.24
42350 42587	104	98	134	143	3	3.3	34.9	0.49	1.2	0.67	1.39	0.711
593 592 /	104	98	135	144	3.5	3.2	37.1	0.44	1.4	0.75	1.73	1.06
HM 518445 HM 518410	107	96	137	148	6.4	3.3	33.1	0.40	1.5	0.82	2.11	0.776
759 752	106	99	144	150	3.5	3.3	35.6	0.34	1.8	0.97	2.47	1.61
766 752	113	99	144	150	7	3.3	35.6	0.34	1.8	0.97	2.45	1.61
6580 6535	109	102	141	154	3.5	3.3	40.7	0.40	1.5	0.82	3.03	1.67
759 753	106	99	147	150	3.5	3.3	35.6	0.34	1.8	0.97	2.47	2.1
850 832	106	100	149	155	3.5	3.3	35.2	0.30	2.0	1.1	3.39	1.74
855 854	118	103	170	174	8	3.3	41.8	0.33	1.8	0.99	4.99	2.55
HH 221434 HH 221410	120	105	171	179		3.3	42.3	0.33	1.8	0.99	5.41	2.24
▲ JM 718149 *HM 218248 ▲ JHM 318448 ▲ JHM 318440	105 111 106	99 98 100	131 133 140	139 141 148	3 7 3	2.5 3.5 2.5	33.0 30.8 34.1	0.44 0.33 0.34	1.4 1.8 1.7	0.74 0.99 0.96	1.49 1.77 2.32	0.66 0.796 1.01
760 752	107	101	144	150	3.5	3.3	35.6	0.34	1.8	0.97	2.38	1.61

Notes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

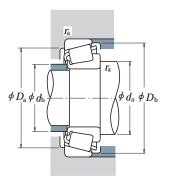
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- ▲ The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 92.075 – 100.012 mm



	Boundary Dimensions (mm)								d Ratings		Limiting Speeds		
	_	•	•	_	Cone	Cup	1) (1	*	{k	_	(mir	,	
<i>d</i>	D	T	В	С	<i>I</i> mi		$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	
92.075	146.050	33.338	34.925	26.195	3.5	3.3	169 000	280 000	17 300	28 500	2 400	3 200	
	148.430	28.575	28.971	21.433	3.5	3.0	140 000	218 000	14 300	22 300	2 200	3 000	
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
	152.400	39.688	36.322	30.162	6.4	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
	168.275	41.275	41.275	30.162	3.5	3.3	223 000	345 000	22 700	35 000	2 000	2 800	
	190.500	57.150	57.531	44.450	8.0	3.3	355 000	500 000	36 000	51 000	1 900	2 600	
93.662	148.430	28.575	28.971	21.433	3.0	3.0	140 000	218 000	14 300	22 300	2 200	3 000	
	149.225	31.750	28.971	24.608	3.0	3.3	140 000	218 000	14 300	22 300	2 200	3 000	
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
95.000	150.000	35.000	34.000	27.000	3.0	2.5	183 000	285 000	18 700	29 100	2 200	3 200	
95.250	146.050	33.338	34.925	26.195	3.5	3.3	169 000	280 000	17 300	28 500	2 400	3 200	
	148.430	28.575	28.971	21.433	3.0	3.0	140 000	218 000	14 300	22 300	2 200	3 000	
	149.225	31.750	28.971	24.608	3.5	3.3	140 000	218 000	14 300	22 300	2 200	3 000	
	152.400	39.688	36.322	30.162	3.5	3.2	183 000	285 000	18 700	29 100	2 200	3 200	
	152.400	39.688	36.322	33.338	3.5	3.3	183 000	285 000	18 700	29 100	2 200	3 200	
	168.275	41.275	41.275	30.162	3.5	3.3	223 000	345 000	22 700	35 000	2 000	2 800	
	171.450	47.625	48.260	38.100	3.5	3.3	282 000	415 000	28 800	42 500	2 000	2 800	
	180.975	47.625	48.006	38.100	3.5	3.3	258 000	375 000	26 300	38 500	2 000	2 600	
	190.500	57.150	57.531	44.450	8.0	3.3	355 000	500 000	36 000	51 000	1 900	2 600	
	190.500	57.150	57.531	46.038	8.0	3.3	390 000	520 000	39 500	53 500	1 900	2 600	
96.838	148.430	28.575	28.971	21.433	3.5	3.0	140 000	218 000	14 300	22 300	2 200	3 000	
	149.225	31.750	28.971	24.606	3.5	3.3	140 000	218 000	14 300	22 300	2 200	3 000	
98.425	161.925	36.512	36.116	26.195	3.5	3.3	191 000	310 000	19 500	31 500	2 000	2 800	
	168.275	41.275	41.275	30.162	3.5	3.3	223 000	345 000	22 700	35 000	2 000	2 800	
	180.975	47.625	48.006	38.100	3.5	3.3	258 000	375 000	26 300	38 500	2 000	2 600	
	190.500	57.150	57.531	44.450	3.5	3.3	355 000	500 000	36 000	51 000	1 900	2 600	
	190.500	57.150	57.531	46.038	3.5	3.3	390 000	520 000	39 500	53 500	1 900	2 600	
99.982	190.500	57.150	57.531	46.038	6.4	3.3	390 000	520 000	39 500	53 500	1 900	2 600	
100.000	150.000	32.000	30.000	26.000	2.3	2.3	146 000	235 000	14 900	24 000	2 200	3 000	
	155.000	36.000	35.000	28.000	3.0	2.5	191 000	325 000	19 500	33 000	2 000	2 800	
	160.000	41.000	40.000	32.000	3.0	2.5	239 000	380 000	24 400	38 500	2 000	2 800	
100.012	157.162	36.512	36.116	26.195	3.5	3.3	191 000	310 000	19 500	31 500	2 000	2 800	





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

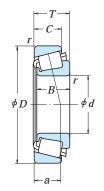
Static Equivalent Load

 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$ When $F_{\rm r} > 0.5F_{\rm r} + Y_0 F_{\rm a}$, use $P_0 = F_{\rm r}$

The values of e, Y_1 , and Y_0 are given in the table below.

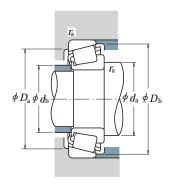
								ı				ı	
Bearin	ng Numbers	P	Abutmen	t and Fill (mn	let Dimer n)			Eff. Load Centers	Constant		Load ctors		ass <g)< th=""></g)<>
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{ m b}$	$D_{\scriptscriptstyle m a}$	$D_{ m b}$	1	Cup r _a ax.	(mm) a	e	Y_1	Y_0	ap CONE	prox. CUP
47890	47820	107	101	131	140	3.5	3.3	32.3	0.45	1.3	0.74	1.46	0.664
42362	42584	107	101	134	142	3.5	3	31.8	0.49	1.2	0.67	1.29	0.553
598	592 A	107	101	135	144	3.5	3.2	37.1	0.44	1.4	0.75	1.6	1.06
598 <i>f</i>	672	113	101	135	144	6.4	3.2	37.1	0.44	1.4	0.75	1.59	1.06
681		110	104	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.62	1.24
857		121	106	170	174	8	3.3	41.8	0.33	1.8	0.99	4.78	2.55
42368	42584	107	102	134	142	3	3	31.8	0.49	1.2	0.67	1.24	0.553
42368	42587	107	102	134	143	3	3.3	34.9	0.49	1.2	0.67	1.24	0.711
597	592 A	109	102	135	144	3.5	3.2	37.1	0.44	1.4	0.75	1.54	1.06
▲ JM 719149	▲ JM 719113	109	104	135	143	3	2.5	33.4	0.44	1.4	0.75	1.46	0.765
47896	42584	110	103	131	140	3.5	3.3	32.3	0.45	1.3	0.74	1.33	0.664
42375		108	103	134	142	3	3	31.8	0.49	1.2	0.67	1.18	0.553
42376		109	103	134	143	3.5	3.3	34.9	0.49	1.2	0.67	1.18	0.711
594	592 A	110	104	135	144	3.5	3.2	37.1	0.44	1.4	0.75	1.47	1.06
594	592	109	103	135	145	3.5	3.3	37.1	0.44	1.4	0.75	1.47	1.12
683	672	113	106	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.47	1.24
77375 776 864 HH 221440	772 854	117 114 123 125	105 107 108 110	152 161 170 171	159 168 174 179	3.5 3.5 8	3.3 3.3 3.3 3.3	37.8 39.1 41.8 42.3	0.37 0.39 0.33 0.33	1.6 1.6 1.8 1.8	0.90 0.86 0.99 0.99	2.91 3.25 4.57 5.0	1.67 1.99 2.55 2.24
42381		110	104	134	142	3.5	3	31.8	0.49	1.2	0.67	1.13	0.553
42381		111	105	135	143	3.5	3.3	34.9	0.49	1.2	0.67	1.13	0.711
52387		114	108	144	154	3.5	3.3	36.1	0.47	1.3	0.69	1.89	0.942
685		116	109	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.32	1.24
779		116	110	161	168	3.5	3.3	39.1	0.39	1.6	0.86	3.06	1.99
866		118	111	170	174	3.5	3.3	41.8	0.33	1.8	0.99	4.38	2.55
HH 221442		119	113	171	179	3.5	3.3	42.3	0.33	1.8	0.99	4.81	2.24
HH 221447	HH 221410	126	114	171	179	6.4	3.3	42.3	0.33	1.8	0.99	4.68	2.24
▲ JLM 820048	▲ JM 720210	111	107	135	144	2.3	2.3	36.8	0.50	1.2	0.66	1.27	0.616
▲ JM 720249		115	109	140	149	3	2.5	36.8	0.47	1.3	0.70	1.68	0.772
▲ JHM 720249		117	109	143	154	3	2.5	38.2	0.47	1.3	0.70	2.09	0.974
52393	52618	116	109	142	152	3.5	3.3	36.1	0.47	1.3	0.69	1.81	0.702
Noto A	The telerances are lister	d in Tob	loo 2 2	and 1 an	Doggo P	112 0	nd D11	4					

Bore Diameter 101.600 – 117.475 mm



	Boundary Dimensions (mm)							Basic Loa		Limiting Speeds		
ı	D	•	,		Cone		1) (1	•	{kṛ		(mir Grease	n-') Oil
<u>d</u>	D	T	В	С	<i>1</i> mi		$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	UII
101.600	157.162	36.512	36.116	26.195	3.5	3.3	191 000	310 000	19 500	31 500	2 000	2 800
	161.925	36.512	36.116	26.195	3.5	3.3	191 000	310 000	19 500	31 500	2 000	2 800
	168.275	41.275	41.275	30.162	3.5	3.3	223 000	345 000	22 700	35 000	2 000	2 800
	180.975	47.625	48.006	38.100	3.5	3.3	258 000	375 000	26 300	38 500	2 000	2 600
	190.500	57.150	57.531	44.450	8.0	3.3	355 000	500 000	36 000	51 000	1 900	2 600
	190.500	57.150	57.531	46.038	8.0	3.3	390 000	520 000	39 500	53 500	1 900	2 600
	212.725	66.675	66.675	53.975	7.0	3.3	570 000	810 000	58 000	82 500	1 700	2 200
104.775	180.975	47.625	48.006	38.100	7.0	3.3	258 000	375 000	26 300	38 500	2 000	2 600
	180.975	47.625	48.006	38.100	3.5	3.3	258 000	375 000	26 300	38 500	2 000	2 600
	190.500	47.625	49.212	34.925	3.5	3.3	296 000	465 000	30 000	47 000	1 800	2 400
106.362	165.100	36.512	36.512	26.988	3.5	3.3	195 000	320 000	19 800	33 000	2 000	2 600
107.950	158.750	23.020	21.438	15.875	3.5	3.3	102 000	165 000	10 400	16 800	2 000	2 800
	159.987	34.925	34.925	26.988	3.5	3.3	164 000	315 000	16 700	32 000	2 000	2 800
	161.925	34.925	34.925	26.988	3.5	3.3	164 000	280 000	16 800	28 600	2 000	2 800
	165.100	36.512	36.512	26.988	3.5	3.3	195 000	320 000	19 800	33 000	2 000	2 600
	190.500	47.625	49.212	34.925	3.5	3.3	296 000	465 000	30 000	47 000	1 800	2 400
	212.725	66.675	66.675	53.975	8.0	3.3	570 000	810 000	58 000	82 500	1 700	2 200
109.987	159.987	34.925	34.925	26.988	3.5	3.3	164 000	315 000	16 700	32 000	2 000	2 800
	159.987	34.925	34.925	26.988	8.0	3.3	164 000	315 000	16 700	32 000	2 000	2 800
109.992	177.800	41.275	41.275	30.162	3.5	3.3	232 000	375 000	23 700	38 000	1 800	2 600
110.000	165.000	35.000	35.000	26.500	3.0	2.5	195 000	320 000	19 800	33 000	2 000	2 600
	180.000	47.000	46.000	38.000	3.0	2.5	310 000	490 000	31 500	50 000	1 900	2 600
111.125	190.500	47.625	49.212	34.925	3.5	3.3	296 000	465 000	30 000	47 000	1 800	2 400
114.300	152.400	21.433	21.433	16.670	1.5	1.5	89 500	178 000	9 100	18 100	2 000	2 800
	177.800	41.275	41.275	30.162	3.5	3.3	232 000	375 000	23 700	38 000	1 800	2 600
	180.000	34.925	31.750	25.400	3.5	0.8	174 000	254 000	17 800	25 900	1 800	2 400
	190.500	47.625	49.212	34.925	3.5	3.3	296 000	465 000	30 000	47 000	1 800	2 400
	212.725	66.675	66.675	53.975	7.0	3.3	475 000	700 000	48 500	71 500	1 700	2 400
	212.725	66.675	66.675	53.975	7.0	3.3	570 000	810 000	58 000	82 500	1 700	2 200
115.087	190.500	47.625	49.212	34.925	3.5	3.3	296 000	465 000	30 000	47 000	1 800	2 400
117.475	180.975	34.925	31.750	25.400	3.5	3.3	174 000	254 000	17 800	25 900	1 800	2 400





Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y ₁

Static Equivalent Load

 P_0 = 0.5 $F_{\rm r}$ + Y_0 $F_{\rm a}$ When $F_{\rm r}$ > 0.5 $F_{\rm r}$ + Y_0 $F_{\rm a}$, use P_0 = $F_{\rm r}$

The values of e, Y_1 , and Y_0 are given in the table below.

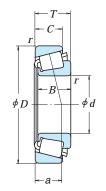
Bearing l	Numbers	ŀ	Abutmen	t and Fi (mr	llet Dimer n)	nsions		Eff. Load Constant Centers		Axial Load Factors		Mass (kg)	
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{ m b}$		Cup a ax.	(mm) a	e	Y_1	Y_0		orox. CUP
52400	52618	117	111	142	152	3.5	3.3	36.1	0.47	1.3	0.69	1.75	0.702
52400	52637	117	111	144	154	3.5	3.3	36.1	0.47	1.3	0.69	1.75	0.942
687	672	118	112	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.15	1.24
780	772	119	113	161	168	3.5	3.3	39.1	0.39	1.6	0.86	2.88	1.99
861	854	129	114	170	174	8	3.3	41.8	0.33	1.8	0.99	4.13	2.55
HH 221449	HH 221410	131	116	171	179	8	3.3	42.3	0.33	1.8	0.99	4.55	2.24
HH 224335	HH 224310	132	121	192	202	7	3.3	47.3	0.33	1.8	1.0	8.14	3.06
787	772	129	116	161	168	7	3.3	39.1	0.39	1.6	0.86	2.66	1.99
782	772	122	116	161	168	3.5	3.3	39.1	0.39	1.6	0.86	2.68	1.99
71412	71750	124	118	171	181	3.5	3.3	40.1	0.42	1.4	0.79	4.0	1.71
56418	56650	122	116	149	159	3.5	3.3	38.6	0.50	1.2	0.66	1.87	0.861
37425	37625	122	115	143	152	3.5	3.3	37.0	0.61	0.99	0.54	0.886	0.488
LM 522546	LM 522510	122	116	146	154	3.5	3.3	33.7	0.40	1.5	0.82	1.65	0.784
48190	48120	122	116	146	156	3.5	3.3	38.7	0.51	1.2	0.65	1.59	0.83
56425	56650	123	117	149	159	3.5	3.3	38.6	0.50	1.2	0.66	1.8	0.861
71425	71750	126	120	171	181	3.5	3.3	40.1	0.42	1.4	0.79	3.79	1.71
HH 224340	HH 224310	139	126	192	202	8	3.3	47.3	0.33	1.8	1.0	7.58	3.06
LM 522549	LM 522510	124	118	146	154	3.5	3.3	33.7	0.40	1.5	0.82	1.55	0.784
LM 522548	LM 522510	133	118	146	154	8	3.3	33.7	0.40	1.5	0.82	1.53	0.784
64433	64700	128	121	160	172	3.5	3.3	42.4	0.52	1.2	0.64	2.64	1.11
▲ JM 822049	▲ JM 822010	124	119	149	159	3	2.5	38.3	0.50	1.2	0.66	1.64	0.842
▲ JHM 522649	▲ JHM 522610	127	122	162	172		2.5	40.9	0.41	1.5	0.81	3.12	1.51
71437	71750	129	123	171	181	3.5	3.3	40.1	0.42	1.4	0.79	3.58	1.71
L 623149	L 623110	123	121	143	148	1.5	1.5	27.4	0.41	1.5	0.80	0.725	0.344
64450	64700	131	125	160	172	3.5	3.3	42.4	0.52	1.2	0.64	2.39	1.11
68450	** 68709	130	123	165	172	3.5	0.8	40.0	0.50	1.2	0.66	1.95	1.0
71450	71750	132	125	171	181	3.5	3.3	40.1	0.42	1.4	0.79	3.37	1.71
938	932	141	128	187	193	7	3.3	46.9	0.33	1.8	1.0	6.01	4.11
HH 224346	HH 224310	143	131	192	202	7	3.3	47.3	0.33	1.8	1.0	7.01	3.06
71453 68462	71750 68712	133 132	126 125	171 163	181 172	3.5 3.5	3.3	40.1 40.0	0.42 0.50	1.4 1.2	0.79 0.66	3.31 1.73	1.71

lotes ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).

The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

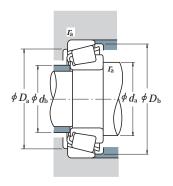
B 166 B 167

Bore Diameter 120.000 – 165.100 mm



Boundary Dimensions (mm)							Basic Load Ratings (N) {kgf}				Limiting Speeds (min ⁻¹)		
d	D	T	В	С	Cone <i>I</i> mi	, '	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	
120.000	170.000	25.400	25.400	19.050	3.3	3.3	130 000	219 000	13 200	22 300	1 900	2 600	
	174.625	35.720	36.512	27.783	3.5	1.5	212 000	385 000	21 600	39 000	1 900	2 600	
120.650	182.562	39.688	38.100	33.338	3.5	3.3	228 000	445 000	23 200	45 000	1 800	2 400	
	206.375	47.625	47.625	34.925	3.3	3.3	320 000	530 000	32 500	54 000	1 600	2 200	
123.825	182.562	39.688	38.100	33.338	3.5	3.3	228 000	445 000	23 200	45 000	1 800	2 400	
125.000	175.000	25.400	25.400	18.288	3.3	3.3	134 000	232 000	13 700	23 600	1 800	2 400	
127.000	165.895	18.258	17.462	13.495	1.5	1.5	84 500	149 000	8 650	15 200	1 900	2 600	
	182.562	39.688	38.100	33.338	3.5	3.3	228 000	445 000	23 200	45 000	1 800	2 400	
	196.850	46.038	46.038	38.100	3.5	3.3	315 000	560 000	32 000	57 500	1 700	2 200	
	215.900	47.625	47.625	34.925	3.5	3.3	287 000	495 000	29 300	50 000	1 500	2 000	
128.588	206.375	47.625	47.625	34.925	3.3	3.3	320 000	530 000	32 500	54 000	1 600	2 200	
130.000	206.375	47.625	47.625	34.925	3.5	3.3	320 000	530 000	32 500	54 000	1 600	2 200	
130.175	203.200	46.038	46.038	38.100	3.5	3.3	315 000	560 000	32 000	57 500	1 700	2 200	
	206.375	47.625	47.625	34.925	3.5	3.3	320 000	530 000	32 500	54 000	1 600	2 200	
133.350	177.008	25.400	26.195	20.638	1.5	1.5	124 000	258 000	12 700	26 300	1 800	2 400	
	190.500	39.688	39.688	33.338	3.5	3.3	240 000	485 000	24 500	49 500	1 700	2 200	
	196.850	46.038	46.038	38.100	3.5	3.3	315 000	560 000	32 000	57 500	1 700	2 200	
	215.900	47.625	47.625	34.925	3.5	3.3	287 000	495 000	29 300	50 000	1 500	2 000	
136.525	190.500	39.688	39.688	33.338	3.5	3.3	216 000	440 000	22 000	45 000	1 700	2 200	
	217.488	47.625	47.625	34.925	3.5	3.3	287 000	495 000	29 300	50 000	1 500	2 000	
139.700	187.325	28.575	29.370	23.020	1.5	1.5	153 000	305 000	15 600	31 500	1 700	2 200	
	215.900	47.625	47.625	34.925	3.5	3.3	287 000	495 000	29 300	50 000	1 500	2 000	
	254.000	66.675	66.675	47.625	7.0	3.3	515 000	830 000	52 500	84 500	1 300	1 800	
142.875	200.025	41.275	39.688	34.130	3.5	3.3	227 000	460 000	23 100	46 500	1 600	2 200	
146.050	193.675	28.575	28.575	23.020	1.5	1.5	170 000	355 000	17 300	36 500	1 600	2 200	
	236.538	57.150	56.642	44.450	3.5	3.3	455 000	720 000	46 000	73 500	1 400	1 900	
	254.000	66.675	66.675	47.625	7.0	3.3	515 000	830 000	52 500	84 500	1 300	1 800	
149.225	254.000	66.675	66.675	47.625	7.0	3.3	515 000	830 000	52 500	84 500	1 300	1 800	
152.400	254.000	66.675	66.675	47.625	7.0	3.3	515 000	830 000	52 500	84 500	1 300	1 800	
158.750	225.425	41.275	39.688	33.338	3.5	3.3	240 000	540 000	24 400	55 000	1 400	1 900	
165.100	247.650	47.625	47.625	38.100	3.5	3.3	345 000	705 000	35 500	71 500	1 300	1 700	





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$					
X	Y	X	Y				
1	0	0.4	Y ₁				

Static Equivalent Load

 $P_0 = 0.5\,F_r + Y_0\,F_a$ When $F_r > 0.5\,F_r + Y_0\,F_a$, use $P_0 = F_r$

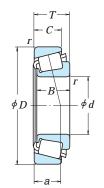
The values of \emph{e}_{\imath} \emph{Y}_{1} , and \emph{Y}_{0} are given in the table below.

Bearing No	umbers	ŀ	Abutmen	t and Fill (mm	let Dimer n)		C	Eff. Load Centers	Constant		Load ctors		ass (g)
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{\scriptscriptstyle m a}$	$D_{\scriptscriptstyle m b}$	1	Cup r _a ax.	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
▲ JL 724348	▲ JL 724314	132	127	156	163	3.3	3.3	32.9	0.46	1.3	0.72	1.08	0.591
* M 224748	M 224710	135	129	163	168	3.5	1.5	32.2	0.33	1.8	0.99	1.9	0.866
48282	48220	136	133	168	176	3.5	3.3	34.2	0.31	2.0	1.1	2.56	1.14
795	792	139	134	186	198	3.3	3.3	45.7	0.46	1.3	0.72	4.44	1.9
48286	48220	139	133	168	176	3.5	3.3	34.2	0.31	2.0	1.1	2.37	1.14
▲ JL 725346	▲ JL 725316	138	133	161	168	3.3	3.3	34.3	0.48	1.3	0.69	1.19	0.573
LL 225749	LL 225710	135	132	158	160	1.5	1.5	24.2	0.33	1.8	0.99	0.647	0.288
48290	48220	141	135	168	176	3.5	3.3	34.2	0.31	2.0	1.1	2.19	1.14
67388	67322	144	138	180	189	3.5	3.3	39.7	0.34	1.7	0.96	3.74	1.46
74500	74850	148	141	196	208	3.5	3.3	48.4	0.49	1.2	0.68	4.92	1.99
799	792	146	140	186	198	3.3	3.3	45.7	0.46	1.3	0.72	3.86	1.9
797	792	148	141	186	198	3.5	3.3	45.7	0.46	1.3	0.72	3.76	1.9
67389	67320	146	141	183	191	3.5	3.3	39.7	0.34	1.7	0.96	3.51	2.06
799 A	792	148	142	186	198	3.5	3.3	45.7	0.46	1.3	0.72	3.74	1.9
L 327249	L 327210	143	141	167	171	1.5	1.5	29.5	0.35	1.7	0.95	1.18	0.55
48385	48320	148	142	177	184	3.5	3.3	35.9	0.32	1.9	1.0	2.58	1.16
67390	67322	149	143	180	189	3.5	3.3	39.7	0.34	1.7	0.96	3.27	1.46
74525	74850	152	146	196	208	3.5	3.3	48.4	0.49	1.2	0.68	4.44	1.99
48393	48320	151	144	177	184	3.5	3.3	35.9	0.32	1.9	1.0	2.31	1.16
74537	74856	155	148	197	210	3.5	3.3	48.4	0.49	1.2	0.68	4.19	2.13
LM 328448	LM 328410	149	147	176	182	1.5	1.5	31.7	0.36	1.7	0.93	1.59	0.67
74550	74850	158	151	196	208	3.5	3.3	48.4	0.49	1.2	0.68	3.93	1.99
99550	99100	170	156	227	238	7	3.3	55.3	0.41	1.5	0.81	9.99	3.83
48685	48620	158	151	185	193	3.5	3.3	37.6	0.34	1.8	0.98	2.63	1.19
36690	36620	155	154	182	188	1.5	1.5	33.5	0.37	1.6	0.90	1.64	0.725
HM 231140	HM 231110	164	160	217	224	3.5	3.3	45.9	0.32	1.9	1.0	6.07	2.93
99575	99100	175	162	227	238	7	3.3	55.3	0.41	1.5	0.81	9.24	3.83
99587	99100	178	165	227	238	7	3.3	55.3	0.41	1.5	0.81	8.86	3.83
99600	99100	181	167	227	238	7	3.3	55.3	0.41	1.5	0.81	8.46	3.83
46780 67780	46720 67720	176 185	169 179	209 229	218 240	3.5 3.5	3.3	44.3 52.4	0.38	1.6 1.4	0.86 0.75	3.69 5.83	1.66 2.33

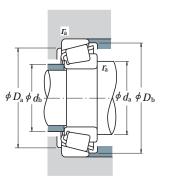
otes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

▲ The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 170.000 – 206.375 mm



		,	Dimension mm)	ns		Basic Loa (N)			Ratings {kg	gf}	Limiting Speeds (min ⁻¹)	
d	D	T	В	С	Cone I mi	r '	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
170.000	230.000	39.000	38.000	31.000	3.0	2.5	278 000	520 000	28 300	53 000	1 300	1 800
	240.000	46.000	44.500	37.000	3.0	2.5	380 000	720 000	39 000	73 000	1 300	1 800
174.625	247.650	47.625	47.625	38.100	3.5	3.3	345 000	705 000	35 500	71 500	1 300	1 700
177.800	227.012	30.162	30.162	23.020	1.5	1.5	181 000	415 000	18 500	42 000	1 300	1 800
	247.650	47.625	47.625	38.100	3.5	3.3	345 000	705 000	35 500	71 500	1 300	1 700
	260.350	53.975	53.975	41.275	3.5	3.3	455 000	835 000	46 500	85 000	1 200	1 700
190.000	260.000	46.000	44.000	36.500	3.0	2.5	370 000	730 000	38 000	74 500	1 100	1 600
190.500	266.700	47.625	46.833	38.100	3.5	3.3	345 000	720 000	35 000	73 000	1 100	1 500
200.000	300.000	65.000	62.000	51.000	3.5	2.5	615 000	1 130 000	62 500	116 000	1 000	1 400
203.200	282.575	46.038	46.038	36.512	3.5	3.3	365 000	800 000	37 500	81 500	1 000	1 400
206.375	282.575	46.038	46.038	36.512	3.5	3.3	365 000	800 000	37 500	81 500	1 000	1 400



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$					
X	Y	X	Y				
1	0	0.4	Y ₁				

NSK

Static Equivalent Load

 $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$

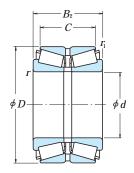
When $F_{\rm r} > 0.5 F_{\rm r} + Y_0 F_{\rm a}$, use $P_0 = F_{\rm r}$ The values of e, Y_1 , and Y_0 are

given in the table below.

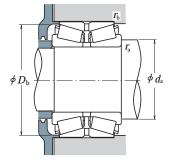
Bearing	Numbers	Α	Abutmen	t and Fil mn)	let Dimer	isions		Eff. Load Centers	Constant		Load tors		ass
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{\scriptscriptstyle m b}$	$D_{ m a}$	$D_{ m b}$	1	Cup a ax.	(mm)	e	<i>Y</i> ₁	Y_0		g) rox. CUP
▲ JHM 534149	▲ JHM 534110	184	178	217	224	3	2.5	43.2	0.38	1.6	0.86	3.1	1.3
▲ JM 734449	▲ JM 734410	185	180	222	232		2.5	50.5	0.44	1.4	0.75	4.42	2.02
67787	67720	192	185	229	240	3.5	3.3	52.4	0.44	1.4	0.75	4.88	2.33
36990	36920	189	186	214	221	1.5	1.5	42.9	0.44	1.4	0.75	2.1	0.907
67790	67720	194	188	229	240	3.5	3.3	52.4	0.44	1.4	0.75	4.56	2.33
M 236849	M 236810	195	192	241	249	3.5	3.3	47.5	0.33	1.8	0.99	6.49	2.86
▲ JM 738249	▲ JM 738210	206	200	242	252	3	2.5	56.4	0.48	1.3	0.69	4.73	2.2
67885	67820	209	203	246	259	3.5	3.3	57.9	0.48	1.3	0.69	5.4	2.64
▲ JHM 840449	▲ JHM 840410	223	215	273	289	3.5	2.5	73.1	0.52	1.2	0.63	10.3	5.19
67983	67920	222	216	260	275	3.5	3.3	61.9	0.51	1.2	0.65	6.03	2.82
67985	67920	224	219	260	275	3.5	3.3	61.9	0.51	1.2	0.65	5.66	2.82

NSK

Bore Diameter 40 – 90 mm



			Dimensions	5			nd Ratings N)	Limiting Spe	eds (min ⁻¹)
d	D	B_2	C	$m{r}$ min.	$oldsymbol{arGamma}_1$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
40	80	45	37.5	1.5	0.6	109 000	140 000	3 700	5 100
45	85	47	37.5	1.5	0.6	117 000	159 000	3 400	4 700
	85	55	43.5	1.5	0.6	143 000	204 000	3 400	4 700
50	90	48	38.5	1.5	0.6	131 000	183 000	3 200	4 400
	90	49	39.5	1.5	0.6	131 000	183 000	3 200	4 400
	90	55	43.5	1.5	0.6	150 000	218 000	3 200	4 400
	110	64	51.5	2.5	0.6	224 000	297 000	2 700	3 700
55	100	51	41.5	2	0.6	162 000	226 000	2 900	3 900
	100	52	42.5	2	0.6	162 000	226 000	2 900	3 900
	100	60	48.5	2	0.6	188 000	274 000	2 900	3 900
	120	70	57	2.5	0.6	256 000	342 000	2 500	3 400
60	110	53	43.5	2	0.6	178 000	246 000	2 700	3 600
	110	66	54.5	2	0.6	225 000	335 000	2 700	3 600
	130	74	59	3	1	298 000	405 000	2 300	3 200
65	120	56	46.5	2	0.6	210 000	300 000	2 400	3 200
	120	57	47.5	2	0.6	210 000	300 000	2 400	3 200
	120	73	61.5	2	0.6	269 000	405 000	2 400	3 300
	140	79	63	3	1	340 000	465 000	2 100	2 900
70	125	57	46.5	2	0.6	227 000	325 000	2 300	3 100
	125	59	48.5	2	0.6	227 000	325 000	2 300	3 100
	125	74	61.5	2	0.6	270 000	410 000	2 300	3 100
	150	83	67	3	1	390 000	535 000	2 000	2 700
75	130	62	51.5	2	0.6	245 000	365 000	2 200	3 000
	130	74	61.5	2	0.6	283 000	440 000	2 200	3 000
	160	87	69	3	1	435 000	600 000	1 900	2 500
80	140	61	49	2.5	0.6	269 000	390 000	2 000	2 800
	140	64	51.5	2.5	0.6	269 000	390 000	2 000	2 800
	140	78	63.5	2.5	0.6	330 000	505 000	2 000	2 800
	170	92	73	3	1	475 000	655 000	1 700	2 400
85	150	70	57	2.5	0.6	315 000	465 000	1 900	2 600
	150	86	69	2.5	0.6	360 000	555 000	1 900	2 600
	180	98	77	4	1	530 000	745 000	1 600	2 200
90	160	71	58	2.5	0.6	345 000	510 000	1 800	2 400
	160	74	61	2.5	0.6	345 000	510 000	1 800	2 400
	160	94	77	2.5	0.6	440 000	700 000	1 800	2 400



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y ₃	0.67	Y ₂

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

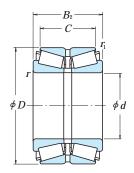
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

	Abutme	ent and F (m		ensions	Constant	P	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$r_{ m b}$ max.	e	Y_2	Y_3	Y_0	approx.
HR 40 KBE 42+L	51	75	1.5	0.6	0.37	2.7	1.8	1.8	0.97
HR 45 KBE 42+L	56	81	1.5	0.6	0.40	2.5	1.7	1.6	1.08
HR 45 KBE 52X+L	56	81	1.5	0.6	0.40	2.5	1.7	1.6	1.31
HR 50 KBE 042+L	61	87	1.5	0.6	0.42	2.4	1.6	1.6	1.20
HR 50 KBE 42+L	61	87	1.5	0.6	0.42	2.4	1.6	1.6	1.22
HR 50 KBE 52X+L	61	87	1.5	0.6	0.42	2.4	1.6	1.6	1.39
HR 50 KBE 043+L	65	104	2	0.6	0.35	2.9	2.0	1.9	2.77
HR 55 KBE 042+L	67	96	2	0.6	0.40	2.5	1.7	1.6	1.59
HR 55 KBE 1003+L	67	96	2	0.6	0.40	2.5	1.7	1.6	1.63
HR 55 KBE 52X+L	67	97	2	0.6	0.40	2.5	1.7	1.6	1.88
HR 55 KBE 43+L	70	113	2	0.6	0.35	2.9	2.0	1.9	3.52
HR 60 KBE 042+L	72	105	2	0.6	0.40	2.5	1.7	1.6	2.03
HR 60 KBE 52X+L	72	106	2	0.6	0.40	2.5	1.7	1.6	2.52
HR 60 KBE 43+L	78	122	2.5	1	0.35	2.9	2.0	1.9	4.40
HR 65 KBE 42+L	77	115	2	0.6	0.40	2.5	1.7	1.6	2.58
HR 65 KBE 1202+L	77	115	2	0.6	0.40	2.5	1.7	1.6	2.61
HR 65 KBE 52X+L	77	117	2	0.6	0.40	2.5	1.7	1.6	3.35
HR 65 KBE 43+L	83	132	2.5	1	0.35	2.9	2.0	1.9	5.42
HR 70 KBE 042+L	82	120	2	0.6	0.42	2.4	1.6	1.6	2.79
HR 70 KBE 42+L	82	120	2	0.6	0.42	2.4	1.6	1.6	2.85
HR 70 KBE 52X+L	82	121	2	0.6	0.42	2.4	1.6	1.6	3.58
HR 70 KBE 43+L	88	142	2.5	1	0.35	2.9	2.0	1.9	6.45
HR 75 KBE 42+L	87	126	2	0.6	0.44	2.3	1.6	1.5	3.15
HR 75 KBE 52X+L	87	127	2	0.6	0.44	2.3	1.6	1.5	3.73
HR 75 KBE 043+L	93	151	2.5	1	0.35	2.9	2.0	1.9	7.66
HR 80 KBE 042+L	95	134	2	0.6	0.42	2.4	1.6	1.6	3.70
HR 80 KBE 42+L	95	134	2	0.6	0.42	2.4	1.6	1.6	3.70
HR 80 KBE 52X+L	95	136	2	0.6	0.42	2.4	1.6	1.6	4.59
HR 80 KBE 043+L	98	161	2.5	1	0.35	2.9	2.0	1.9	9.02
HR 85 KBE 42+L	100	143	2	0.6	0.42	2.4	1.6	1.6	4.69
HR 85 KBE 52X+L	100	144	2	0.6	0.42	2.4	1.6	1.6	5.70
HR 85 KBE 043+L	106	169	3	1	0.35	2.9	2.0	1.9	10.8
HR 90 KBE 042+L	105	152	2	0.6	0.42	2.4	1.6	1.6	5.53
HR 90 KBE 42+L	105	152	2	0.6	0.42	2.4	1.6	1.6	5.71
HR 90 KBE 52X+L	105	154	2	0.6	0.42	2.4	1.6	1.6	7.26

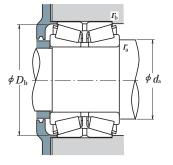
Remarks For other double-row tapered roller bearings not listed above, please contact NSK.

NSK

Bore Diameter 90 – 120 mm



			y Dimension mm)	ns			oad Ratings (N)	Limiting Spe	eds (min ⁻¹)
d	D	B_2	С	r min.	$m{r}_1$ min.	C_{r}	$C_{0\mathrm{r}}$	Grease	Oil
90	190	102	81	4	1	595 000	845 000	1 600	2 100
	190	144	115	4	1	770 000	1 180 000	1 600	2 200
95	170	78	63	3	1	385 000	570 000	1 700	2 300
	170	100	83	3	1	495 000	800 000	1 700	2 300
	200	108	85	4	1	640 000	910 000	1 500	2 000
100	165	52	46	2.5	0.6	222 000	340 000	1 700	2 300
	180	81	64	3	1	435 000	665 000	1 600	2 200
	180	81	65	3	1	435 000	665 000	1 600	2 200
	180	82	66	3	1	435 000	665 000	1 600	2 200
	180	83	67	3	1	435 000	665 000	1 600	2 200
	180	105	85	3	1	555 000	905 000	1 600	2 200
	180	107	87	3	1	555 000	905 000	1 600	2 200
	180	110	90	3	1	555 000	905 000	1 600	2 200
	215	112	87	4	1	725 000	1 050 000	1 400	1 900
105	190	88	70	3	1	480 000	735 000	1 500	2 000
	190	117	96	3	1	620 000	1 020 000	1 500	2 000
	190	115	95	3	1	620 000	1 020 000	1 500	2 000
	225	116	91	4	1	780 000	1 130 000	1 300	1 800
110	180	56	50	2.5	0.6	264 000	400 000	1 500	2 000
	180	70	56	2.5	0.6	340 000	555 000	1 500	2 000
	180	125	100	2.5	0.6	550 000	1 060 000	1 500	2 100
	200	90	72	3	1	540 000	840 000	1 400	1 900
	200	92	74	3	1	540 000	840 000	1 400	1 900
	200	120	100	3	1	685 000	1 130 000	1 400	1 900
	200	121	101	3	1	685 000	1 130 000	1 400	1 900
	240	118	93	4	1.5	830 000	1 190 000	1 200	1 700
120	180	46	41	2.5	0.6	184 000	296 000	1 500	2 000
	180	58	46	2.5	0.6	260 000	450 000	1 500	2 000
	200	62	55	2.5	0.6	310 000	500 000	1 400	1 800
	200	78	62	2.5	0.6	415 000	690 000	1 400	1 900
	200	100	84	2.5	0.6	515 000	885 000	1 400	1 800
	215	97	78	3	1	575 000	900 000	1 300	1 800
	215	132	109	3	1	750 000	1 270 000	1 300	1 800
	260	128	101	4	1	915 000	1 310 000	1 100	1 500
	260	188	145	4	1	1 320 000	2 110 000	1 100	1 500



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$					
X	Y	X	Y				
1	Y ₃	0.67	Y ₂				

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

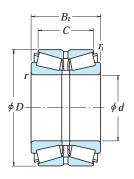
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Decelor Numbers	Abutme	ent and F (m		ensions	Constant	P	xial Load Factors	i	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$m{r_{a}}$ max.	$r_{ m b}$ max.	e	Y_2	Y_3	Y_0	арргох.
HR 90 KBE 043+L	111	178	3	1	0.35	2.9	2.0	1.9	12.7
HR 90 KBE 1901+L	111	179	3	1	0.35	2.9	2.0	1.9	17.9
HR 95 KBE 42+L	113	161	2.5	1	0.42	2.4	1.6	1.6	6.75
HR 95 KBE 52+L	113	163	2.5	1	0.42	2.4	1.6	1.6	8.60
HR 95 KBE 43+L	116	187	3	1	0.35	2.9	2.0	1.9	14.7
100 KBE 31+L	115	156	2	0.6	0.33	3.0	2.0	2.0	4.04
HR100 KBE 1805+L	118	170	2.5	1	0.42	2.4	1.6	1.6	8.16
HR100 KBE 042+L	118	170	2.5	1	0.42	2.4	1.6	1.6	8.13
HR100 KBE 1801+L	118	170	2.5	1	0.42	2.4	1.6	1.6	8.22
HR100 KBE 42+L	118	170	2.5	1	0.42	2.4	1.6	1.6	8.7
HR100 KBE 1802+L	118	173	2.5	1	0.42	2.4	1.6	1.6	10.6
HR100 KBE 52X+L	118	173	2.5	1	0.42	2.4	1.6	1.6	10.7
HR100 KBE 1804+L	118	173	2.5	1	0.42	2.4	1.6	1.6	11
HR100 KBE 043+L	121	200	3	1	0.35	2.9	2.0	1.9	18.1
HR105 KBE 42X+L	123	179	2.5	1	0.42	2.4	1.6	1.6	9.76
HR105 KBE 1902+L	123	182	2.5	1	0.42	2.4	1.6	1.6	13.4
HR105 KBE 52+L	123	182	2.5	1	0.42	2.4	1.6	1.6	13.1
HR105 KBE 043+L	126	209	3	1	0.35	2.9	2.0	1.9	20.4
110 KBE 31+L	125	172	2	0.6	0.39	2.6	1.7	1.7	5.11
110 KBE 031+L	125	172	2	0.6	0.39	2.6	1.7	1.7	6.33
110 KBE 1802+L	125	172	2	0.6	0.26	3.8	2.6	2.5	11.4
HR110 KBE 42+L	128	190	2.5	1	0.42	2.4	1.6	1.6	11.2
HR110 KBE 42X+L	128	190	2.5	1	0.42	2.4	1.6	1.6	11.5
HR110 KBE 2001+L	128	193	2.5	1	0.42	2.4	1.6	1.6	15.4
HR110 KBE 52X + L	128	193	2.5	1	0.42	2.4	1.6	1.6	15.2
HR110 KBE 043+L	131	223	3	1.5	0.35	2.9	2.0	1.9	23.6
120 KBE 30+L	135	172	2	0.6	0.40	2.5	1.7	1.6	3.75
120 KBE 030+L	135	172	2	0.6	0.39	2.6	1.7	1.7	4.64
120 KBE 31+L	135	190	2	0.6	0.39	2.6	1.7	1.7	7.35
120 KBE 031+L	135	190	2	0.6	0.39	2.6	1.7	1.7	8.97
120 KBE 2001+L	135	193	2	0.6	0.37	2.7	1.8	1.8	11.3
HR120 KBE 42X+L	138	204	2.5	1	0.44	2.3	1.6	1.5	13.7
HR120 KBE 52X+L	138	207	2.5	1	0.44	2.3	1.6	1.5	18.8
HR120 KBE 43+L	141	240	3	1	0.35	2.9	2.0	1.9	29.4
HR120 KBE 2601+L	141	242	3	1	0.35	2.9	2.0	1.9	44.6

Remarks For other double-row tapered roller bearings not listed above, please contact NSK.

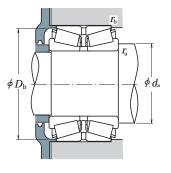


Bore Diameter 125 – 150 mm



		Boundar	y Dimensions	S		Basic Lo	oad Ratings	Limiting Spe	ode (min-1)
			(mm)				(N)	"	, ,
d	D	B_2	С	$m{r}$ min.	$oldsymbol{r_1}{ ext{min.}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
125	210	110	88	4	1	560 000	1 030 000	1 300	1 800
130	230	98	78.5	4	1	640 000	1 010 000	1 200	1 600
	230	100	80.5	4	1	640 000	1 010 000	1 200	1 600
	280	137	107.5	5	1.5	940 000	1 350 000	1 000	1 400
	230	145	115	4	1	905 000	1 580 000	1 200	1 700
	230	145	117.5	4	1	905 000	1 580 000	1 200	1 700
	230	150	120	4	1	905 000	1 580 000	1 200	1 700
140	210	53	47	2.5	0.6	280 000	495 000	1 200	1 700
	210	66	53	2.5	1	305 000	530 000	1 200	1 700
	210	106	94	2.5	0.6	555 000	1 200 000	1 300	1 700
	225	68	61	3	1	400 000	630 000	1 200	1 600
	225	84	68	3	1	490 000	850 000	1 200	1 600
	225	85	68	3	1	490 000	850 000	1 200	1 600
	230	120	94	3	1	685 000	1 270 000	1 200	1 600
	230	140	110	3	1	820 000	1 550 000	1 200	1 600
	240	132	106	4	1.5	685 000	1 360 000	1 100	1 500
	250	102	82.5	4	1	670 000	1 030 000	1 100	1 500
	250	153	125.5	4	1	1 040 000	1 830 000	1 100	1 500
	300	145	115.5	5	1.5	1 030 000	1 480 000	1 000	1 300
150	225	56	50	3	1	300 000	545 000	1 200	1 600
	225	70	56	3	1	395 000	685 000	1 200	1 600
	250	80	71	3	1	510 000	810 000	1 100	1 400
	250	100	80	3	1	630 000	1 090 000	1 100	1 400
	250	115	95	3	1	745 000	1 320 000	1 100	1 500
	260	150	115	4	1	815 000	1 520 000	1 100	1 400
	270	109	87	4	1	830 000	1 330 000	1 000	1 400
	270	164	130	4	1	1 210 000	2 150 000	1 000	1 400
	270	174	140	4	1	1 210 000	2 150 000	1 000	1 400
	320	154	120	5	1.5	1 420 000	2 130 000	900	1 200

Remarks For other double-row tapered roller bearings not listed above, please contact NSK.



Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e		
X	Y	X	Y		
1	Y ₃	0.67	Y ₂		

Static Equivalent Load

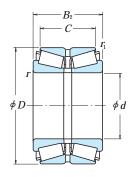
 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

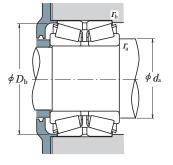
Decide New Joseph	Abutme	ent and Fi (m		ensions	Constant	F	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$r_{ m b}$ max.	e	Y_2	Y_3	Y_0	approx.
125 KBE 2101+L	146	201	3	1	0.43	2.3	1.6	1.5	14.5
HR130 KBE 42+L	151	220	3	1	0.44	2.3	1.6	1.5	15.8
HR130 KBE 2301+L	151	220	3	1	0.44	2.3	1.6	1.5	15.9
130 KBE 43+L	157	258	4	1.5	0.36	2.8	1.9	1.8	35
HR130 KBE 2302+L	151	221	3	1	0.44	2.3	1.6	1.5	24.1
HR130 KBE 52+L	151	222	3	1	0.44	2.3	1.6	1.5	23.8
HR130 KBE 2303+L	151	221	3	1	0.44	2.3	1.6	1.5	24.2
140 KBE 30+L	155	202	2	0.6	0.39	2.6	1.7	1.7	6.02
140 KBE 030+L	155	202	2	1	0.40	2.5	1.7	1.6	7.02
140 KBE 2101+L	155	202	2	0.6	0.33	3.0	2.0	2.0	12.3
140 KBE 31+L	158	216	2.5	1	0.39	2.6	1.7	1.7	9.31
140 KBE 031+L	158	215	2.5	1	0.39	2.6	1.7	1.7	11.6
140 KBE 2201+L	158	215	2.5	1	0.39	2.6	1.7	1.7	11.7
140 KBE 2301+L	158	220	2.5	1	0.33	3.0	2.0	2.0	17.6
140 KBE 2302+L	158	221	2.5	1	0.35	2.9	2.0	1.9	20.7
140 KBE 2401+L	161	227	3	1.5	0.44	2.3	1.5	1.5	22.7
HR140 KBE 42+L	161	237	3	1	0.44	2.3	1.6	1.5	18.9
HR140 KBE 52X+L	161	241	3	1	0.44	2.3	1.6	1.5	29.6
140 KBE 43+L	167	275	4	1.5	0.36	2.8	1.9	1.8	42.6
150 KBE 30+L	168	213	2.5	1	0.35	2.9	2.0	1.9	7.41
150 KBE 030+L	168	215	2.5	1	0.35	2.9	2.0	1.9	8.70
150 KBE 31+L	168	240	2.5	1	0.40	2.5	1.7	1.6	14.2
150 KBE 031+L	168	238	2.5	1	0.39	2.6	1.7	1.7	17.8
150 KBE 2502+L	168	238	2.5	1	0.37	2.7	1.8	1.8	20.9
150 KBE 2601+L	171	242	3	1	0.43	2.3	1.6	1.5	30.0
HR150 KBE 42+L HR150 KBE 52X+L HR150 KBE 2701+L HR150 KBE 43+L	171 171 171 177	253 257 257 295	3 3 4	1 1 1 1.5	0.44 0.44 0.44 0.35	2.3 2.3 2.3 2.9	1.6 1.6 1.6 2.0	1.5 1.5 1.5 1.9	

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Bore Diameter 160 – 200 mm



			y Dimensior	ns		Basic Lo	ad Ratings	Limiting Spe	eds (min ⁻¹)
		(mm)				(N)		
d	D	B_2	С	r min.	$oldsymbol{r_1}{ ext{min.}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
160	240	60	53	3	1	355 000	580 000	1 100	1 500
	240	75	60	3	1	395 000	710 000	1 100	1 500
	240	110	90	3	1	650 000	1 290 000	1 100	1 500
	270	86	76	3	1	540 000	885 000	1 000	1 300
	270	108	86	3	1	775 000	1 380 000	1 000	1 300
	270	140	120	3	1	990 000	1 880 000	1 000	1 300
	280	150	125	4	1	1 100 000	2 020 000	1 000	1 300
	290	115	91	4	1	800 000	1 220 000	900	1 300
	290	178	144	4	1	1 360 000	2 440 000	1 000	1 300
	340	160	126	5	1.5	1 310 000	1 920 000	800	1 100
165	290	150	125	4	1	1 140 000	2 130 000	900	1 300
170	250	85	65	3	1	435 000	845 000	1 000	1 400
	260	67	60	3	1	400 000	700 000	1 000	1 300
	260	84	67	3	1	575 000	1 030 000	1 000	1 300
	280	88	78	3	1	630 000	1 040 000	900	1 300
	280	110	88	3	1	820 000	1 450 000	900	1 300
	280	150	130	3	1	1 110 000	2 160 000	1 000	1 300
	310	192	152	5	1.5	1 590 000	2 910 000	900	1 200
180	280	74	66	3	1	455 000	810 000	900	1 300
	280	93	74	3	1	655 000	1 220 000	900	1 200
	300	96	85	4	1.5	725 000	1 210 000	900	1 200
	300	120	96	4	1.5	940 000	1 690 000	900	1 200
	320	127	99	5	1.5	895 000	1 390 000	800	1 200
	320	192	152	5	1.5	1 640 000	3 050 000	900	1 200
	340	180	140	5	1.5	1 410 000	2 510 000	800	1 100
190	290	75	67	3	1	490 000	845 000	900	1 200
	290	94	75	3	1	670 000	1 230 000	900	1 200
	320	104	92	4	1.5	800 000	1 380 000	800	1 100
	320	130	104	4	1.5	1 070 000	1 960 000	800	1 100
	340	133	105	5	1.5	990 000	1 580 000	800	1 100
	340	204	160	5	1.5	1 910 000	3 550 000	800	1 100
200	310	152	123	3	1	1 300 000	2 740 000	800	1 100
	320	146	110	5	1.5	990 000	2 120 000	800	1 100
	330	180	140	5	1.5	1 390 000	2 730 000	800	1 100
	340	112	100	4	1.5	940 000	1 670 000	800	1 000
	340	140	112	4	1.5	1 260 000	2 250 000	800	1 000
	360	142	110	5	1.5	1 100 000	1 780 000	700	1 000
	360	218	174	5	1.5	2 070 000	3 850 000	800	1 000
D							L. I NCV		



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$			
X	Y	X	Y		
1	Y ₃	0.67	Y ₂		

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

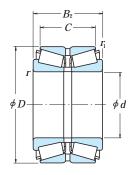
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Danis a Novebour	Abutme	ent and F (m		ensions	Constant	F	Axial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$r_{ m b}$ max.	e	Y_2	Y_3	Y_0	арргох.
160 KBE 30+L	178	231	2.5	1	0.37	2.7	1.8	1.8	8.56
160 KBE 030+L	178	230	2.5	1	0.40	2.5	1.7	1.6	10.5
160 KBE 2401+L	178	232	2.5	1	0.38	2.6	1.8	1.7	16.2
160 KBE 31+L	178	255	2.5	1	0.40	2.5	1.7	1.6	18.6
160 KBE 031+L	178	256	2.5	1	0.39	2.6	1.7	1.7	23.1
160 KBE 2701+L	178	261	2.5	1	0.39	2.6	1.7	1.7	30.6
160 KBE 2801+L 160 KBE 42+L HR160 KBE 52X+L 160 KBE 43+L	181 181 181 187	266 275 277 314	3 3 4	1 1 1 1.5	0.32 0.43 0.44 0.36	3.2 2.3 2.3 2.8	2.1 1.6 1.6 1.9	2.1 1.5 1.5 1.8	35.9 28.2 47.3 60.4
165 KBE 2901+L	186	272	3	1	0.33	3.1	2.1	2.0	39.5
170 KBE 2501+L	188	241	2.5	1	0.44	2.3	1.5	1.5	12.3
170 KBE 30+L	188	248	2.5	1	0.40	2.5	1.7	1.6	11.8
170 KBE 030+L	188	249	2.5	1	0.39	2.6	1.7	1.7	14.4
170 KBE 31+L	188	266	2.5	1	0.39	2.6	1.7	1.7	19.7
170 KBE 031+L	188	268	2.5	1	0.39	2.6	1.7	1.7	24.2
170 KBE 2802+L	188	269	2.5	1	0.39	2.6	1.7	1.7	34.6
HR170 KBE 52X+L	197	297	4	1.5	0.44	2.3	1.6	1.5	57.3
180 KBE 30+L	198	265	2.5	1	0.40	2.5	1.7	1.6	15.4
180 KBE 030+L	198	265	2.5	1	0.35	2.9	2.0	1.9	14.4
180 KBE 31+L	201	284	3	1.5	0.39	2.6	1.7	1.7	24.8
180 KBE 031+L	201	287	3	1.5	0.39	2.6	1.7	1.7	31.1
180 KBE 42+L	207	300	4	1.5	0.44	2.3	1.5	1.5	36.5
HR180 KBE 52X+L	207	308	4	1.5	0.45	2.2	1.5	1.5	59.2
180 KBE 3401+L	207	305	4	1.5	0.43	2.3	1.6	1.5	68.1
190 KBE 30+L	208	279	2.5	1	0.39	2.6	1.7	1.7	16.2
190 KBE 030+L	208	279	2.5	1	0.40	2.5	1.7	1.6	20.1
190 KBE 31+L	211	301	3	1.5	0.40	2.5	1.7	1.6	30.9
190 KBE 031+L	211	302	3	1.5	0.39	2.6	1.7	1.7	39.0
190 KBE 42+L	217	320	4	1.5	0.40	2.5	1.7	1.6	43.9
HR190 KBE 52X+L	217	327	4	1.5	0.44	2.3	1.6	1.5	70.8
HR200 KBE 3101+L	218	301	2.5	1	0.43	2.3	1.6	1.5	40.1
200 KBE 3201+L	227	301	4	1.5	0.52	1.9	1.3	1.3	41.6
200 KBE 3301+L	227	316	4	1.5	0.42	2.4	1.6	1.6	54.4
200 KBE 31+L	221	321	3	1.5	0.40	2.5	1.7	1.6	38.8
200 KBE 031+L	221	324	3	1.5	0.39	2.6	1.7	1.7	47.0
200 KBE 42+L	227	338	4	1.5	0.40	2.5	1.7	1.6	52.6
HR200 KBE 52+L	227	344	4	1.5	0.41	2.5	1.7	1.6	88.3

Remarks For other double-row tapered roller bearings not listed above, please contact NSK.

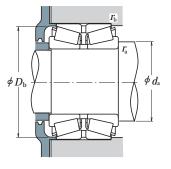
NSK

Bore Diameter 206 – 260 mm



			y Dimensior (mm)	ıs			oad Ratings (N)	Limiting Spe	eds (min ⁻¹)
d	D	B_2	С	$m{r}$ min.	$oldsymbol{r_1}{min.}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	Oil
206	283	102	83	4	1.5	580 000	1 430 000	900	1 200
210	355	116	103	4	1.5	905 000	1 520 000	700	1 000
220	300	110	88	3	1	730 000	1 710 000	800	1 100
	340	90	80	4	1.5	695 000	1 280 000	700	1 000
	340	113	90	4	1.5	920 000	1 830 000	700	1 000
	370	120	107	5	1.5	1 110 000	1 940 000	700	1 000
	370	150	120	5	1.5	1 460 000	2 760 000	700	1 000
	400	158	122	5	1.5	1 390 000	2 300 000	600	900
240	360	92	82	4	1.5	780 000	1 490 000	700	900
	360	115	92	4	1.5	1 020 000	2 040 000	700	900
	400	128	114	5	1.5	1 180 000	2 190 000	600	900
	400	160	128	5	1.5	1 620 000	3 050 000	600	900
	400	209	168	5	1.5	2 220 000	4 450 000	600	900
250	380	98	87	4	1	795 000	1 460 000	600	900
260	400	104	92	5	1.5	895 000	1 670 000	600	800
	400	130	104	5	1.5	1 210 000	2 460 000	600	800
	440	144	128	5	1.5	1 540 000	2 760 000	600	800
	440	172	145	5	1.5	1 870 000	3 500 000	600	800
	440	180	144	5	1.5	2 110 000	4 150 000	600	800

Remarks For other double-row tapered roller bearings not listed above, please contact NSK.



Dynamic Equivalent Load

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$				
X	Y	X	Y			
1	Y ₃	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Dessire Number	Abutm	ent and Fi (m		ensions	Constant	£	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$r_{ m b}$ max.	e	Y_2	Y_3	Y_0	approx.
206 KBE 2801+L	227	275	3	1.5	0.51	2.0	1.3	1.3	18.1
210 KBE 31+L	231	338	3	1.5	0.46	2.2	1.5	1.4	41.7
220 KBE 3001+L	238	292	2.5	1	0.37	2.7	1.8	1.8	21.2
220 KBE 30+L	241	324	3	1.5	0.40	2.5	1.7	1.6	27.9
220 KBE 030+L	241	327	3	1.5	0.40	2.5	1.7	1.6	34.7
220 KBE 31+L	247	345	4	1.5	0.39	2.6	1.7	1.7	48.3
220 KBE 031+L	247	349	4	1.5	0.39	2.6	1.7	1.7	60.2
220 KBE 42+L	247	371	4	1.5	0.40	2.5	1.7	1.6	74.2
240 KBE 30+L	261	344	3	1.5	0.39	2.6	1.7	1.7	30.1
240 KBE 030+L	261	344	3	1.5	0.35	2.9	2.0	1.9	37.3
240 KBE 31+L	267	380	4	1.5	0.43	2.3	1.6	1.5	60.0
240 KBE 031+L	267	378	4	1.5	0.39	2.6	1.7	1.7	73.6
240 KBE 4003+L	267	384	4	1.5	0.33	3.0	2.0	2.0	96.4
250 KBE 3801+L	271	365	3	1	0.40	2.5	1.7	1.6	35.5
260 KBE 30+L	287	379	4	1.5	0.40	2.5	1.7	1.6	43.4
260 KBE 030+L	287	382	4	1.5	0.40	2.5	1.7	1.6	54.1
260 KBE 31+L	287	416	4	1.5	0.39	2.6	1.7	1.7	82.5
260 KBE 4401+L	287	414	4	1.5	0.38	2.6	1.8	1.7	98.1
260 KBE 031+L	287	416	4	1.5	0.39	2.6	1.7	1.7	104.0





SPHERICAL ROLLER BEARINGS

SPHERICAL ROLLER BEARINGS

Cylindrical Bores, Tapered Bores Bore Diameter 20 – 150mm B184

Bore Diameter 160 – 560mm B192

Bore Diameter 600 – 1400mm ····· B202



DESIGN, TYPES, AND FEATURES

Shown in the figures, types EA, C, CD, CA, which are designed for high load capacity, are available. Types EA, C and CD have pressed steel cages, and type CA has machined brass cages. The EA type bearings listed here are classified as NSKHPS bearings, which offer particularly high load-carrying capacity, high limiting speeds, and are highly functional under high-temperature operating conditions of up to 200°C.

An oil groove and holes are provided in the outer ring to supply lubricant and the bearing numbers are suffixed with E4.

To use bearings with oil grooves and holes, it is recommended to provide an oil groove in the housing bore, since the depth of the groove in the bearing is limited. The number and dimensions of the oil groove and holes are shown in Tables 1 and 2.

When bearings with a hole for a locking pin to prevent outer ring rotation are required, please inform NSK.



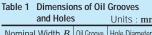
PERMISSIBLE MISALIGNMENT

Table 2 Number of Oil Holes

The permissible misalignment of spherical roller bearings varies depending on the size and load, but it is approximately 0.018 to 0.045 radian (1° to 2.5°) with normal loads.



The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

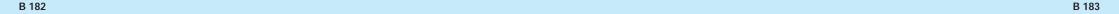


CA

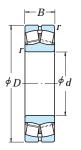
	and Holes	S	Units : mm			
	Width B	Oil Groove	Hole Diameter		er Ring Dia $oldsymbol{D}$	Number
over	incl.	Width W	$d_{\scriptscriptstyle extsf{OH}}$			of Holes
18	30	5	2.5	over	incl.	
30	40	6 7	3	_	180	4
40	50	7	4	180	250	6
50	65	8	5	250	315	6
65	80	10	6	315	400	6
80	100	12	8	400	500	
100	120	15	10	500	630	6 8
120 160	160 200	20 25	12 15	630 800	800 1000	8 8 8
200	250	30	20	1000	1250	0
250	315	35	20			
315	400	40	25	1250	1600	8
400	_	40	25	1600	2000	8

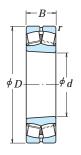
And if the load on spherical roller bearings becomes too small during operation or if the ratio of axial and radial loads is larger than the value of 'e'(listed in the bearing tables), slippage occurs between the rollers and raceways, which may result in smearing. The higher the weight of the rollers and cage, the higher this tendency becomes, especially for large spherical roller bearings.

If very small bearing loads are expected, please contact NSK for selection of an appropriate bearing.



Bore Diameter 20 – 55 mm







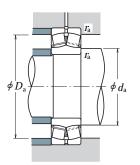
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Вс	oundary (m	Dimensi nm)	ons	(1	Basic Load N)	Ratings {k	gf}	Limiting (mir	•	Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
20	52	15	1.1	29 300	26 900	2 980	2 740	6 300	8 200	21304CDE4
25	52	18	1	37 500	37 000	3 850	3 800	7 100	9 000	22205CE4
	62	17	1.1	43 000	40 500	4 350	4 150	5 300	6 700	21305CDE4
30	62	20	1	50 000	50 000	5 100	5 100	6 000	7 500	22206CE4
	72	19	1.1	55 000	54 000	5 600	5 500	4 500	6 000	21306CDE4
35	72	23	1.1	69 000	71 000	7 050	7 200	5 300	6 700	22207CE4
	80	21	1.5	71 500	76 000	7 250	7 750	4 000	5 300	21307CDE4
40	80	23	1.1	113 000	99 500	11 500	10 100	6 700	8 500	*22208EAE4
	90	23	1.5	118 000	111 000	12 000	11 300	6 000	7 500	*21308EAE4
	90	33	1.5	170 000	153 000	17 300	15 600	5 300	6 700	*22308EAE4
45	85	23	1.1	118 000	111 000	12 000	11 300	6 000	7 500	*22209EAE4
	100	25	1.5	149 000	144 000	15 200	14 600	5 000	6 300	*21309EAE4
	100	36	1.5	207 000	195 000	21 100	19 900	4 500	5 600	*22309EAE4
50	90	23	1.1	124 000	119 000	12 600	12 100	5 600	7 100	*22210EAE4
	110	27	2	178 000	174 000	18 100	17 800	4 500	5 600	*21310EAE4
	110	40	2	246 000	234 000	25 100	23 900	4 300	5 300	*22310EAE4
55	100	25	1.5	149 000	144 000	15 200	14 600	5 300	6 700	*22211EAE4
	120	29	2	178 000	174 000	18 100	17 800	4 500	5 600	*21311EAE4
	120	43	2	292 000	292 000	29 800	29 800	3 800	4 800	*22311EAE4

Note (1) The suffix K represents bearings with tapered bores (taper 1 : 12).



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$				
X	Y	X	Y			
1	Y ₃	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

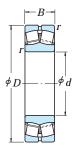
Numbers	А	butment	and Fillet Din (mm)	nensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	max.	$D_{ m a}$ max.	min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
21304CDKE4	27	28	45	42	1	0.31	3.2	2.1	2.1	0.17
22205CKE4 21305CDKE4	31 32	31 34	46 55	45 51	1	0.35 0.29	2.9 3.4	1.9 2.3	1.9	0.17 0.26
22206CKE4	36	37	56	54	1	0.33	3.1	2.1	2.0	0.27
21306CDKE4	37	40	65	59	1	0.28	3.6	2.4	2.3	0.39
22207CKE4	42	43	65	63	1	0.32	3.1	2.1	2.0	0.42
21307CDKE4	44	47	71	67	1.5	0.28	3.6	2.4	2.4	0.53
*22208EAKE4	47	49	73	70	1	0.28	3.6	2.4	2.4	0.50
*21308EAKE4	49	54	81	75	1.5	0.25	3.9	2.7	2.6	0.73
*22308EAKE4	49	52	81	77	1.5	0.35	2.8	1.9	1.9	0.98
*22209EAKE4	52	54	78	75	1	0.25	3.9	2.7	2.6	0.55
*21309EAKE4	54	65	91	89	1.5	0.23	4.3	2.9	2.8	0.96
*22309EAKE4	54	59	91	86	1.5	0.34	2.9	2.0	1.9	1.34
*22210EAKE4	57	60	83	81	1	0.24	4.3	2.9	2.8	0.61
*21310EAKE4	60	72	100	98	2	0.23	4.4	3.0	2.9	1.21
*22310EAKE4	60	64	100	93	2	0.35	2.8	1.9	1.9	1.78
*22211EAKE4	64	65	91	89	1.5	0.23	4.3	2.9	2.8	0.81
*21311EAKE4	65	72	110	98	2	0.23	4.4	3.0	2.9	1.58
*22311EAKE4	65	73	110	103	2	0.34	2.9	2.0	1.9	2.3

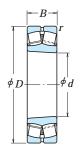
Remarks
1. The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
2. When making a selection of the recommended fit (Tolerance of Shaft) on Page A84 of the NSK Rolling Bearings catalog, in case of NSKHPS bearings, the conditions are different.

The segmentations are: Light Loads ($\leq 0.05\,C_T$): Normal Loads (0.05 to 0.10 C_T); and Heavy Loads ($> 0.10\,C_T$).

3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B358 – B359, and B366.

Bore Diameter 60 – 85 mm







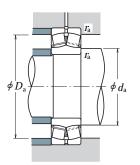
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Вс	oundary [(m	Dimension)	ons	(1	Basic Load	0	gf}	Limiting (mir		Bearing
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
60	95	26	1.1	98 500	141 000	10 000	14 400	3 600	4 500	23012CE4
	110	28	1.5	178 000	174 000	18 100	17 800	4 800	6 000	*22212EAE4
	130	31	2.1	238 000	244 000	24 200	24 900	3 800	4 800	*21312EAE4
	130	46	2.1	340 000	340 000	34 500	35 000	3 600	4 500	*22312EAE4
65	120	31	1.5	221 000	230 000	22 500	23 500	4 300	5 300	*22213EAE4
	140	33	2.1	264 000	275 000	27 000	28 000	3 600	4 500	*21313EAE4
	140	48	2.1	375 000	380 000	38 000	38 500	3 200	4 000	*22313EAE4
70	125	31	1.5	225 000	232 000	22 900	23 600	4 000	5 300	*22214EAE4
	150	35	2.1	310 000	325 000	32 000	33 500	3 200	4 000	*21314EAE4
	150	51	2.1	425 000	435 000	43 500	44 000	3 000	3 800	*22314EAE4
75	130	31	1.5	238 000	244 000	24 200	24 900	4 000	5 000	*22215EAE4
	160	37	2.1	310 000	325 000	32 000	33 500	3 200	4 000	*21315EAE4
	160	55	2.1	485 000	505 000	49 500	51 500	2 800	3 600	*22315EAE4
80	140	33	2	264 000	275 000	27 000	28 000	3 600	4 500	*22216EAE4
	170	39	2.1	355 000	375 000	36 000	38 000	3 000	3 800	*21316EAE4
	170	58	2.1	540 000	565 000	55 000	58 000	2 600	3 400	*22316EAE4
85	150	36	2	310 000	325 000	32 000	33 500	3 400	4 300	*22217EAE4
	180	41	3	360 000	395 000	37 000	40 000	3 000	4 000	*21317EAE4
	180	60	3	600 000	630 000	61 000	64 000	2 400	3 200	*22317EAE4

Note (1) The suffix K represents bearings with tapered bores (taper 1 : 12).



Dynamic Equivalent Load

$P = XF_r$	+	YF_a
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$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$				
X	Y	X	Y			
1	Y_3	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

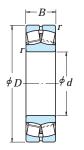
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

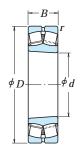
Numbers	ŀ	Abutment and Fillet Dimensions (mm)						xial Loa Factors		Mass (kg)
Tapered Bore(1)	d_{ϵ} min.	max.	$oldsymbol{D}_{i}$ max.	a min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23012CKE4	67	68	88	85	1	0.26	3.9	2.6	2.5	0.68
*22212EAKE4	69	72	101	98	1.5	0.23	4.4	3.0	2.9	1.1
*21312EAKE4	72	87	118	117	2	0.22	4.5	3.0	3.0	1.98
*22312EAKE4	72	79	118	111	2	0.34	3.0	2.0	1.9	2.89
*22213EAKE4	74	80	111	107	1.5	0.24	4.2	2.8	2.7	1.51
*21313EAKE4	77	94	128	126	2	0.22	4.6	3.1	3.0	2.45
*22313EAKE4	77	84	128	119	2	0.33	3.0	2.0	2.0	3.52
*22214EAKE4	79	84	116	111	1.5	0.23	4.3	2.9	2.8	1.58
*21314EAKE4	82	101	138	135	2	0.22	4.6	3.1	3.0	3.0
*22314EAKE4	82	91	138	129	2	0.33	3.0	2.0	2.0	4.28
*22215EAKE4	84	87	121	117	1.5	0.22	4.5	3.0	3.0	1.64
*21315EAKE4	87	101	148	134	2	0.22	4.6	3.1	3.0	3.64
*22315EAKE4	87	97	148	137	2	0.33	3.0	2.0	2.0	5.26
*22216EAKE4	90	94	130	126	2	0.22	4.6	3.1	3.0	2.01
*21316EAKE4	92	109	158	146	2	0.23	4.4	3.0	2.9	4.32
*22316EAKE4	92	103	158	145	2	0.33	3.0	2.0	2.0	6.23
*22217EAKE4	95	101	140	135	2	0.22	4.6	3.1	3.0	2.54
*21317EAKE4	99	108	166	142	2.5	0.24	4.3	2.9	2.8	5.2
*22317EAKE4	99	110	166	155	2.5	0.33	3.1	2.1	2.0	7.23

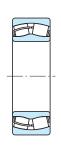
Remarks
1. The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
2. When making a selection of the recommended fit (Tolerance of Shaft) on Page A84 of the NSK Rolling Bearings catalog, in case of NSKHPS bearings, the conditions are different.

The segmentations are: Light Loads ($\leq 0.05\,C_1$): Normal Loads (0.05 to 0.10 C_1); and Heavy Loads ($> 0.10\,C_1$). 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B359 – B361, and B366.

Bore Diameter 90 – 110 mm







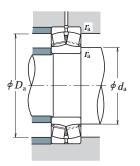
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

				ı						
Во	oundary (m	Dimensio nm)	ins	(Basic Load (N)	3	.gf}	Limiting (mir		Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
90	160	40	2	360 000	395 000	37 000	40 000	3 200	4 000	*22218EAE4
	160	52.4	2	340 000	490 000	34 500	50 000	1 800	2 400	23218CE4
	190	43	3	415 000	450 000	42 000	46 000	2 800	3 600	*21318EAE4
	190	64	3	665 000	705 000	68 000	72 000	2 400	3 000	*22318EAE4
95	170	43	2.1	415 000	450 000	42 000	46 000	3 000	3 800	*22219EAE4
	170	55.6	2.1	370 000	525 000	37 500	53 500	1 700	2 200	23219CAE4
	200	45	3	345 000	435 000	35 000	44 500	1 500	2 000	21319CE4
	200	67	3	735 000	780 000	75 000	79 500	2 200	2 800	*22319EAE4
100	150	37	1.5	212 000	335 000	21 600	34 500	2 200	2 800	23020CDE4
	150	50	1.5	276 000	470 000	28 100	48 000	1 800	2 400	24020CE4
	165	52	2	345 000	530 000	35 500	54 000	1 700	2 200	23120CE4
	165	65	2	345 000	535 000	35 000	55 000	1 700	2 200	24120CAE4
	180	46	2.1	455 000	490 000	46 500	50 000	2 800	3 600	*22220EAE4
	180	60.3	2.1	420 000	605 000	42 500	61 500	1 600	2 200	23220CE4
	215 215	47 73	3	395 000 860 000	485 000 930 000	40 500 88 000	49 500 94 500	1 400 2 000	1 900 2 600	21320CE4 *22320EAE4
110	170	45	2	293 000	465 000	29 900	47 500	2 000	2 400	23022CDE4
	170	60	2	380 000	645 000	38 500	66 000	1 600	2 200	24022CE4
	180	56	2	385 000	630 000	39 500	64 000	1 600	2 000	23122CE4
	180	69	2	460 000	750 000	47 000	76 500	1 600	2 000	24122CE4
	200	53	2.1	605 000	645 000	61 500	66 000	2 600	3 200	*22222EAE4
	200	69.8	2.1	515 000	760 000	52 500	77 500	1 500	1 900	23222CE4
	240	50	3	450 000	545 000	46 000	55 500	1 300	1 700	21322CAE4
	240	80	3	1030 000	1 120 000	105 000	115 000	1 900	2 400	*22322EAE4

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).



Dynamic Equivalent Load

$P = XF_{r} + Y$	F_{z}
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$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}\!>\!e$				
X	Y	X	Y			
1	Y_3	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

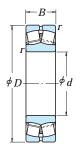
Numbers	,	Abutment	and Fillet Dir (mm)	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d	a max.	$oldsymbol{D}_{i}$ max.	a min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
*22218EAKE4	100	108	150	142	2	0.24	4.3	2.9	2.8	3.3
23218CKE4	100	105	150	138	2	0.32	3.2	2.1	2.1	4.51
*21318EAKE4	104	115	176	152	2.5	0.24	4.3	2.9	2.8	6.1
*22318EAKE4	104	115	176	163	2.5	0.33	3.1	2.1	2.0	8.56
*22219EAKE4	107	115	158	152	2	0.24	4.3	2.9	2.8	4.04
23219CAKE4	107	—	158	146	2	0.32	3.1	2.1	2.0	5.33
21319CKE4	109	127	186	172	2.5	0.22	4.6	3.1	3.0	6.92
*22319EAKE4	109	121	186	172	2.5	0.33	3.1	2.1	2.0	9.91
23020CDKE4	109	112	141	136	1.5	0.22	4.6	3.1	3.0	2.31
24020CK30E4	109	110	141	132	1.5	0.30	3.4	2.3	2.2	3.08
23120CKE4	110	113	155	144	2	0.30	3.4	2.3	2.2	4.38
24120CAK30E4 *22220EAKE4 23220CKE4	110 112 112	119 118	155 168 168	143 160 155	2 2 2	0.35 0.24 0.32	2.9 4.3 3.2	1.9 2.9 2.1	1.9 2.8 2.1	5.42 4.84 6.6
21320CKE4	114	133	201	184	2.5	0.21	4.7	3.2	3.1	8.46
*22320EAKE4	114	130	201	184	2.5	0.33	3.0	2.0	2.0	12.7
23022CDKE4	120	124	160	153	2	0.24	4.2	2.8	2.8	3.76
24022CK30E4	120	121	160	148	2	0.32	3.1	2.1	2.1	4.96
23122CKE4	120	127	170	158	2	0.28	3.5	2.4	2.3	5.7
24122CK30E4	120	123	170	154	2	0.36	2.8	1.9	1.8	6.84
*22222EAKE4	122	129	188	178	2	0.25	4.0	2.7	2.6	6.99
23222CKE4	122	130	188	170	2	0.34	3.0	2.0	1.9	9.54
21322CAKE4	124		226	206	2.5	0.22	4.6	3.1	3.0	11.2
*22322EAKE4	124	145	226	206	2.5	0.33	3.1	2.1	2.0	17.6

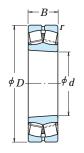
- Remarks
 1. The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
 2. When making a selection of the recommended fit (Tolerance of Shaft) on Page A84 of the NSK Rolling Bearings catalog, in case of NSKHPS bearings, the conditions are different.
 - The segmentations are: Light Loads ($\leq 0.05\,C_7$): Normal Loads (0.05 to 0.10 C_7); and Heavy Loads ($> 0.10\,C_7$).

 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B360 B361, and B366 B367.

Bore Diameter 120 - 150 mm







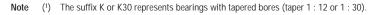


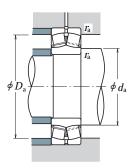
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Во		Dimensi nm)	ions		Basic Load	0	. 6	Limiting	•	Bearing	
d	D	В	$m{r}$ min.	$C_{ m r}$	(N) $C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0 m r}$	(mir Grease	Oil	Cylindrical Bore	
120	180	46	2	315 000	525 000	32 000	53 500	1 800	2 200	23024CDE4	
	180	60	2	395 000	705 000	40 500	72 000	1 500	2 000	24024CE4	
	200	62	2	465 000	720 000	47 500	73 500	1 400	1 800	23124CE4	
	200	80	2	575 000	950 000	58 500	96 500	1 400	1 800	24124CE4	
	215	58	2.1	685 000	765 000	70 000	78 000	2 400	3 000	*22224EAE4	
	215	76	2.1	630 000	970 000	64 500	99 000	1 300	1 700	23224CE4	
	260	86	3	1190 000	1 320 000	122 000	134 000	1 700	2 200	*22324EAE4	
130	200	52	2	400 000	655 000	40 500	67 000	1 700	2 000	23026CDE4	
	200	69	2	495 000	865 000	50 500	88 000	1 400	1 800	24026CE4	
	210	64	2	505 000	825 000	51 500	84 500	1 300	1 700	23126CE4	
	210	80	2	590 000	1 010 000	60 000	103 000	1 300	1 700	24126CE4	
	230	64	3	820 000	940 000	83 500	96 000	2 200	2 600	*22226EAE4	
	230	80	3	700 000	1 080 000	71 500	110 000	1 200	1 600	23226CE4	
	280	93	4	995 000	1 350 000	101 000	137 000	1 300	1 600	22326CE4	
140	210	53	2	420 000	715 000	43 000	73 000	1 600	1 900	23028CDE4	
	210	69	2	525 000	945 000	53 500	96 500	1 300	1 700	24028CE4	
	225	68	2.1	580 000	945 000	59 000	96 500	1 200	1 600	23128CE4	
	225	85	2.1	670 000	1 160 000	68 500	118 000	1 200	1 600	24128CE4	
	250	68	3	645 000	930 000	65 500	95 000	1 400	1 700	22228CDE4	
	250	88	3	835 000	1 300 000	85 000	133 000	1 100	1 500	23228CE4	
	300	102	4	1 160 000	1 590 000	118 000	162 000	1 200	1 500	22328CE4	
150	225	56	2.1	470 000	815 000	48 000	83 000	1 400	1 800	23030CDE4	
	225	75	2.1	590 000	1 090 000	60 500	111 000	1 200	1 500	24030CE4	
	250	80	2.1	725 000	1 180 000	74 000	121 000	1 100	1 400	23130CE4	
	250	100	2.1	890 000	1 530 000	91 000	156 000	1 100	1 400	24130CE4	
	270	73	3	765 000	1 120 000	78 000	114 000	1 300	1 600	22230CDE4	
	270	96	3	975 000	1 560 000	99 500	159 000	1 100	1 400	23230CE4	
	320	108	4	1 220 000	1 690 000	125 000	172 000	1 100	1 400	22330CAE4	





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}\!>\!e$				
X	Y	X	Y			
1	Y_3	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Numbers	ļ	Abutment a	and Fillet Din (mm)	nensions		Constant		kial Loa Factors	d	Mass (kg)
Tapered Bore(1)	d_{i} min.	a max.	$D_{ m a}$ max.	min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23024CDKE4	130	134	170	163	2	0.22	4.5	3.0	2.9	4.11
24024CK30E4	130	131	170	158	2	0.32	3.2	2.1	2.1	5.33
23124CKE4	130	138	190	175	2	0.29	3.5	2.4	2.3	7.85
24124CK30E4	130	136	190	171	2	0.37	2.7	1.8	1.8	10
*22224EAKE4	132	142	203	190	2	0.25	3.9	2.7	2.6	8.8
23224CKE4	132	140	203	182	2	0.34	2.9	2.0	1.9	12.1
*22324EAKE4	134	157	246	222	2.5	0.32	3.1	2.1	2.0	22.2
23026CDKE4	140	147	190	180	2	0.23	4.3	2.9	2.8	5.98
24026CK30E4	140	143	190	175	2	0.31	3.2	2.2	2.1	7.84
23126CKE4	140	149	200	184	2	0.28	3.6	2.4	2.4	8.69
24126CK30E4	140	146	200	180	2	0.35	2.9	1.9	1.9	10.7
*22226EAKE4	144	152	216	204	2.5	0.26	3.8	2.6	2.5	11
23226CKE4	144	150	216	196	2.5	0.34	2.9	2.0	1.9	14.3
22326CKE4	148	166	262	236	3	0.34	2.9	2.0	1.9	28.1
23028CDKE4	150	157	200	190	2	0.22	4.5	3.0	2.9	6.49
24028CK30E4	150	154	200	186	2	0.29	3.4	2.3	2.2	8.37
23128CKE4	152	158	213	198	2	0.28	3.6	2.4	2.3	10.5
24128CK30E4	152	156	213	193	2	0.35	2.9	1.9	1.9	13
22228CDKE4	154	167	236	219	2.5	0.25	4.0	2.7	2.6	14.5
23228CKE4	154	163	236	213	2.5	0.35	2.9	1.9	1.9	18.8
22328CKE4	158	177	282	253	3	0.35	2.9	1.9	1.9	35.4
23030CDKE4	162	168	213	203	2	0.22	4.6	3.1	3.0	7.9
24030CK30E4	162	165	213	198	2	0.30	3.4	2.3	2.2	10.5
23130CKE4	162	174	238	218	2	0.30	3.4	2.3	2.2	15.8
24130CK30E4	162	169	238	212	2	0.38	2.6	1.8	1.7	19.8
22230CDKE4	164	179	256	236	2.5	0.26	3.9	2.6	2.5	18.4
23230CKE4	164	176	256	230	2.5	0.35	2.9	1.9	1.9	24.2
22330CAKE4	168	—	302	270	3	0.35	2.9	1.9	1.9	41.5

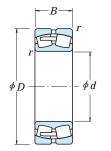
Remarks
1. The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
2. When making a selection of the recommended fit (Tolerance of Shaft) on Page A84 of the NSK Rolling Bearings catalog, in case of NSKHPS bearings, the conditions are different.

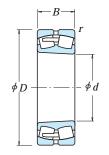
The segmentations are: Light Loads ($\leq 0.05\,C_7$): Normal Loads (0.05 to 0.10 C_7); and Heavy Loads ($> 0.10\,C_7$).

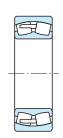
3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B361 – B362, and B367 – B368.

NSK

Bore Diameter 160 – 190 mm







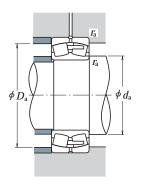
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Во		Dimensi nm)	ons	(1	Basic Load N)	3	gf}	Limiting (mir	•	Bearing	
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore	
160	220	45	2	360 000	675 000	37 000	69 000	1 400	1 800	23932CAE4	
	240	60	2.1	540 000	955 000	55 000	97 500	1 300	1 700	23032CDE4	
	240	80	2.1	680 000	1 260 000	69 000	128 000	1 100	1 400	24032CE4	
	270	86	2.1	855 000	1 400 000	87 000	143 000	1 000	1 300	23132CE4	
	270	109	2.1	1 040 000	1 760 000	106 000	179 000	1 000	1 300	24132CE4	
	290	80	3	910 000	1 320 000	93 000	135 000	1 200	1 500	22232CDE4	
	290	104	3	1 100 000	1 770 000	112 000	180 000	1 000	1 300	23232CE4	
	340	114	4	1 360 000	1 900 000	139 000	193 000	1 100	1 300	22332CAE4	
170	230	45	2	350 000	660 000	35 500	67 500	1 400	1 800	23934BCAE4	
	260	67	2.1	640 000	1 090 000	65 000	112 000	1 200	1 600	23034CDE4	
	260	90	2.1	825 000	1 520 000	84 000	155 000	1 000	1 300	24034CE4	
	280	88	2.1	940 000	1 570 000	96 000	160 000	1 000	1 300	23134CE4	
	280	109	2.1	1 080 000	1 860 000	110 000	190 000	1 000	1 300	24134CE4	
	310	86	4	990 000	1 500 000	101 000	153 000	1 100	1 400	22234CDE4	
	310	110	4	1 200 000	1 910 000	122 000	195 000	900	1 200	23234CE4	
	360	120	4	1 580 000	2 110 000	161 000	215 000	1 000	1 200	22334CAE4	
180	250	52	2	470 000	890 000	48 000	90 500	1 200	1 600	23936CAE4	
	280	74	2.1	750 000	1 270 000	76 000	129 000	1 200	1 400	23036CDE4	
	280	100	2.1	965 000	1 750 000	98 500	178 000	950	1 200	24036CE4	
	300	96	3	1 050 000	1 760 000	108 000	180 000	900	1 200	23136CE4	
	300	118	3	1 190 000	2 040 000	121 000	208 000	900	1 200	24136CE4	
	320	86	4	1 020 000	1 540 000	104 000	157 000	1 100	1 300	22236CDE4	
	320	112	4	1 300 000	2 110 000	133 000	215 000	850	1 100	23236CE4	
	380	126	4	1 740 000	2 340 000	177 000	238 000	950	1 200	22336CAE4	
190	260	52	2	460 000	875 000	47 000	89 500	1 200	1 500	23938CAE4	
	290	75	2.1	775 000	1 350 000	79 000	138 000	1 100	1 400	23038CAE4	
	290	100	2.1	975 000	1 840 000	99 500	188 000	900	1 200	24038CE4	
	320	104	3	1 190 000	2 020 000	121 000	206 000	850	1 100	23138CE4	
	320	128	3	1 370 000	2 330 000	140 000	238 000	850	1 100	24138CE4	
	340	92	4	1 140 000	1 730 000	116 000	176 000	1 000	1 200	22238CAE4	
	340	120	4	1 440 000	2 350 000	147 000	240 000	800	1 100	23238CE4	
	400	132	5	1 890 000	2 590 000	193 000	264 000	900	1 100	22338CAE4	

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).



Dynamic Equivalent Load $P = XF_{\rm r} + YF_{\rm a}$

	1 a					
$F_{\rm a}/I$	$F_{\rm r} \leq e$	$F_{\rm a}/F_{\rm r} > e$				
X	Y	X	Y			
1	Y ₃	0.67	Y ₂			

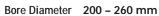
Static Equivalent Load

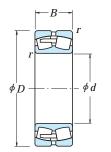
 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

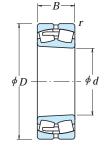
The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

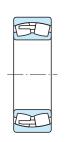
Numbers	,	Abutment	and Fillet Dii (mm)	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d min.	a max.	$oldsymbol{D}$ max.	a min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23932CAKE4	170		210	203	2	0.18	5.6	3.8	3.7	4.97
23032CDKE4	172	179	228	216	2	0.22	4.5	3.0	2.9	9.66
24032CK30E4	172	177	228	212	2	0.30	3.4	2.3	2.2	12.7
23132CKE4	172	185	258	234	2	0.30	3.4	2.3	2.2	20.3
24132CK30E4	172	179	258	229	2	0.39	2.6	1.7	1.7	25.4
22232CDKE4	174	190	276	255	2.5	0.26	3.8	2.6	2.5	23.1
23232CKE4	174	189	276	245	2.5	0.34	2.9	2.0	1.9	30.5
22332CAKE4	178	—	322	287	3	0.35	2.9	1.9	1.9	49.3
23934BCAKE4	180	—	220	213	2	0.17	5.8	3.9	3.8	5.38
23034CDKE4	182	191	248	233	2	0.23	4.3	2.9	2.8	13
24034CK30E4	182	188	248	228	2	0.31	3.2	2.2	2.1	17.3
23134CKE4	182	194	268	245	2	0.29	3.5	2.3	2.3	21.8
24134CK30E4	182	190	268	239	2	0.37	2.7	1.8	1.8	26.6
22234CDKE4	188	206	292	270	3	0.26	3.8	2.6	2.5	28.8
23234CKE4 22334CAKE4	188 188	201	292 342	261 304	3	0.34 0.35	2.9 2.9	2.0 1.9	1.9 1.9	36.4 57.9
23936CAKE4 23036CDKE4 24036CK30E4	190 192 192	202 200	240 268 268	230 249 245	2 2 2	0.18 0.24 0.32	5.5 4.2 3.1	3.7 2.8 2.1	3.6 2.8 2.0	7.64 17.1 22.7
23136CKE4	194	206	286	260	2.5	0.30	3.4	2.3	2.2	27.5
24136CK30E4	194	202	286	255	2.5	0.37	2.7	1.8	1.8	33.1
22236CDKE4	198	212	302	278	3	0.26	3.9	2.6	2.6	30.2
23236CKE4	198	211	302	274	3	0.33	3.0	2.0	2.0	38.9
22336CAKE4	198	—	362	322	3	0.34	2.9	2.0	1.9	67
23938CAKE4 23038CAKE4 24038CK30E4	200 202 202	 210	250 278 278	240 261 253	2 2 2	0.18 0.24 0.31	5.7 4.2 3.2	3.8 2.8 2.2	3.7 2.8 2.1	8.03 17.6 24
23138CKE4	204	219	306	276	2.5	0.31	3.3	2.2	2.2	34.5
24138CK30E4	204	211	306	269	2.5	0.40	2.5	1.7	1.6	41.5
22238CAKE4	208	—	322	296	3	0.26	3.8	2.6	2.5	35.5
23238CKE4	208	222	322	288	3	0.35	2.9	1.9	1.9	47.6
22338CAKE4	212	—	378	338	4	0.34	2.9	2.0	1.9	77.6

Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages B362 and B368.









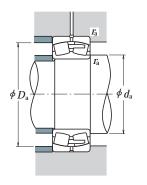
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Вс		Dimensi nm)	ions	(1	Basic Load	3	gf}	Limiting (mir		Bearing	
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore	
200	280	60	2.1	570 000	1 060 000	58 000	108 000	1 100	1 400	23940CAE4	
	310	82	2.1	940 000	1 700 000	96 000	174 000	1 000	1 300	23040CAE4	
	310	109	2.1	1 140 000	2 120 000	116 000	216 000	850	1 100	24040CE4	
	340	112	3	1 360 000	2 330 000	139 000	238 000	800	1 000	23140CE4	
	340	140	3	1 570 000	2 670 000	160 000	272 000	800	1 000	24140CE4	
	360	98	4	1 300 000	2 010 000	133 000	204 000	950	1 200	22240CAE4	
	360	128	4	1 660 000	2 750 000	169 000	281 000	750	1 000	23240CE4	
	420	138	5	2 000 000	2 990 000	204 000	305 000	850	1 000	22340CAE4	
220	300	60	2.1	625 000	1 240 000	64 000	126 000	1 000	1 300	23944CAE4	
	340	90	3	1 090 000	1 980 000	111 000	202 000	950	1 200	23044CAE4	
	340	118	3	1 360 000	2 600 000	138 000	265 000	750	1 000	24044CE4	
	370	120	4	1 570 000	2 710 000	160 000	276 000	710	950	23144CE4	
	370	150	4	1 800 000	3 200 000	183 000	325 000	710	950	24144CE4	
	400	108	4	1 570 000	2 430 000	160 000	247 000	850	1 000	22244CAE4	
	400	144	4	2 020 000	3 400 000	206 000	350 000	670	900	23244CE4	
	460	145	5	2 350 000	3 400 000	240 000	345 000	750	950	22344CAE4	
240	320	60	2.1	635 000	1 300 000	65 000	133 000	950	1 200	23948CAE4	
	360	92	3	1 160 000	2 140 000	118 000	218 000	850	1 100	23048CAE4	
	360	118	3	1 390 000	2 730 000	141 000	278 000	710	950	24048CE4	
	400	128	4	1 790 000	3 100 000	182 000	320 000	670	850	23148CE4	
	400	160	4	2 130 000	3 800 000	217 000	385 000	670	850	24148CE4	
	440	120	4	1 870 000	2 890 000	191 000	294 000	750	950	22248CAE4	
	440	160	4	2 440 000	4 050 000	249 000	415 000	630	800	23248CAE4	
	500	155	5	2 600 000	3 800 000	265 000	385 000	670	850	22348CAE4	
260	360	75	2.1	930 000	1 870 000	95 000	191 000	850	1 000	23952CAE4	
	400	104	4	1 430 000	2 580 000	145 000	263 000	800	950	23052CAE4	
	400	140	4	1 810 000	3 500 000	185 000	360 000	630	850	24052CAE4	
	440	144	4	2 160 000	3 750 000	221 000	385 000	600	800	23152CAE4	
	440	180	4	2 560 000	4 700 000	261 000	480 000	600	800	24152CAE4	
	480	130	5	2 180 000	3 400 000	222 000	345 000	670	850	22252CAE4	
	480	174	5	2 740 000	4 550 000	279 000	460 000	560	750	23252CAE4	
	540	165	6	3 100 000	4 600 000	320 000	470 000	630	800	22352CAE4	





Dynamic Equivalent Load $P = XF_r + YF_a$

	r · a										
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}\!>\!e$									
X	Y	X	Y								
1	Y_3	0.67	Y ₂								

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

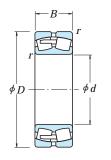
Numbers	,	Abutment and Fillet Dimensions (mm)				Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d min.	a max.	$oldsymbol{D}$ max.	a min.	$m{r_{ m a}}$ max.	e	Y_2	Y_3	Y_0	approx.
23940CAKE4	212	_	268	258	2	0.20	5.1	3.4	3.3	11
23040CAKE4	212	_	298	279	2	0.25	4.0	2.7	2.6	22.6
24040CK30E4	212	223	298	271	2	0.32	3.1	2.1	2.0	30.4
23140CKE4	214	232	326	293	2.5	0.31	3.2	2.2	2.1	42.7
24140CK30E4	214	226	326	290	2.5	0.39	2.6	1.8	1.7	51.3
22240CAKE4	218	—	342	315	3	0.26	3.8	2.6	2.5	42.6
23240CKE4	218	237	342	307	3	0.34	2.9	2.0	1.9	57.1
22340CAKE4	222		398	352	4	0.34	2.9	2.0	1.9	92.6
23944CAKE4 23044CAKE4 24044CK30E4	232 234 234	 244	288 326 326	278 302 296	2 2.5 2.5	0.18 0.24 0.31	5.7 4.1 3.2	3.8 2.8 2.1	3.7 2.7 2.1	12.2 29.7 40.5
23144CKE4	238	254	352	320	3	0.30	3.3	2.2	2.2	53
24144CK30E4	238	248	352	313	3	0.39	2.6	1.7	1.7	66.7
22244CAKE4	238	—	382	348	3	0.27	3.7	2.5	2.4	59
23244CKE4	238	260	382	337	3	0.35	2.9	1.9	1.9	80.4
22344CAKE4	242	—	438	391	4	0.33	3.0	2.0	2.0	116
23948CAKE4 23048CAKE4 24048CK30E4	252 254 254	 265	308 346 346	298 324 317	2 2.5 2.5	0.17 0.24 0.29	6.0 4.2 3.4	4.0 2.8 2.3	3.9 2.7 2.2	13.3 32.6 43.4
23148CKE4	258	275	382	347	3	0.30	3.3	2.2	2.2	66.9
24148CK30E4	258	268	382	341	3	0.38	2.7	1.8	1.8	79.5
22248CAKE4	258	—	422	383	3	0.27	3.7	2.5	2.4	80.2
23248CAKE4	258	_	422	372	3	0.37	2.7	1.8	1.8	106
22348CAKE4	262		478	423	4	0.32	3.2	2.1	2.1	147
23952CAKE4	272		348	333	2	0.19	5.4	3.6	3.5	23
23052CAKE4	278		382	356	3	0.25	4.1	2.7	2.7	46.6
24052CAK30E4	278		382	348	3	0.32	3.1	2.1	2.1	62.6
23152CAKE4	278	_	422	380	3	0.32	3.2	2.1	2.1	88.2
24152CAK30E4	278	_	422	371	3	0.39	2.6	1.7	1.7	109
22252CAKE4	282	_	458	418	4	0.27	3.7	2.5	2.5	104
23252CAKE4	282	_	458	406	4	0.37	2.7	1.8	1.8	137
22352CAKE4	288		512	462	5	0.32	3.2	2.1	2.1	180

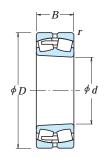
Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages **B363** and **B369**.

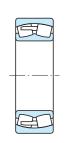
B 195 B 194

Bore Diameter 280 - 340 mm









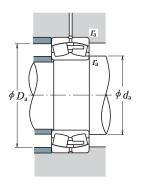
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

В		Dimens	ions	(Basic Load	9	gf}	Limiting S		Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
280	380	75	2.1	925 000	1 950 000	94 500	199 000	800	950	23956CAE4
	420	106	4	1 540 000	2 950 000	157 000	300 000	710	900	23056CAE4
	420	140	4	1 880 000	3 800 000	191 000	385 000	600	800	24056CAE4
	460	146	5	2 230 000	4 000 000	228 000	410 000	560	750	23156CAE4
	460	180	5	2 640 000	5 000 000	269 000	505 000	560	750	24156CAE4
	500	130	5	2 280 000	3 650 000	233 000	370 000	630	800	22256CAE4
	500	176	5	2 880 000	4 900 000	294 000	500 000	530	670	23256CAE4
	580	175	6	3 500 000	5 150 000	355 000	525 000	560	710	22356CAE4
300	420	90	3	1 230 000	2 490 000	125 000	254 000	710	900	23960CAE4
	460	118	4	1 920 000	3 700 000	196 000	375 000	670	850	23060CAE4
	460	160	4	2 310 000	4 600 000	235 000	470 000	530	710	24060CAE4
	500	160	5	2 670 000	4 800 000	273 000	490 000	500	670	23160CAE4
	500	200	5	3 100 000	5 800 000	315 000	595 000	500	670	24160CAE4
	540	140	5	2 610 000	4 250 000	266 000	430 000	600	750	22260CAE4
	540	192	5	3 400 000	5 900 000	350 000	600 000	480	630	23260CAE4
320	440	90	3	1 300 000	2 750 000	132 000	281 000	670	850	23964CAE4
	480	121	4	1 960 000	3 850 000	200 000	395 000	630	800	23064CAE4
	480	160	4	2 440 000	5 050 000	249 000	515 000	500	670	24064CAE4
	540	176	5	3 050 000	5 500 000	315 000	560 000	480	600	23164CAE4
	540	218	5	3 550 000	6 650 000	360 000	675 000	480	600	24164CAE4
	580	150	5	2 990 000	4 850 000	305 000	495 000	530	670	22264CAE4
	580	208	5	3 900 000	6 900 000	395 000	700 000	450	600	23264CAE4
340	460	90	3	1 330 000	2 840 000	136 000	289 000	630	800	23968CAE4
	520	133	5	2 280 000	4 400 000	232 000	445 000	560	710	23068CAE4
	520	180	5	2 920 000	6 050 000	298 000	615 000	480	600	24068CAE4
	580	190	5	3 600 000	6 600 000	370 000	670 000	430	560	23168CAE4
	580	243	5	4 250 000	7 900 000	430 000	810 000	430	560	24168CAE4
	620	224	6	4 400 000	7 800 000	450 000	795 000	400	530	23268CAE4

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).



Dynamic Equivalent Load $P = XF_r + YF_s$

$F = A F_r + I F_a$										
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$								
X	Y	X	Y							
1	Y ₃	0.67	Y ₂							

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

Numbers	Abutme	ent and Fille (mm		ons	Constant	А	xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	L max.) a min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23956CAKE4	292	368	351	2	0.18	5.7	3.9	3.8	24.5
23056CAKE4	298	402	377	3	0.24	4.2	2.8	2.7	50.5
24056CAK30E4	298	402	369	3	0.31	3.3	2.2	2.2	66.4
23156CAKE4	302	438	400	4	0.30	3.3	2.2	2.2	94.3
24156CAK30E4	302	438	392	4	0.37	2.7	1.8	1.8	115
22256CAKE4	302	478	439	4	0.25	4.0	2.7	2.6	110
23256CAKE4	302	478	425	4	0.35	2.9	1.9	1.9	147
22356CAKE4	308	552	496	5	0.31	3.2	2.1	2.1	221
23960CAKE4	314	406	386	2.5	0.19	5.2	3.5	3.4	38.2
23060CAKE4	318	442	413	3	0.24	4.2	2.8	2.7	70.5
24060CAK30E4	318	442	400	3	0.32	3.1	2.1	2.0	93.6
23160CAKE4	322	478	433	4 4	0.31	3.3	2.2	2.2	125
24160CAK30E4	322	478	423		0.38	2.6	1.8	1.7	152
22260CAKE4	322	518	473	4 4	0.25	4.0	2.7	2.6	139
23260CAKE4	322	518	458		0.35	2.9	1.9	1.9	189
23964CAKE4	334	426	406	2.5	0.18	5.5	3.7	3.6	40.6
23064CAKE4	338	462	432	3	0.24	4.2	2.8	2.8	75.6
24064CAK30E4	338	462	422	3	0.31	3.3	2.2	2.2	99.7
23164CAKE4	342	518	466	4	0.31	3.2	2.1	2.1	162
24164CAK30E4	342	518	456		0.39	2.6	1.7	1.7	196
22264CAKE4	342	558	508	4 4	0.26	3.9	2.6	2.6	174
23264CAKE4	342	558	488		0.36	2.8	1.9	1.8	239
23968CAKE4	354	446	427	2.5	0.18	5.7	3.8	3.7	42.4
23068CAKE4	362	498	465	4	0.24	4.2	2.8	2.8	101
24068CAK30E4	362	498	454	4	0.32	3.2	2.1	2.1	135
23168CAKE4	362	558	499	4	0.31	3.2	2.1	2.1	206
24168CAK30E4	362	558	489	4	0.40	2.5	1.7	1.7	257
23268CAKE4	368	592	521	5	0.36	2.8	1.9	1.8	295

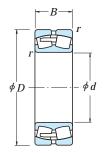
Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages B363 – B364, and B369 – B370.

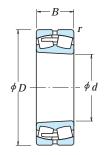
B 196 B 197

Bore Diameter 360 – 440 mm











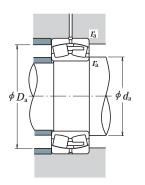
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Во		Dimensi nm)	ons		Basic Load	0	-£)	Limiting S		Bearing
d	D	В	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	gf} $C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
360	480	90	3	1 390 000	3 050 000	142 000	315 000	600	750	23972CAE4
	540	134	5	2 390 000	4 700 000	244 000	480 000	530	670	23072CAE4
	540	180	5	2 930 000	6 100 000	299 000	625 000	450	600	24072CAE4
	600	192	5	3 800 000	7 100 000	390 000	725 000	400	530	23172CAE4
	600	243	5	4 200 000	8 000 000	430 000	815 000	400	530	24172CAE4
	650	232	6	4 800 000	8 550 000	490 000	870 000	380	500	23272CAE4
380	520	106	4	1 870 000	4 100 000	190 000	420 000	530	670	23976CAE4
	560	135	5	2 500 000	5 100 000	255 000	520 000	530	630	23076CAE4
	560	180	5	3 050 000	6 600 000	315 000	670 000	430	560	24076CAE4
	620	194	5	4 000 000	7 600 000	405 000	775 000	400	500	23176CAE4
	620	243	5	4 350 000	8 450 000	440 000	865 000	400	500	24176CAE4
	680	240	6	5 150 000	9 200 000	525 000	940 000	360	480	23276CAE4
400	540	106	4	1 890 000	4 250 000	193 000	435 000	530	630	23980CAE4
	600	148	5	2 970 000	5 900 000	305 000	605 000	480	600	23080CAE4
	600	200	5	3 600 000	7 600 000	370 000	775 000	400	500	24080CAE4
	650 650 720	200 250 256	6 6 6		7 900 000 10 100 000 10 400 000	420 000 505 000 590 000		380 380 340	480 480 450	23180CAE4 24180CAE4 23280CAE4
420	560	106	4	1 870 000	4 250 000	191 000	430 000	500	600	23984CAE4
	620	150	5	2 910 000	5 850 000	297 000	595 000	450	560	23084CAE4
	620	200	5	3 750 000	8 100 000	380 000	825 000	380	480	24084CAE4
	700 700 760	224 280 272	6 6 7.5		9 400 000 12 000 000 11 700 000	510 000 610 000 660 000		340 340 320	450 450 430	23184CAE4 24184CAE4 23284CAE4
440	600	118	4	2 190 000	4 800 000	223 000	490 000	450	560	23988CAE4
	650	157	6	3 150 000	6 350 000	320 000	645 000	430	530	23088CAE4
	650	212	6	4 150 000	9 100 000	425 000	930 000	360	450	24088CAE4
	720 720 790	226 280 280	6 6 7.5	6 000 000	10 300 000 12 100 000 12 800 000	540 000 610 000 705 000	1 230 000	320 320 300	430 430 400	23188CAE4 24188CAE4 23288CAE4

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).



Dynamic Equivalent Load $P = XF_r + YF_a$

	1 4					
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$				
X	Y	X	Y			
1	Y ₃	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

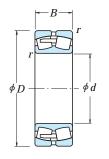
The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

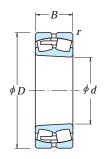
Numbers	Abutme	Abutment and Fillet Dimensions (mm)					xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	$oldsymbol{L}$ max.) a min.	$oldsymbol{arGamma}_{a}$ max.	e	Y_2	Y_3	Y_0	approx.
23972CAKE4	374	466	447	2.5	0.17	6.0	4.1	4.0	44.7
23072CAKE4	382	518	485	4	0.24	4.2	2.8	2.8	106
24072CAK30E4	382	518	476	4	0.32	3.2	2.1	2.1	139
23172CAKE4	382	578	520	4	0.31	3.2	2.2	2.1	217
24172CAK30E4	382	578	507	4	0.40	2.5	1.7	1.7	264
23272CAKE4	388	622	549	5	0.36	2.8	1.9	1.8	342
23976CAKE4	398	502	482	3	0.18	5.5	3.7	3.6	65.4
23076CAKE4	402	538	506	4	0.22	4.5	3.0	3.0	113
24076CAK30E4	402	538	496	4	0.29	3.4	2.3	2.3	148
23176CAKE4	402	598	540	4	0.30	3.3	2.2	2.2	229
24176CAK30E4	402	598	529	4	0.38	2.6	1.8	1.7	275
23276CAKE4	408	652	578	5	0.35	2.9	1.9	1.9	372
23980CAKE4	418	522	501	3	0.18	5.7	3.9	3.8	69.1
23080CAKE4	422	578	540	4	0.23	4.4	3.0	2.9	146
24080CAK30E4	422	578	527	4	0.31	3.3	2.2	2.2	193
23180CAKE4	428	622	569	5	0.29	3.4	2.3	2.3	257
24180CAK30E4	428	622	551	5	0.37	2.7	1.8	1.8	316
23280CAKE4	428	692	610	5	0.36	2.8	1.9	1.9	449
23984CAKE4	438	542	521	3	0.17	6.0	4.0	3.9	71.6
23084CAKE4	442	598	562	4	0.23	4.3	2.9	2.8	151
24084CAK30E4	442	598	549	4	0.31	3.2	2.2	2.1	199
23184CAKE4	448	672	607	5	0.31	3.3	2.2	2.2	341
24184CAK30E4	448	672	598	5	0.38	2.6	1.8	1.7	421
23284CAKE4	456	724	644	6	0.35	2.9	1.9	1.9	534
23988CAKE4	458	582	555	3	0.18	5.7	3.9	3.8	96.3
23088CAKE4	468	622	587	5	0.23	4.3	2.9	2.8	173
24088CAK30E4	468	622	576	5	0.31	3.2	2.1	2.1	237
23188CAKE4	468	692	627	5	0.3	3.3	2.2	2.2	360
24188CAK30E4	468	692	617	5	0.37	2.7	1.8	1.8	433
23288CAKE4	476	754	669	6	0.35	2.9	1.9	1.9	594

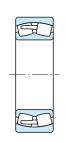
Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages B364, and B370 – B371.

Bore Diameter 460 - 560 mm









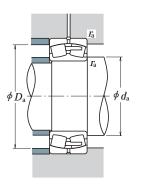
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

E	Boundary (r	Dimens nm)	ions	(Basic Load	0	(gf)	Limiting S (min		Bearing	
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore	
460	620	118	4	2 220 000	4 950 000	227 000	505 000	430	530	23992CAE4	
	680	163	6	3 450 000	7 100 000	355 000	725 000	400	500	23092CAE4	
	680	218	6	4 500 000	9 950 000	460 000	1 010 000	340	430	24092CAE4	
	760	240	7.5	5 700 000	10 900 000	580 000	1 110 000	300	400	23192CAE4	
	760	300	7.5	6 300 000	12 400 000	640 000	1 270 000	300	400	24192CAE4	
	830	296	7.5	7 350 000	13 700 000	750 000	1 400 000	280	380	23292CAE4	
480	650	128	5	2 580 000	5 850 000	263 000	595 000	400	500	23996CAE4	
	700	165	6	3 800 000	7 950 000	385 000	810 000	400	480	23096CAE4	
	700	218	6	4 600 000	10 200 000	470 000	1 040 000	320	430	24096CAE4	
	790	248	7.5	6 050 000	11 700 000	620 000	1 200 000	300	380	23196CAE4	
	790	308	7.5	7 150 000	14 600 000	730 000	1 490 000	300	380	24196CAE4	
	870	310	7.5	7 850 000	14 400 000	805 000	1 470 000	260	360	23296CAE4	
500	670	128	5	2 460 000	5 550 000	250 000	565 000	400	500	239/500CAE4	
	720	167	6	3 750 000	8 100 000	385 000	825 000	380	480	230/500CAE4	
	720	218	6	4 450 000	9 900 000	450 000	1 010 000	300	400	240/500CAE4	
	830	264	7.5	6 850 000	13 400 000	700 000	1 360 000	280	360	231/500CAE4	
	830	325	7.5	8 000 000	16 000 000	815 000	1 630 000	280	360	241/500CAE4	
	920	336	7.5	9 000 000	16 600 000	915 000	1 690 000	260	320	232/500CAE4	
530	710	136	5	2 930 000	6 800 000	299 000	695 000	360	450	239/530CAE4	
	780	185	6	4 400 000	9 200 000	450 000	940 000	340	430	230/530CAE4	
	780	250	6	5 400 000	11 800 000	550 000	1 210 000	280	360	240/530CAE4	
	870	272	7.5	7 150 000	14 100 000	730 000	1 440 000	260	340	231/530CAE4	
	870	335	7.5	8 500 000	17 500 000	870 000	1 790 000	260	340	241/530CAE4	
	980	355	9.5	10 100 000	18 800 000	1 030 000	1 920 000	240	300	232/530CAE4	
560	750	140	5	3 100 000	7 250 000	320 000	740 000	340	430	239/560CAE4	
	820	195	6	5 000 000	10 700 000	510 000	1 090 000	320	400	230/560CAE4	
	820	258	6	5 950 000	13 300 000	605 000	1 360 000	260	340	240/560CAE4	
	920	280	7.5	7 850 000	15 500 000	800 000	1 580 000	240	320	231/560CAE4	
	920	355	7.5	9 400 000	19 600 000	960 000	2 000 000	240	320	241/560CAE4	
	1 030	365	9.5	10 900 000	20 500 000	1 110 000	2 090 000	220	280	232/560CAE4	





Dynamic Equivalent Load $P = XF_{r} + YF_{a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}>e$				
X	X Y		Y			
1	Y ₃	0.67	Y_2			

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

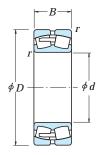
The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

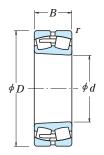
Numbers	Abutme	ent and Fille (mm		ons	Constant	А	xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	max.) a min.	$r_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23992CAKE4	478	602	575	3	0.17	5.9	4.0	3.9	100
23092CAKE4	488	652	615	5	0.22	4.6	3.1	3.0	201
24092CAK30E4	488	652	604	5	0.29	3.4	2.3	2.3	266
23192CAKE4	496	724	661	6	0.31	3.3	2.2	2.2	423
24192CAK30E4	496	724	646	6	0.39	2.6	1.7	1.7	512
23292CAKE4	496	794	702	6	0.36	2.8	1.9	1.8	691
23996CAKE4	502	628	602	4	0.18	5.7	3.8	3.7	121
23096CAKE4	508	672	633	5	0.22	4.6	3.1	3.0	211
24096CAK30E4	508	672	625	5	0.30	3.4	2.3	2.2	270
23196CAKE4	516	754	688	6	0.31	3.3	2.2	2.2	475
24196CAK30E4	516	754	670	6	0.39	2.6	1.7	1.7	567
23296CAKE4	516	834	733	6	0.36	2.8	1.9	1.8	795
239/500CAKE4	522	648	622	4	0.17	6.0	4.0	3.9	124
230/500CAKE4	528	692	655	5	0.21	4.8	3.2	3.1	220
240/500CAK30E4	528	692	643	5	0.30	3.4	2.3	2.2	276
231/500CAKE4	536	794	720	6	0.31	3.2	2.2	2.1	567
241/500CAK30E4	536	794	703	6	0.39	2.6	1.7	1.7	666
232/500CAKE4	536	884	773	6	0.38	2.7	1.8	1.8	969
239/530CAKE4	552	688	659	4	0.17	6.0	4.0	3.9	149
230/530CAKE4	558	752	706	5	0.22	4.6	3.1	3.0	298
240/530CAK30E4	558	752	690	5	0.31	3.3	2.2	2.2	390
231/530CAKE4	566	834	758	6	0.30	3.3	2.2	2.2	628
241/530CAK30E4	566	834	740	6	0.38	2.6	1.8	1.7	773
232/530CAKE4	574	936	824	8	0.38	2.7	1.8	1.7	1 170
239/560CAKE4	582	728	697	4	0.16	6.1	4.1	4.0	172
230/560CAKE4	588	792	742	5	0.22	4.5	3.0	2.9	344
240/560CAK30E4	588	792	729	5	0.30	3.3	2.2	2.2	440
231/560CAKE4	596	884	804	6	0.30	3.4	2.3	2.2	727
241/560CAK30E4	596	884	782	6	0.39	2.6	1.8	1.7	886
232/560CAKE4	604	986	870	8	0.36	2.8	1.9	1.8	1 320

Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages B365 and B371.

NSK

Bore Diameter 600 – 800 mm



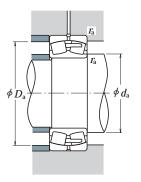


Cylindrical Bore

Tapered Bore

Е	oundary (r	Dimens	ions	(1)	Basic Load	0	gf}	Limiting S	•	Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
600	800	150	5	3 450 000	8 100 000	350 000	830 000	320	400	239/600CAE4
	870	200	6	5 450 000	12 200 000	555 000	1 240 000	300	360	230/600CAE4
	870	272	6	6 600 000	15 100 000	675 000	1 540 000	240	320	240/600CAE4
	980	300	7.5	8 750 000	17 500 000	895 000	1 790 000	220	280	231/600CAE4
	980	375	7.5	10 400 000	21 900 000	1 060 000	2 230 000	220	280	241/600CAE4
	1 090	388	9.5	12 700 000	24 900 000	1 300 000	2 540 000	200	260	232/600CAE4
630	850	165	6	4 000 000	9 350 000	405 000	950 000	300	360	239/630CAE4
	920	212	7.5	5 900 000	12 700 000	600 000	1 300 000	280	340	230/630CAE4
	920	290	7.5	7 550 000	17 700 000	770 000	1 810 000	220	300	240/630CAE4
	1 030	315	7.5	9 600 000	19 400 000	980 000	1 970 000	200	260	231/630CAE4
	1 030	400	7.5	11 300 000	23 900 000	1 160 000	2 440 000	200	260	241/630CAE4
	1 150	412	12	13 400 000	25 600 000	1 370 000	2 610 000	180	240	232/630CAE4
670	900	170	6	4 350 000	10 300 000	445 000	1 050 000	260	340	239/670CAE4
	980	230	7.5	6 850 000	15 000 000	700 000	1 530 000	240	320	230/670CAE4
	980	308	7.5	8 450 000	19 500 000	860 000	1 990 000	200	260	240/670CAE4
	1 090	336	7.5	10 600 000	21 600 000	1 080 000	2 200 000	190	240	231/670CAE4
	1 090	412	7.5	12 400 000	26 500 000	1 270 000	2 700 000	190	240	241/670CAE4
	1 220	438	12	14 900 000	28 700 000	1 520 000	2 920 000	170	220	232/670CAE4
710	950	180	6	4 800 000	11 700 000	490 000	1 200 000	240	300	239/710CAE4
	1 030	236	7.5	7 100 000	15 800 000	725 000	1 610 000	240	280	230/710CAE4
	1 030	315	7.5	8 850 000	20 700 000	905 000	2 110 000	190	240	240/710CAE4
	1 150	438	9.5	13 900 000	30 500 000	1 410 000	3 100 000	170	220	241/710CAE4
	1 280	450	12	15 700 000	30 500 000	1 600 000	3 100 000	160	200	232/710CAE4
750	1 000	185	6	5 250 000	12 800 000	535 000	1 310 000	220	280	239/750CAE4
	1 090	250	7.5	7 750 000	17 200 000	790 000	1 750 000	220	260	230/750CAE4
	1 090	335	7.5	10 100 000	24 000 000	1 030 000	2 450 000	180	220	240/750CAE4
	1 360	475	15	17 700 000	35 500 000	1 800 000	3 600 000	140	190	232/750CAE4
800	1 060	195	6	5 600 000	13 700 000	570 000	1 400 000	220	260	239/800CAE4
	1 150	258	7.5	8 350 000	19 100 000	850 000	1 950 000	200	240	230/800CAE4
	1 150	345	7.5	10 900 000	26 300 000	1 110 000	2 680 000	160	200	240/800CAE4
	1 280	375	9.5	13 800 000	29 200 000	1 410 000	2 970 000	150	190	231/800CAE4
	1 420	488	15	20 300 000	41 000 000	2 070 000	4 150 000	130	170	232/800CAE4





Dynamic Equivalent Load $P = XF_{r} + YF_{o}$

F = A	$\Gamma_{\rm r}$ + $I \Gamma_{\rm a}$		
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y ₃	0.67	Y ₂

Static Equivalent Load

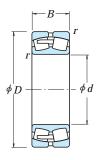
 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

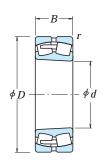
The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

Νι	umbers	Abutm	Abutment and Fillet Dimensions (mm)					xial Loa Factors		Mass (kg)
	Tapered Bore(1)	$d_{ m a}$ min.	max.	$D_{ m a}$ min.	$m{r_a}$ max.	e	Y_2	Y_3	Y_0	approx.
2:	39/600CAKE4	622	778	745	4	0.17	5.9	3.9	3.9	205
	30/600CAKE4	628	842	794	5	0.21	4.8	3.3	3.2	389
	40/600CAK30E4	628	842	772	5	0.30	3.3	2.2	2.2	529
	31/600CAKE4	636	944	856	6	0.30	3.4	2.3	2.2	898
	41/600CAK30E4	636	944	836	6	0.39	2.6	1.8	1.7	1 050
	32/600CAKE4	644	1 046	923	8	0.36	2.8	1.9	1.8	1 590
2	39/630CAKE4	658	822	786	5	0.18	5.6	3.8	3.7	259
	30/630CAKE4	666	884	835	6	0.22	4.7	3.1	3.1	468
	40/630CAK30E4	666	884	815	6	0.30	3.3	2.2	2.2	637
2	31/630CAKE4	666	994	900	6	0.30	3.4	2.3	2.2	1 040
	41/630CAK30E4	666	994	876	6	0.38	2.7	1.8	1.7	1 250
	32/630CAKE4	684	1 096	970	10	0.36	2.8	1.9	1.8	1 850
2	39/670CAKE4 30/670CAKE4 40/670CAK30E4 31/670CAKE4	698 706 706 706	872 944 944 1 054	836 891 868 952	5 6 6	0.17 0.22 0.30 0.30	5.8 4.7 3.3 3.3	3.9 3.1 2.2 2.2	3.8 3.1 2.2 2.2	300 571 773 1 230
	41/670CAK30E4	706	1 054	934	6	0.37	2.7	1.8	1.8	1 440
	32/670CAKE4	724	1 166	1 024	10	0.37	2.7	1.8	1.8	2 210
2	39/710CAKE4	738	922	883	5	0.17	5.8	3.9	3.8	352
	30/710CAKE4	746	994	936	6	0.22	4.6	3.1	3.0	647
	40/710CAK30E4	746	994	916	6	0.29	3.4	2.3	2.2	861
	41/710CAK30E4	754	1 106	981	8	0.38	2.6	1.8	1.7	1 730
	32/710CAKE4	764	1 226	1 080	10	0.36	2.8	1.9	1.8	2 470
	39/750CAKE4	778	972	931	5	0.17	6.0	4.1	4.0	398
	30/750CAKE4	786	1 054	990	6	0.22	4.6	3.1	3.0	768
	40/750CAK30E4	786	1 054	969	6	0.29	3.4	2.3	2.2	1 030
	32/750CAKE4	814	1 296	1 148	12	0.36	2.8	1.9	1.8	2 980
2	39/800CAKE4	828	1 032	987	5	0.17	6.0	4.0	3.9	462
	30/800CAKE4	836	1 114	1 045	6	0.21	4.7	3.2	3.1	870
	40/800CAK30E4	836	1 114	1 029	6	0.27	3.7	2.5	2.5	1 130
	31/800CAKE4	844	1 236	1 127	8	0.28	3.6	2.4	2.3	1870
	32/800CAKE4	864	1 356	1 208	12	0.35	2.8	1.9	1.9	3 250

Bore Diameter 850 – 1400 mm





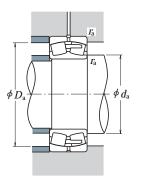


Cylindrical Bore

Tapered Bore

Е	Boundary (r	Dimens nm)	ions	1)	Basic Load N)	3	gf}	Limiting S (min	•	Bearing
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Cylindrical Bore
850	1 120 1 220	200 272	6 7.5	6 100 000 9 300 000	15 200 000 21 400 000	620 000 945 000	1 550 000 2 190 000	190 180	240 220	239/850CAE4 230/850CAE4
	1 220 1 500	365 515	7.5 15	11 600 000 22 300 000	28 300 000 45 500 000	1 180 000 2 270 000	2 890 000 4 650 000	150 120	190 160	240/850CAE4 232/850CAE4
900	1 180 1 280	206 280	6 7.5	6 600 000 9 850 000	16 700 000 22 800 000	670 000 1 000 000	1 700 000 2 330 000	180 160	220 200	239/900CAE4 230/900CAE4
	1 280 1 580	375 515	7.5 15	12 800 000 23 400 000	31 500 000 47 500 000		3 250 000 4 850 000	140 110	180 140	240/900CAE4 232/900CAE4
950	1 250 1 360	224 300	7.5 7.5	7 600 000 11 300 000	19 900 000 26 500 000	775 000 1 160 000	2 030 000 2 710 000	160 150	200 190	239/950CAE4 230/950CAE4
	1 360 1 660	412 530	7.5 15	14 500 000 24 700 000	36 500 000 50 500 000	1 480 000 2 520 000	3 700 000 5 150 000	120 100	160 130	240/950CAE4 232/950CAE4
1 000	1 320 1 420 1 420	236 308 412	7.5 7.5 7.5	8 200 000 11 900 000 15 300 000	21 700 000 28 100 000 38 500 000	835 000 1 210 000 1 560 000	2 210 000 2 860 000 3 950 000	150 140 110	190 170 150	239/1000CAE4 230/1000CAE4 240/1000CAE4
1 060	1 400 1 500 1 500	250 325 438	7.5 9.5 9.5	9 300 000 13 000 000 16 800 000	24 400 000 31 500 000 43 000 000	950 000 1 330 000 1 720 000	2 490 000 3 200 000 4 350 000	130 120 100	170 160 130	239/1060CAE4 230/1060CAE4 240/1060CAE4
1 120	1 580 1 580	345 462	9.5 9.5	15 400 000 18 700 000	38 000 000 49 500 000	1 570 000 1 910 000	3 850 000 5 050 000	110 95	140 120	230/1120CAE4 240/1120CAE4
1 180	1 660	475	9.5	20 200 000	52 500 000	2 060 000	5 350 000	85	110	240/1180CAE4
1 250	1 750	500	9.5	21 000 000	59 500 000	2 140 000	6 050 000	75	100	240/1250CAE4
1 320	1 850	530	12	22 600 000	63 500 000	2 310 000	6 500 000	67	85	240/1320CAE4
1 400	1 950	545	12	24 500 000	65 000 000	2 500 000	6 650 000	60	75	240/1400CAE4





Dynamic Equivalent Load $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$				
X	Y	X	Y			
1	Y ₃	0.67	Y ₂			

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

The values of \emph{e} , $\emph{Y}_{\emph{2}}$, $\emph{Y}_{\emph{3}}$, and $\emph{Y}_{\emph{0}}$ are given in the table below.

Numbers	Abutm	ent and Fil (mr	let Dimens n)	ions	Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{\!\scriptscriptstyle a}$ min.	max.	$D_{ m a}$ min.	$m{r}_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
239/850CAKE4 230/850CAKE4	878 886	1 092 1 184	1 046 1 109	5 6	0.16 0.21	6.2 4.8	4.2 3.2	4.1 3.1	523 1 020
240/850CAK30E4 232/850CAKE4	886 914	1 184 1 436	1 093 1 274	6 12	0.28 0.35	3.6 2.8	2.4 1.9	2.4 1.9	1 350 3 890
239/900CAKE4 230/900CAKE4	928 936	1 152 1 244	1 103 1 169	5 6	0.16 0.20	6.4 4.9	4.3 3.3	4.2 3.2	591 1 160
240/900CAK30E4 232/900CAKE4	936 964	1 244 1 516	1 147 1 354	6 12	0.28 0.33	3.6 3.0	2.4 2.0	2.4 2.0	1 520 4 300
239/950CAKE4 230/950CAKE4	986 986	1 214 1 324	1 169 1 241	6	0.16 0.21	6.3 4.8	4.2 3.2	4.1 3.2	732 1 400
240/950CAK30E4 232/950CAKE4	986 1 014	1 324 1 596	1 219 1 428	6 12	0.28 0.32	3.6 3.1	2.4 2.1	2.3 2.1	1 880 4 800
239/1000CAKE4 230/1000CAKE4 240/1000CAK30E4	1 036 1 036 1 036	1 284 1 384 1 384	1 229 1 298 1 275	6 6 6	0.16 0.20 0.27	6.4 4.9 3.7	4.3 3.3 2.5	4.2 3.2 2.4	881 1 560 2 010
239/1060CAKE4 230/1060CAKE4 240/1060CAK30E4	1 096 1 104 1 104	1 364 1 456 1 456	1 302 1 368 1 346	6 8 8	0.16 0.21 0.28	6.1 4.9 3.6	4.1 3.3 2.4	4.0 3.2 2.4	1 030 1 790 2 410
230/1120CAKE4 240/1120CAK30E4	1 164 1 164	1 536 1 536	1 444 1 421	8	0.20 0.27	5.0 3.7	3.4 2.5	3.3 2.5	2 120 2 790
240/1180CAK30E4	1 224	1 616	1 494	8	0.27	3.7	2.5	2.4	3 180
240/1250CAK30E4	1 294	1 706	1 579	8	0.25	4.0	2.7	2.6	3 700
240/1320CAK30E4	1 374	1 796	1 656	10	0.26	3.9	2.6	2.6	4 400
240/1400CAK30E4	1 454	1 896	1 767	10	0.25	4.0	2.7	2.6	4 900





THRUST BEARINGS

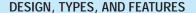
SINGLE-DIRECTION THRUST BALL BEARINGS

With Flat Seat, Aligning Seat, or Aligning Seat Washer	Bore Diameter	10 – 100 mm ······	B210
	Bore Diameter	110 – 360 mm ······	B21
DOLINI E DIDECTION TUDUCT DALL DEADINGS			

DOUBLE-DIRECTION THRUST BALL BEARINGS

With Flat Seat, Aligning Seat, or Aligning Seat Washer	Bore Diameter	10 – 190 mm ······	B218
THRUST CYLINDRICAL ROLLER BEARINGS	Bore Diameter	35 – 320mm·····	B224
THRUST SPHERICAL ROLLER BEARINGS	Bore Diameter	60 – 500mm·····	B228

Angular Contact Thrust Ball Bearings are described on pages B234 to B243.



THRUST BALL BEARINGS

Thrust ball bearings are classified into those with flat seats or aligning seats depending on the shape of the outer ring seat (housing washer). They can sustain axial loads but no radial loads.

sustain axial loads but no radial loads.

The series of thrust ball bearings available are shown in Table 1.

For Single-Direction Thrust Ball Bearings, pressed steel cages and machined brass cages are usually used as shown in Table 2. The cages in Double-Direction Thrust Ball Bearings are the same as those in Single-Direction Thrust Ball Bearings of the same diameter series.

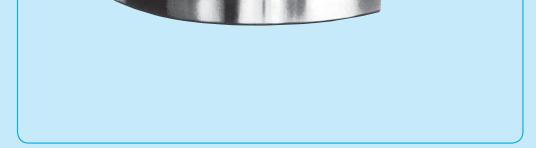
The basic load ratings listed in the bearing tables are based on the standard cage type shown in Table 2. If the type of cage is different for bearings with the same number, the number of balls may vary, in such a case, the load rating will differ from the one listed in the bearing tables.

Table1 Series of Thrust Ball Bearings

	W/Flat Seat	W/Aligning Seat	W/Aligning Seat Washer			
	511	_	_			
Single- Direction	512	532	532U			
	513	533	533U			
	514	534	534U			
Double-	522	542	542U			
Direction	523	543	543U 544U			
	524	544				

Table 2 Standard Cages for Thrust Ball Bearings

Pressed Steel	Machined Brass						
51100 - 51152X	51156X - 51172X						
51200 - 51236X	51238X - 51272X						
51305 - 51336X	51338X - 51340X						
51405 - 51418X	51420X - 51436X						
53200 - 53236X	53238X - 53272X						
53305 - 53336X	53338X - 53340X						
53405 - 53418X	53420X - 53436X						



B 206 B 207





THRUST CYLINDRICAL ROLLER BEARINGS

These are thrust bearings containing cylindrical rollers. They can sustain only axial loads, but they are suitable for heavy loads and have high axial rigidity.

The cages are machined brass.

THRUST SPHERICAL ROLLER BEARINGS

These are thrust bearings containing convex rollers. They have a selfaligning capability and are free of any influence of mounting error or shaft deflection. Besides the original type, the E type with pressed cages for high load capacity is also available. Their bearing numbers are suffixed by E. For horizontal shaft or high speed application, machined brass cages are

recommended. For details, contact NSK.

Since there are several places where lubrication is difficult, such as the area between the roller heads and inner ring rib, the sliding surfaces between cage and guide sleeve, etc., oil lubrication should be used even at low speed.

The cages in the original type are machined brass.

TOLERANCES AND RUNNING ACCURACY

THRUST BALL BEARINGS	·· Table 8.6 (Pages A72 to A74)
THRUST CYLINDRICAL ROLLER BEARINGS	
According to	o Table 8.2 (Pages A72 to A74)
THRUST SPHERICAL ROLLER BEARINGS	··Table 8.7 (Pages A75)

RECOMMENDED FITS

THRUST BALL BEARINGS	Table	9.3	(Pages	A84)
	Table	9.5	(Pages	A85)
THRUST CYLINDRICAL ROLLER BEARINGS	Table	9.3	(Pages	A84)
	Table	9.5	(Pages	A85)
THRUST SPHERICAL ROLLER BEARINGS	Table	9.3	(Pages	A84)
	Table	9.5	(Pages	A85)

DIMENSIONS RELATED TO MOUNTING

The dimensions related to mounting of thrust spherical roller bearings are listed in the Bearing Table.

If the bearing load is heavy, it is necessary to design the shaft shoulder with ample strength in order to provide sufficient support for the shaft

PERMISSIBLE MISALIGNMENT

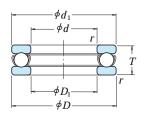
The permissible misalignment of thrust spherical roller bearings varies depending on the size, but it is approximately 0.018 to 0.036 radian (1° to 2°) with average loads.

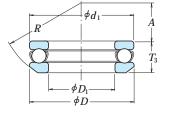
MINIMUM AXIAL LOAD

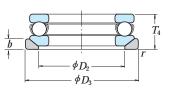
It is necessary to apply some axial load to thrust bearings to prevent slippage between the rolling elements and raceways. For more details, please refer to Page A99.

B 208 B 209





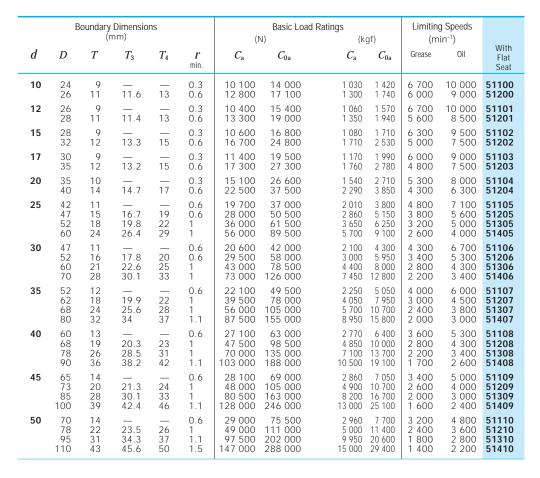


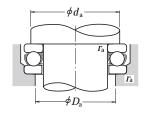


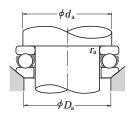
With Flat Seat

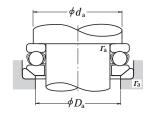
With Aligning Seat

With Aligning Seat Washer





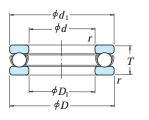


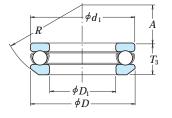


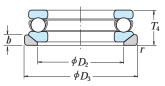
Bearing N	umbers		Dimensions (mm)								l Fillet mm)	Mass(kg) approx.		
With Aligning Seat	With Aligning Seat Washer	d_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{r}_{ m a}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53200	53200 U	24 26	11 12	_ 18	 28	 3.5	— 8.5	_ 22	18 20	16 16	0.3 0.6	0.019 0.028	0.029	0.036
53201	53201 U	26 28	13 14	 20	30	3.5	 11.5	 25	20 22	18 18	0.3	0.021 0.031	0.031	0.039
53202	53202 U	28 32	16 17	 24	 35	4	 12	 28	23 25	20 22	0.3 0.6	0.023 0.043	0.048	 0.059
53203	53203 U	30 35	18 19	 26	38	4	 16	 32	25 28	22 24	0.3 0.6	0.025 0.050	0.055	 0.069
 53204	53204 U	35 40	21 22	 30	<u>-</u>	- 5	 18	 36	29 32	26 28	0.3 0.6	0.037 0.077	0.080	 0.096
53205 53305 53405	53205 U 53305 U 53405 U	42 47 52 60	26 27 27 27	36 38 42	50 55 62	5.5 6 8	 19 21 19	40 45 50	35 38 41 46	32 34 36 39	0.6 0.6 1	0.056 0.111 0.169 0.334	0.123 0.182 0.353	0.151 0.224 0.426
53206 53306 53406	53206 U 53306 U 53406 U	47 52 60 70	32 32 32 32	42 45 50	55 62 75	 5.5 7 9	 22 22 20	45 50 56	40 43 48 54	37 39 42 46	0.6 0.6 1	0.064 0.137 0.267 0.519	0.154 0.28 0.535	0.183 0.336 0.666
53207 53307 53407	53207 U 53307 U 53407 U	52 62 68 80	37 37 37 37	48 52 58	 65 72 85		24 24 23	50 56 64	45 51 55 62	42 46 48 53	0.6 1 1 1	0.081 0.21 0.386 0.769	0.231 0.403 0.785	0.292 0.488 0.967
53208 53308 53408	53208 U 53308 U 53408 U	60 68 78 90	42 42 42 42	55 60 65	72 82 95	— 7 8.5 12	— 28.5 28 26	— 56 64 72	52 57 63 70	48 51 55 60	0.6 1 1 1	0.12 0.27 0.536 1.1	0.289 0.581 1.12	0.355 0.704 1.38
53209 53309 53409	53209 U 53309 U 53409 U	65 73 85 100	47 47 47 47	 60 65 72	78 90 105	— 7.5 10 12.5	 26 25 29	56 64 80	57 62 69 78	53 56 61 67	0.6 1 1 1	0.143 0.31 0.672 1.46	0.333 0.702 1.53	0.419 0.888 1.87
53210 53310 53410	53210 U 53310 U 53410 U	70 78 95 110	52 52 52 52	 62 72 80	82 100 115	— 7.5 11 14	— 32.5 28 35	 64 72 90	62 67 77 86	58 61 68 74	0.6 1 1 1.5	0.153 0.378 0.931 1.94	0.404 1.01 1.98	0.504 1.27 2.41

B 210 B 211





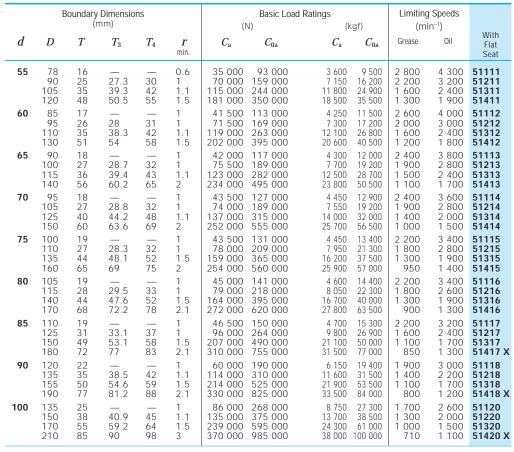


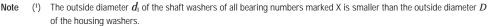


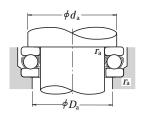
With Flat Seat

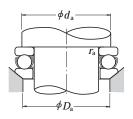
With Aligning Seat

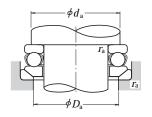
With Aligning Seat Washer





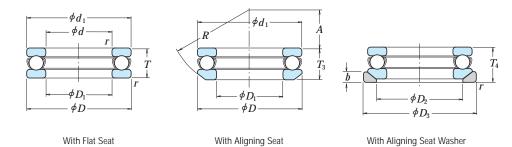






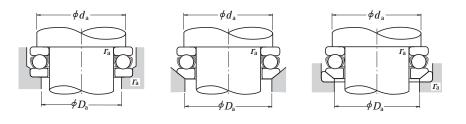
Bearing N	umbers(1)				Dimensi (mm					nent and nsions (Mass(kg) approx.)
With Aligning Seat	With Aligning Seat Washer	$d_{\scriptscriptstyle 1}$	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53211 53311 53411	53211 U 53311 U 53411 U	78 90 105 120	57 57 57 57	72 80 88	95 110 125	9 11.5 15.5	— 35 30 28	72 80 90	69 76 85 94	64 69 75 81	0.6 1 1 1.5	0.227 0.599 1.31 2.58	0.656 1.45 2.59	0.819 1.78 3.16
53212 53312 53412	53212 U 53312 U 53412 U	85 95 110 130	62 62 62 62	78 85 95	100 115 135	— 9 11.5 16	32.5 41 34	72 90 100	75 81 90 102	70 74 80 88	1 1 1 1.5	0.281 0.673 1.4 3.16	0.731 1.51 3.2	0.897 1.83 3.91
53213 53313 53413	53213 U 53313 U 53413 U	90 100 115 140	67 67 67 68	82 90 100	105 120 145	— 9 12.5 17.5	40 38.5 40	80 90 112	80 86 95 110	75 79 85 95	1 1 1 2	0.324 0.756 1.54 4.1	0.812 1.67 4.22	0.989 2.04 5.13
53214 53314 53414	53214 U 53314 U 53414 U	95 105 125 150	72 72 72 73	88 98 110	110 130 155	— 9 13 19.5	38 43 34	80 100 112	85 91 103 118	80 84 92 102	1 1 1 2	0.346 0.793 2.0 5.05	0.866 2.2 5.12	1.05 2.64 6.21
53215 53315 53415	53215 U 53315 U 53415 U	100 110 135 160	77 77 77 78	92 105 115	115 140 165	9.5 15 21	 49 37 42	90 100 125	90 96 111 125	85 89 99 110	1 1 1.5 2	0.389 0.845 2.6 6.15	1.27 2.8 6.23	1.11 3.42 7.58
53216 53316 53416	53216 U 53316 U 53416 U	105 115 140 170	82 82 82 83	98 110 125	120 145 175	 10 15 22	 46 50 36	90 112 125	95 101 116 133	90 94 104 117	1 1 1.5 2	0.417 0.931 2.74 7.21	1.01 2.94 7.33	1.23 3.55 8.9
— 53217 53317 53417 X	53217 U 53317 U 53417 XU	110 125 150 177	87 88 88 88	105 115 130	130 155 185	— 11 17.5 23	52 43 47	100 112 140	100 109 124 141	95 101 111 124	1 1 1.5 2	0.44 1.22 3.57 8.51	1.35 3.78 8.72	1.63 4.67 10.4
53218 53318 53418 X	53218 U 53318 U 53418 XU	120 135 155 187	92 93 93 93	110 120 140	140 160 195	 13.5 18 25.5	45 40 40	100 112 140	108 117 129 149	102 108 116 131	1 1 1.5 2	0.646 1.69 3.83 10.2	1.89 4.11 10.3	2.38 5.09 12.4
53220 53320 53420 X	53220 U 53320 U 53420 XU	135 150 170 205	102 103 103 103	125 135 155	155 175 220	 14 18 27	— 52 46 50	112 125 160	121 130 142 165	114 120 128 145	1 1 1.5 2.5	0.96 2.25 4.98 14.8	2.49 5.31 15	3.03 6.37 18.1





	ı		y Dimensio (mm)	ons			Basic Load	0	:gf}	١ ،	g Speeds in ⁻¹)	
d	D	T	T_3	T_4	$m{r}$ min.	$C_{\rm a}$	C_{0a}	C_{a}	C_{0a}	Grease	Oil	With Flat Seat
110	145 160 190 230	25 38 63 95	— 40.2 67.2 99.7	— 45 72 109	1 1.1 2 3	88 000 136 000 282 000 415 000	288 000 395 000 755 000 1 150 000	8 950 13 900 28 800 42 000	29 400 40 000 77 000 118 000	1 700 1 300 900 630	2 400 1 900 1 300 950	51122 51222 51322 X 51422 X
120	155 170 210 250	25 39 70 102	 40.8 74.1 107.3	 46 80 118	1 1.1 2.1 4	90 000 141 000 330 000 480 000	310 000 430 000 930 000 1 400 000	9 150 14 400 33 500 49 000	31 500 44 000 95 000 142 000	1 600 1 200 800 600	2 400 1 800 1 200 900	51124 51224 51324 X 51424 X
130	170 190 225 270	30 45 75 110	 47.9 80.3 115.2	53 86 128	1 1.5 2.1 4	105 000 183 000 350 000 525 000	350 000 550 000 1 030 000 1 590 000	10 700 18 700 35 500 53 500	36 000 56 000 105 000 162 000	1 400 1 100 750 530	2 000 1 600 1 100 800	51126 51226 X 51326 X 51426 X
140	180 200 240 280	31 46 80 112	 48.6 84.9 117	— 55 92 131	1 1.5 2.1 4	107 000 186 000 370 000 550 000	375 000 575 000 1 130 000 1 750 000	11 000 18 900 37 500 56 500	38 500 59 000 115 000 178 000	1 300 1 000 670 530	2 000 1 500 1 000 800	51128 X 51228 X 51328 X 51428 X
150	190 215 250 300	31 50 80 120	53.3 83.7 125.9	 60 92 140	1 1.5 2.1 4	110 000 238 000 380 000 620 000	400 000 735 000 1 200 000 2 010 000	11 200 24 300 39 000 63 000	41 000 75 000 123 000 205 000	1 300 950 670 480	1 900 1 400 1 000 710	51130 X 51230 X 51330 X 51430 X
160	200 225 270 320	31 51 87 130		 61 100 150	1 1.5 3 5	113 000 249 000 475 000 650 000	425 000 805 000 1 570 000 2 210 000	11 500 25 400 48 500 66 000	43 500 82 000 160 000 226 000	1 200 900 600 450	1 900 1 400 900 670	51132 X 51232 X 51332 X 51432 X
170	215 240 280 340	34 55 87 135	— 58.7 91.3 141	 65 100 156	1.1 1.5 3 5	135 000 280 000 465 000 715 000	510 000 915 000 1 570 000 2 480 000	13 800 28 500 47 500 73 000	52 000 93 000 160 000 253 000	1 100 850 600 430	1 700 1 300 900 630	51134 X 51234 X 51334 X 51434 X
180	225 250 300 360	34 56 95 140	— 58.2 99.3 148.3	 66 109 164	1.1 1.5 3 5	136 000 284 000 480 000 750 000	530 000 955 000 1 680 000 2 730 000	13 800 28 900 49 000 76 500	54 000 97 000 171 000 278 000	1 100 800 560 400	1 700 1 200 850 600	51136 X 51236 X 51336 X 51436 X
190	240 270 320	37 62 105	 65.7 111	73 121	1.1 2 4	172 000 320 000 550 000	655 000 1 110 000 1 960 000		67 000 113 000 199 000	1 000 750 500	1 600 1 100 750	51138 X 51238 X 51338 X

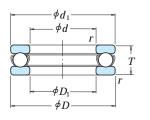
Note (1) The outside diameter d_1 of the shaft washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.

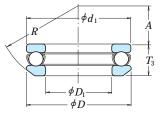


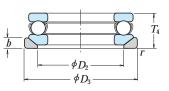
Bearing Numbers ⁽¹⁾				Dimensi (mm					nent and nsions (Mass(kg) approx.)
With With Aligning Aligning Seat Seat Washer	d_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{r}_{ m a}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53222 53222 U 53322 X 53322 XU 53422 X 53422 XU	145 160 187 225	112 113 113 113	— 135 150 170	— 165 195 240		 65 51 59	— 125 140 180	131 140 158 181	124 130 142 159	1 1 2 2.5	1.04 2.42 7.19 20		 3.2 9.1 24.3
53224 53224 U 53324 X 53324 XU 53424 X 53424 XU		122 123 123 123	— 145 165 185	175 220 260	— 15 22 32	 61 63 70	125 160 200	141 150 173 196	134 140 157 174	1 1 2 3	1.12 2.7 9.7 26.2	2.94 10.1 26.5	— 3.58 12.4 31.3
53226 X 53226 XU 53326 X 53326 XU 53426 X 53426 XU	170 187 220 265	132 133 134 134	160 177 200	195 235 280	 17 26 38	 67 53 58	140 160 200	154 166 186 212	146 154 169 188	1 1.5 2 3	1.68 3.95 12.1 32.3	4.35 12.7 32.4	
53228 X 53228 XU 53328 X 53328 XU 53428 X 53428 XU	178 197 235 275	142 143 144 144	— 170 190 206	210 250 290	 17 26 38	— 87 68 83	160 180 225	164 176 199 222	156 164 181 198	1 1.5 2 3	1.83 4.3 14.2 34.7	 4.74 16.3 34.8	
53230 X 53230 XU 53330 X 53330 XU 53430 X 53430 XU	245	152 153 154 154	180 200 225	225 260 310		 79 89.5 69	160 200 225	174 189 209 238	166 176 191 212	1 1.5 2 3	1.95 5.52 15 43.5	 6.09 17.3 43.8	
53232 X 53232 XU 53332 X 53332 XU 53432 X 53432 XU	265	162 163 164 164	190 215 240	235 280 330	— 21 29 41.5	74 77 84	160 200 250	184 199 225 254	176 186 205 226	1 1.5 2.5 4	2.07 6.04 19.6 52.7	 6.78 22.3 52.9	8.7 26.7 62
53234 X 53234 XU 53334 X 53334 XU 53434 X 53434 XU	213 237 275 335	172 173 174 174	200 220 255	250 290 350	— 21.5 29 46	91 105 74	180 225 250	197 212 235 269	188 198 215 241	1 1.5 2.5 4	2.72 7.41 20.3 61.2	8.21 23.2 61.3	
53236 X 53236 XU 53336 X 53336 XU 53436 X 53436 XU	222 247 295 355	183 183 184 184	210 240 270	260 310 370	— 21.5 32 46.5	— 112 91 97	200 225 280	207 222 251 285	198 208 229 255	1 1.5 2.5 4	2.79 7.94 25.9 70.5	— 8.57 29.2 72.1	 10.8 34.9 84.9
53238 X 53238 XU 53338 X 53338 XU	237 267 315	193 194 195	230 255	280 330	 23 33	98 104	200 250	220 238 266	210 222 244	1 2 3	3.6 11.8 36.5	 12.9 38.1	 15.7 44.7

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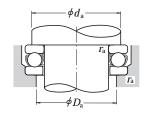
With Flat Seat

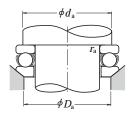
With Aligning Seat

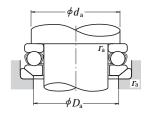
With Aligning Seat Washer

	E		y Dimensio mm)	ons		(1	Basic Load R	atings {kg	nf}		g Speeds in ⁻¹)	
d	D	Т	T_3	T_4	$m{r}$ min.	$C_{\rm a}$	C_{0a}	$C_{\rm a}$	C_{0a}	Grease	Oil	With Flat Seat
200	250 280 340	37 62 110	 65.3 118.4	— 74 130	1.1 2 4	173 000 315 000 600 000	675 000 1 110 000 2 220 000	17 600 32 500 61 500	69 000 113 000 227 000	1 000 710 480	1 500 1 100 710	51140 X 51240 X 51340 X
220	270 300	37 63	<u> </u>	— 75	1.1 2	179 000 325 000	740 000 1 210 000	18 200 33 500	75 500 123 000	950 670	1 500 1 000	51144 X 51244 X
240	300 340	45 78	— 81.6	<u> </u>	1.5 2.1	229 000 420 000	935 000 1 650 000	23 400 43 000	95 000 168 000	850 560	1 200 850	51148 X 51248 X
260	320 360	45 79	 82.8	93	1.5 2.1	233 000 435 000	990 000 1 800 000	23 800 44 500	101 000 184 000	800 560	1 200 850	51152 X 51252 X
280	350 380	53 80	 85	<u> </u>	1.5 2.1	315 000 450 000	1 310 000 1 950 000	32 000 46 000	134 000 199 000	710 530	1 000 800	51156 X 51256 X
300	380 420	62 95	 100.5	 112	2 3	360 000 540 000	1 560 000 2 410 000		159 000 246 000	600 450	900 670	51160 X 51260 X
320	400 440	63 95	 100.5	 112	2 3	365 000 585 000	1 660 000 2 680 000		169 000 273 000	600 450	900 670	51164 X 51264 X
340	420 460	64 96	_ 100.3	_ 113	2	375 000 595 000	1 760 000 2 800 000	38 500 60 500	179 000 285 000	560 430	850 630	51168 X 51268 X
360	440 500	65 110	 116.7	130	2 4	385 000 705 000	1 860 000 3 500 000		190 000 355 000	560 380	800 560	51172 X 51272 X

Note (1) The outside diameter d_1 of the shaft washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.



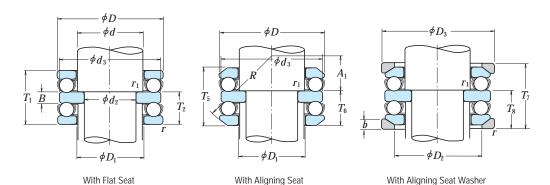


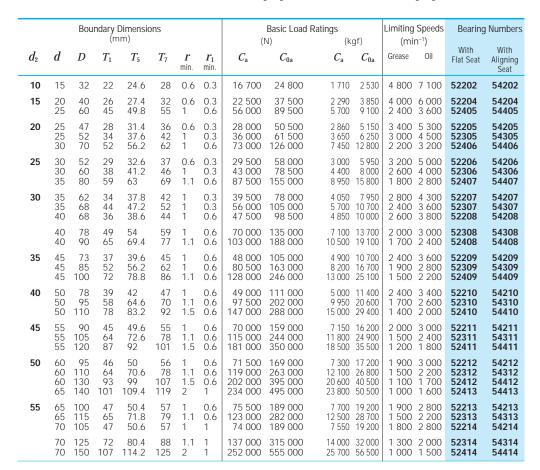


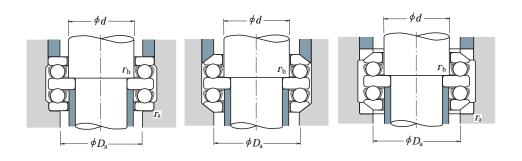
Bearing Nu					Dimensi (mm					nent and nsions (Mass(kg) approx.	
With Aligning Seat	With Aligning Seat Washer	$d_{\scriptscriptstyle 1}$	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
	53240 XU 53340 XU	247 277 335	203 204 205	— 240 270	— 290 350	 23 38	 125 92	— 225 250	230 248 282	220 232 258	1 2 3	3.75 12.3 43.6	 13.4 46.2	 16.1 54.8
53244 X	 53244 XU	267 297	223 224	 260	310	 25	118	 225	250 268	240 252	1 2	4.09 13.6	 14.9	 18
 53248 X	 53248 XU	297 335	243 244	 290	 350	 30	 122	 250	276 299	264 281	1.5 2	6.55 23.7	 25.6	 30.7
53252 X	 53252 XU	317 355	263 264	 305	 370	30	 152	 280	296 319	284 301	1.5 2	7.01 25.1		33.2
53256 X	 53256 XU	347 375	283 284	 325	 390	31	143	 280	322 339	308 321	1.5 2	12 27.1	30.3	 37
53260 X	 53260 XU	376 415	304 304	 360	430	34	 164	 320	348 371	332 349	2 2.5	17.2 43.5	- 47.7	 56.1
53264 X	 53264 XU	396 435	324 325	380	 450	 36	 157	320	368 391	352 369	2 2.5	18.6 45	 49.9	 59.4
 53268 X	 53268 XU	416 455	344 345	 400	 470	 36	 199	 360	388 411	372 389	2 2.5	19.9 47.9	 52.7	<u> </u>
53272 X	53272 XU	436 495	364 365	 430	_ 510	 43	 172	 360	408 442	392 418	2 3	21.5 68.8	— 76.3	— 90.9

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Bore Diameter 10 – 55 mm

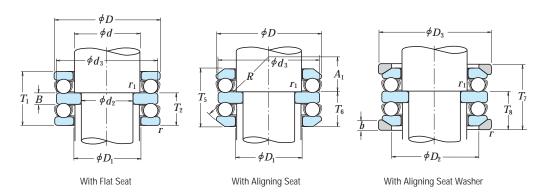






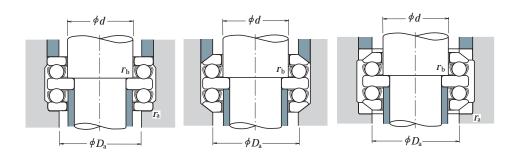
					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	ı	Mass(kg approx.)
With Aligning Seat Washer	d_3	D_1	D_2	D_3	T_2	T_6	T_8	В	b	A_1	R	$D_{ m a}$ max.	r _a max.	$r_{ m b}$ max.	With Flat Seat		With Aligning Seat Washer
54202 U	32	17	24	35	13.5	14.8	16.5	5	4	10.5	28	24	0.6	0.3	0.081	0.090	0.113
54204 U 54405 U	40 60	22 27	30 42	42 62	16 28	16.7 30.4	19 33	6 11	5 8	16 15	36 50	30 42	0.6 1	0.3 0.6	0.148 0.641	0.151 0.68	0.185 0.825
54205 U 54305 U 54406 U	47 52 70	27 27 32	36 38 50	50 55 75	17.5 21 32	19.2 22.8 34.1	21.5 25 37	7 8 12	5.5 6 9	16.5 18 16	40 45 56	36 38 50	0.6 1 1	0.3 0.3 0.6	0.213 0.324 0.978	0.236 0.35 1.01	0.293 0.434 1.27
54206 U 54306 U 54407 U	52 60 80	32 32 37	42 45 58	55 62 85	18 23.5 36.5	19.8 25.1 38.5	22 27.5 41.5	7 9 14	5.5 7 10	20 19.5 18.5	45 50 64	42 45 58	0.6 1 1	0.3 0.3 0.6	0.254 0.483 1.43	0.288 0.511 1.47	0.345 0.621 1.83
54207 U 54307 U 54208 U	62 68 68	37 37 42	48 52 55	65 72 72	21 27 22.5	22.9 28.6 23.8	25 31 26.5	8 10 9	7 7.5 7	21 21 25	50 56 56	48 52 55	1 1 1	0.3 0.3 0.6	0.406 0.71 0.543	0.447 0.744 0.581	0.57 0.915 0.713
54308 U 54408 U	78 90	42 42	60 65	82 95	30.5 40	33 42.2	35.5 46	12 15	8.5 12	23.5 22	64 72	60 65	1 1	0.6 0.6	1.04 1.98	1.13 2.02	1.38 2.54
54209 U 54309 U 54409 U	73 85 100	47 47 47	60 65 72	78 90 105	23 32 44.5	24.3 34.1 47.9	27 37 51.5	9 12 17	7.5 10 12.5	23 21 23.5	56 64 80	60 65 72	1 1 1	0.6 0.6 0.6	0.606 1.28 2.71	0.652 1.34 2.85	0.823 1.71 3.53
54210 U 54310 U 54410 U	78 95 110	52 52 52		82 100 115	24 36 48	25.5 39.3 50.6	28 42 55	9 14 18	7.5 11 14	30.5 23 30	64 72 90	62 72 80	1 1 1.5	0.6 0.6 0.6	0.697 1.78 3.51	0.75 1.94 3.59	0.949 2.46 4.45
54211 U 54311 U 54411 U	90 105 120	57 57 57		95 110 125	27.5 39.5 53.5	29.8 43.8 56	32.5 46.5 60.5	10 15 20	9 11.5 15.5	32.5 25.5 22.5	72 80 90	72 80 88	1 1 1.5	0.6 0.6 0.6	1.11 2.43 4.66	1.22 2.7 4.68	1.55 3.35 5.82
54212 U 54312 U 54412 U 54413 U	95 110 130 140	62 62 62 68	85	100 115 135 145	28 39.5 57 62	30 42.8 60 66.2	33 46.5 64 71	10 15 21 23	9 11.5 16 17.5	30.5 36.5 28 34	72 90 100 112	78 85 95 100	1 1 1.5 2	0.6 0.6 0.6 1	1.22 2.59 5.74 7.41	1.33 2.82 5.82 7.66	1.66 3.45 7.24 9.47
54213 U 54313 U 54214 U	100 115 105	67 67 72	90	105 120 110	28.5 40 28.5	30.2 43.4 30.3	33.5 47 33.5	10 15 10	9 12.5 9	38.5 34.5 36.5	80 90 80	82 90 88	1 1 1	0.6 0.6 1	1.34 2.8 1.44	1.45 3.06 1.59	1.81 3.8 1.95
54314 U 54414 U	125 150	72 73	98 110	130 155	44 65.5	48.2 69.1	52 74.5	16 24	13 19.5	39 28.5	100 112	98 110	1	1 1	3.67 8.99	4.07 9.12	4.95 11.3

Bore Diameter 60 – 130 mm



		Bou		Dimensio	ons			(1	Basic Load R	0	gf}	Limiting (mi	•	Bearing Numbers	(¹)
d_2	d	D	T_1	T_5	T_7	$m{r}$ min.	$r_{ m 1}$ min.	C_{a}	C_{0a}	$C_{\rm a}$	C_{0a}	Grease	Oil	With With Flat Seat Alignin Seat	g
60	75 75 75	110 135 160	47 79 115	49.6 87.2 123	57 95 135	1 1.5 2	1 1 1	78 000 159 000 254 000	209 000 365 000 560 000	7 950 16 200 25 900	21 300 37 500 57 000	1 200	2 600 1 800 1 400		
65	80 80 80 85	115 140 170 180	48 79 120 128	51 86.2 128.4 138	58 95 140 150	1 1.5 2.1 2.1	1 1 1 1.1	79 000 164 000 272 000 310 000	218 000 395 000 620 000 755 000	8 050 16 700 27 800 31 500	22 300 40 000 63 500 77 000	1 200 850			x
70	85 85 90	125 150 190	55 87 135	59.2 95.2 143.4	67 105 157	1 1.5 2.1	1 1 1.1	96 000 207 000 330 000	264 000 490 000 825 000	9 800 21 100 33 500	26 900 50 000 84 000	1 100	2 200 1 600 1 100		X
75 80	90 90 100	135 155 210	62 88 150	69 97.2 160	76 106 176	1.1 1.5 3	1 1 1.1	114 000 214 000 370 000	310 000 525 000 985 000	11 600 21 900 38 000	31 500 53 500 100 000	1 100	2 000 1 600 1 000		X
85 90	100 100 110	150 170 230	67 97 166	72.8 105.4 —	81 115 —	1.1 1.5 3	1 1 1.1	135 000 239 000 415 000	375 000 595 000 1 150 000	13 700 24 300 42 000	38 500 61 000 118 000	1 300 950 600	1 900 1 500 900		
95	110 110 120	160 190 250	67 110 177	71.4 118.4 —	81 128 —	1.1 2 4	1 1 1.5	136 000 282 000 515 000	395 000 755 000 1 540 000	13 900 28 800 52 500	40 000 77 000 157 000			52222 54222 52322 X 54322 52424 X —	X
100	120 120 130	170 210 270	68 123 192	71.6 131.2 —	82 143 —	1.1 2.1 4	1.1 1.1 1.5	141 000 330 000 525 000	430 000 930 000 1 590 000	14 400 33 500 53 500	44 000 95 000 162 000			52224 54224 52324 X 54324 52426 X —	X
110	130 130 140	190 225 280	80 130 196	85.8 — —	96 — —	1.5 2.1 4	1.1 1.1 1.5		550 000 1 030 000 1 750 000	18 700 35 500 56 500	56 000 105 000 178 000		1 100	52226 X 54226 52326 X — 52428 X —	X
120	140 140 150	200 240 300	81 140 209	86.2 — —	99 — —	1.5 2.1 4	1.1 1.1 2		575 000 1 130 000 2 010 000	18 900 37 500 63 000		1 000 670 480	1 000	52228 X 54228 52328 X — 52430 X —	X
130	150 150 160	215 250 320	89 140 226	95.6 — —	109 — —	1.5 2.1 5	1.1 1.1 2		735 000 1 200 000 2 210 000	24 300 39 000 66 000	75 000 123 000 226 000	900 630 430	950	52230 X 54230 52330 X — 52432 X —	X

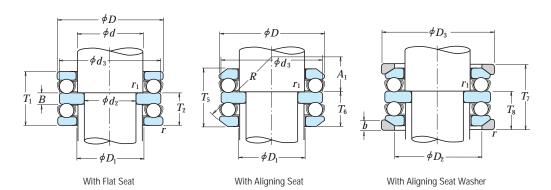
Note (1) The outside diameter d_s of the central washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.



					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	1	Mass(kg approx.)
With Aligning Seat Washer	d_3	D_1	D_2	D_3	T_2	T_6	T_8	В	b	A_1	R	$D_{ m a}$ max.	$r_{ m a}$ max.	$r_{ m b}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
54215 U 54315 U 54415 U	110 135 160	77 77 78	105	115 140 165	28.5 48.5 70.5	29.8 52.6 74.5	33.5 56.5 80.5	10 18 26	9.5 15 21	47.5 32.5 36.5	90 100 125	92 105 115	1 1.5 2	1 1 1	1.54 4.74 10.8	1.66 5.14 11	2.06 6.38 13.7
54216 U 54316 U 54416 U 54417 XU	115 140 170 179.5	82 82 83 88	110 125		29 48.5 73.5 78.5	30.5 52.1 77.7 83.5	34 56.5 83.5 89.5	10 18 27 29	10 15 22 23	45 45.5 30.5 40.5	90 112 125 140	98 110 125 130	1 1.5 2 2	1 1 1	1.66 4.99 12.6 15.4	1.78 5.39 12.8 15.8	2.21 6.61 16 19.5
54217 U 54317 U 54418 XU	125 150 189.5	88 88 93	105 115 140		33.5 53 82.5	35.6 57.1 86.7	39.5 62 93.5	12 19 30	11 17.5 25.5	49.5 39 34.5	100 112 140	105 115 140	1 1.5 2	1 1 1	2.26 6.38 17.5	2.45 6.8 18.1	3.02 10.5 22.5
54218 U 54318 U 54420 XU	135 155 209.5	93 93 103	120	140 160 220	38 53.5 91.5	41.5 58.1 96.5	45 62.5 104.5	14 19 33	13.5 18 27	42 36.5 43.5	100 112 160	110 120 155	1 1.5 2.5	1 1 1	3.09 6.79 26.8	3.42 7.33 27.2	4.39 9.29 33.4
54220 U 54320 U —	150 170 229	103 103 113	125 135 —		41 59 101.5	43.9 63.2 —	48 68 —	15 21 37	14 18 —	49 42 —	112 125 —	125 135 159	1 1.5 2.5	1 1 1	4.08 8.82 35.6	4.54 9.47 —	5.64 11.6 —
54222 U 54322 XU —	160 189.5 249	113 113 123	135 150 —	165 195 —	41 67 108.5	43.2 71.2 —	48 76 —	15 24 40	14 20.5 —	62 47 —	125 140 —	135 150 174	1 2 3	1 1 1.5	4.39 12.7 47.6	4.83 13.5 —	5.94 16.6 —
54224 U 54324 XU —	170 209.5 269	123 123 134	145 165 —		41.5 75 117	43.3 79.1 —	48.5 85 —	15 27 42	15 22 —	58.5 58 —	125 160 —	145 165 188	1 2 3	1 1 1.5	4.92 17.6 57.8	5.4 16.4 —	6.68 22.9 —
54226 XU — —	189.5 224 279	133 134 144	160 —	195 — —	49 80 120	51.9 — —	57 — —	18 30 44	17 — —	63 — —	140 —	160 169 198	1.5 2 3	1 1 1.5	7.43 21.5 62.4	8.24 —	10.2 — —
54228 XU — —	199.5 239 299	143 144 153	170 —	210 — —	49.5 85.5 127.5	52.1 — —	58.5 — —	18 31 46	17 —	83.5 — —	160 —	170 181 212	1.5 2 3	1 1 2	8.01 24.8 77.8	8.87 —	11.2 — —
54230 XU — —	214.5 249 319	153 154 164	180 —	225 — —	54.5 85.5 138	57.8 — —	64.5 —	20 31 50	20.5 —	74.5 —	160 —	180 191 226	1.5 2 4	1 1 2	10.4 30.3 93.6	11.5 — —	15 — —

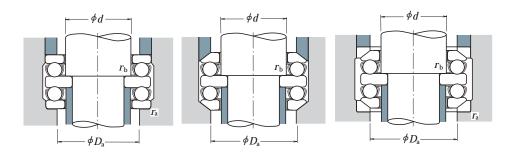
B 220 B 221

Bore Diameter 135 – 190 mm



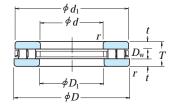
		Bou		Dimensionm)	ons				Basic Load R	atings {kgf}	Limiting Speeds (min ⁻¹)	Bearing Numbers ⁽¹⁾
d_2	d	D	T_1	T_5	T_7	$m{r}$ min.	$r_1 \atop ext{min.}$	C _a	C_{0a}	$C_{\rm a}$ $C_{0 \rm a}$	Grease Oil	With With Flat Seat Aligning Seat
135	170	340	236	_	_	5	2.1	715 000	2 480 000	73 000 253 000	400 600	52434 X —
140	160 160 180	225 270 360	90 153 245	97.4 — —	110 —	1.5 3 5	1.1 1.1 3	249 000 475 000 750 000	805 000 1 570 000 2 730 000	25 400 82 000 48 500 160 000 76 500 278 000	600 900	52232 X 54232 X 52332 X — 52436 X —
150	170 170 180 180	240 280 250 300	97 153 98 165	104.4 — 102.4 —	117 — 118 —	1.5 3 1.5 3	1.1 1.1 2 2	280 000 465 000 284 000 480 000	915 000 1 570 000 955 000 1 680 000	28 500 93 000 47 500 160 000 28 900 97 000 49 000 171 000	560 850 800 1 200	52334 X —
160	190 190	270 320	109 183	116.4	131	2 4	2	320 000 550 000	1 110 000 1 960 000	32 500 113 000 56 000 199 000		52238 X 54238 X 52338 X —
170	200 200	280 340	109 192	115.6 —	133	2	2	315 000 600 000	1 110 000 2 220 000	32 500 113 000 61 500 227 000	710 1 000 450 670	52240 X 54240 X 52340 X —
190	220	300	110	115.2	134	2	2	325 000	1 210 000	33 500 123 000	670 1 000	52244 X 54244 X

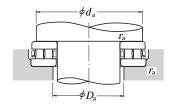
Note (!) The outside diameter d_s of the central washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.



					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	ı	Mass(ko approx	
With Aligning Seat Washer	d_3	D_1	D_2	D_3	T_2	T_6	T_8	В	b	A_1	R	$D_{ m a}$ max.	r _a max.	$r_{ m b}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
_	339	174	_	_	143	_	_	50	_	_	_	240	4	2	110	_	_
54232 XU 	224.5 269 359	163 164 184	190 — —	235 — —	55 93 148.5	58.7 — —	65 — —	20 33 52	21 — —	70 —	160 —	190 205 254	1.5 2.5 4	1 1 2.5	11.2 35.1 126	12.7 — —	16.5 — —
54234 XU 54236 XU	239.5 279 249 299	173 174 183 184	200 210 —	250 — 260 —	59 93 59.5 101	62.7 — 61.7 —	69 — 69.5 —	21 33 21 37	21.5 — 21.5 —	87 — 108.5 —	180 200 	200 215 210 229	1.5 2.5 1.5 2.5	1 1 2 2.5	13.6 40.8 14.8 46.3	15.2 — 16.1 —	19.8 — 20.6 —
54238 XU —	269 319	194 195	230	280 —	66.5 111.5	70.2 —	77.5 —	24 40	23	93.5 —	200	230 244	2	2	22.1 113	22.2 —	29.8 —
54240 XU —	279 339	204 205	240 —	290 —	66.5 117	69.8 —	78.5 —	24 42	23	120.5 —	225 —	240 258	2	2	23.1 78.4	23.2	30.6
54244 XU	299	224	260	310	67	69.6	79	24	25	114	225	260	2	2	25.2	27.8	34.1

Bore Diameter 35 – 130 mm





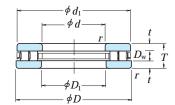
	Boundary D (mr				ad Ratings N)	1	J Speeds in ⁻¹)
d	D	T	r min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	Grease	Oil
35	80	32	1.1	95 500	247 000	1 000	3 000
40	78	22	1	63 000	194 000	1 200	3 600
45	65	14	0.6	33 000	100 000	1 700	5 000
	85	24	1	71 000	233 000	1 100	3 400
50	110	27	1.1	139 000	470 000	900	2 800
	95	27	1.1	113 000	350 000	1 000	3 000
55	105	30	1.1	134 000	450 000	900	2 600
60	95	26	1	99 000	325 000	1 000	3 000
	110	30	1.1	139 000	480 000	850	2 600
65	100	27	1	110 000	325 000	950	2 800
	115	30	1.1	145 000	515 000	850	2 600
70	150	36	2	259 000	935 000	670	2 000
	125	34	1.1	191 000	635 000	750	2 200
75	100	19	1	63 500	221 000	1 100	3 400
	135	36	1.5	209 000	735 000	710	2 200
80	115	28	1	120 000	420 000	900	2 600
	140	36	1.5	208 000	740 000	710	2 000
85	110	19	1	75 000	298 000	1 100	3 200
	125	31	1	151 000	485 000	800	2 400
	150	39	1.5	257 000	995 000	630	1 900
90	120	22	1	96 000	370 000	950	3 000
	155	39	1.5	250 000	885 000	630	1 900
100	170	42	1.5	292 000	1 110 000	560	1 700
110	160	38	1.1	228 000	855 000	630	1 900
	190	48	2	390 000	1 490 000	500	1 500
120	170	39	1.1	233 000	895 000	600	1 800
	210	54	2.1	505 000	1 930 000	450	1 400
130	190	45	1.5	300 000	1 090 000	530	1 600
	225	58	2.1	585 000	2 370 000	430	1 300
	270	85	4	895 000	3 300 000	320	950

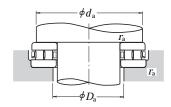
Bearing Numbers			ensions nm)			tment and I ensions (n		Mass (kg)
bearing Numbers	$d_{\scriptscriptstyle 1}$	D_1	$D_{ m w}$	t	d a min.	$D_{ m a}$ max.	$m{r}_{ m a}$ max.	approx.
35 TMP 14	80	37	12	10	71	46	1	0.97
40 TMP 93	78	42	8	7	71	48	1	0.525
45 TMP 11	65	47	6	4	60	49	0.6	0.144
45 TMP 93	85	47	8	8	78	53	1	0.665
50 TMP 74	109	52	11	8	100	61	1	1.52
50 TMP 93	93	52	11		89	57	1	0.94
55 TMP 93	105	55.2	11	9.5	98	63	1	1.28
60 TMP 12	95	62	10	8	88	67	1	0.735
60 TMP 93	110	62	11	9.5	103	68	1	1.36
65 TMP 12	100	67	12.5	7.25	93	71	1	0.805
65 TMP 93	115	65.2	11	9.5	108	73	1	1.44
70 TMP 74	149	72	15	10.5	137	84	2	3.8
70 TMP 93	125	72	14	10	117	78	1	1.95
75 TMP 11	100	77	8	5.5	96	79	1	0.41
75 TMP 93	135	77	14	11	125	84	1.5	2.42
80 TMP 12	115	82	11	8.5	109	86	1	1.02
80 TMP 93	138	82	14	11	130	91	1.5	2.54
85 TMP 11	110	87	7.5	5.75	105	89	1	0.46
85 TMP 12	125	88	14	8.5	118	92	1	1.36
85 TMP 93	148	87	14	12.5	140	95	1.5	3.2
90 TMP 11	119	91.5	9	6.5	114	95	1	0.725
90 TMP 93	155	90.2	16	11.5	144	101	1.5	3.3
100 TMP 93	170	103	16	13	159	110	1.5	4.25
110 TMP 12	160	113	15	11.5	150	119	1	2.66
110 TMP 93	190	113	19	14.5	179	120	2	6.15
120 TMP 12	170	123	15	12	160	129	1	2.93
120 TMP 93	210	123	22	16	199	129	2	8.55
130 TMP 12	187	133	19	13	177	142	1.5	4.5
130 TMP 93	225	133	22	18	214	140	2	10.4
130 TMP 94	270	133	32	26.5	254	150	3	26.2

Remarks For cylindrical roller thrust bearings not listed adove, please contact NSK.

NSN

Bore Diameter 140 – 320 mm





	Boundary [(m				ad Ratings (N)	١	J Speeds in ⁻¹)
d	D	T	$m{r}$ min.	$C_{\rm a}$	C_{0a}	Grease	Oil
140	200	46	2	285 000	1 120 000	500	1 500
	240	60	2.1	610 000	2 360 000	400	1 200
	280	85	4	990 000	3 800 000	300	900
150	215	50	2	375 000	1 500 000	480	1 400
	250	60	2.1	635 000	2 510 000	400	1 200
160	200	31	1	173 000	815 000	630	1 900
	270	67	3	745 000	3 150 000	360	1 100
170	240	55	1.5	485 000	1 960 000	430	1 300
	280	67	3	800 000	3 500 000	340	1 000
180	300	73	3	1 000 000	4 000 000	320	950
	360	109	5	1 640 000	6 200 000	240	710
190	270	62	3	705 000	2 630 000	360	1 100
	320	78	4	1 080 000	4 500 000	300	900
200	250	37	1.1	365 000	1 690 000	500	1 500
	340	85	4	1 180 000	5 150 000	280	800
220	270	37	1.1	385 000	1 860 000	480	1 500
	300	63	2	770 000	3 100 000	340	1 000
240	300	45	1.5	435 000	2 160 000	400	1 200
	340	78	2.1	965 000	4 100 000	280	850
260	320	45	1.5	460 000	2 350 000	400	1 200
	360	79	2.1	995 000	4 350 000	280	850
280	350	53	1.5	545 000	2 800 000	340	1 000
	380	80	2.1	1 050 000	4 750 000	260	800
300	380 420	62 95	2 3	795 000 1 390 000	4 000 000 6 250 000	300 220	900 670
320	400 440	63 95	2 3	820 000 1 420 000	4 250 000 6 550 000	300 220	900 670

Bearing Numbers			ensions mm)			tment and I nensions (n		Mass (kg)
bearing numbers	$d_{\scriptscriptstyle 1}$	D_1	$D_{ m w}$	t	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	approx.
140 TMP 12	197	143	17	14.5	188	153	2	4.85
140 TMP 93	240	143	25	17.5	226	154	2	12.2
140 TMP 94	280	143	32	26.5	262	158	3	27.5
150 TMP 12	215	153	19	15.5	202	163	2 2	6.15
150 TMP 93	250	153	25	17.5	236	165		12.8
160 TMP 11	200	162	11	10	191	168	1	2.21
160 TMP 93	265	164	25	21	255	173	2.5	16.9
170 TMP 12	237	173	22	16.5	227	182	1.5	8.2
170 TMP 93	280	173	25	21	265	183	2.5	17.7
180 TMP 93	300	185	32	20.5	284	194	2.5	22.5
180 TMP 94	354	189	45	32	335	205	4	58.2
190 TMP 12	266	195	30	16	255	200	2.5	11.8
190 TMP 93	320	195	32	23	303	205	3	27.6
200 TMP 11	247	203	17	10	242	207	1	4.1
200 TMP 93	340	205	32	26.5	322	218	3	34.5
220 TMP 11	267	223	17	10	262	227	1 2	4.5
220 TMP 12	297	224	30	16.5	287	232		13.5
240 TMP 11	297	243	18	13.5	288	251	1.5	7.2
240 TMP 12	335	244	32	23	322	258	2	23.3
260 TMP 11	317	263	18	13.5	308	272	1.5	7.75
260 TMP 12	355	264	32	23.5	342	276	2	25.2
280 TMP 11	347	283	20	16.5	335	294	1.5	11.6
280 TMP 12	375	284	32	24	362	296	2	27.2
300 TMP 11	376	304	25	18.5	365	315	2	16.7
300 TMP 12	415	304	38	28.5	398	322	2.5	42
320 TMP 11	396	324	25	19	385	335	2	18
320 TMP 12	435	325	38	28.5	418	340	2.5	44.5

Remarks For cylindrical roller thrust bearings not listed adove, please contact NSK.

B 226 B 227

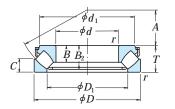
Bore Diameter 60 – 200 mm

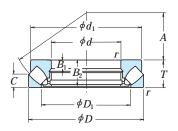


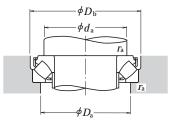
Mass

(kg)

approx.







 d_1

 D_1

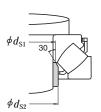
Dimensions (mm)

 B_2

C

A

 B,B_1



Spacer Sleeve Dimensions (mm)

max.

 $d_{
m S1}$ max.

Dynamic Equivalent Load $P=1.2F_{\rm r}+F_{\rm a}$ Static Equivalent Load $P_0=2.8F_{\rm r}+F_{\rm a}$ However, $F_{\rm r}/F_{\rm a}\!\leqq\!0.55$ must be satisfied.

Abutment and Fillet

Dimensions (mm)

 D_{b}

min.

 $r_{\rm a}$

max.

 $d_{a}^{(1)}$ D_{a}

max.

min.

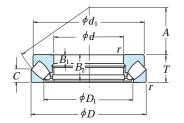
		Dimensior nm)	IS	(Basic Load I N)	•	gf}	Limiting Speeds	Bearing
d	D	T	$m{r}$ min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	C_{a}	C_{0a}	(min ⁻¹) Oil	Numbers
60	130	42	1.5	330 000	885 000	33 500	90 000	2 600	29412 E
65	140	45	2	405 000	1 100 000	41 500	112 000	2 400	29413 E
70	150	48	2 2	450 000	1 240 000	46 000	126 000	2 400	29414 E
75	160	51		515 000	1 430 000	52 500	146 000	2 200	29415 E
80 85	170 150 180	54 39 58	2.1 1.5 2.1	575 000 330 000 630 000	1 600 000 1 040 000 1 760 000	58 500 34 000 64 500	163 000 106 000 179 000	2 000 2 400 1 900	29416 E 29317 E 29417 E
90	155	39	1.5	350 000	1 080 000	35 500	110 000	2 200	29318 E
	190	60	2.1	695 000	1 950 000	70 500	199 000	1 800	29418 E
100	170	42	1.5	410 000	1 280 000	41 500	131 000	2 000	29320 E
	210	67	3	840 000	2 400 000	86 000	245 000	1 600	29420 E
110	190 230	48 73	2 3	530 000 1 010 000	1 710 000 2 930 000	54 000 103 000	174 000 299 000	1 800 1 500	29322 E 29422 E
120	210	54	2.1	645 000	2 100 000	65 500	214 000	1 600	29324 E
	250	78	4	1 160 000	3 400 000	119 000	350 000	1 400	29424 E
130	225	58	2.1	740 000	2 450 000	75 500	250 000	1 500	29326 E
	270	85	4	1 330 000	3 900 000	135 000	400 000	1 200	29426 E
140	240	60	2.1	840 000	2 810 000	85 500	287 000	1 400	29328 E
	280	85	4	1 370 000	4 200 000	140 000	425 000	1 200	29428 E
150	250	60	2.1	870 000	2 900 000	89 000	296 000	1 400	29330 E
	300	90	4	1 580 000	4 900 000	162 000	500 000	1 100	29430 E
160	270	67	3	1 010 000	3 400 000	103 000	345 000	1 300	29332 E
	320	95	5	1 740 000	5 400 000	178 000	550 000	1 100	29432 E
170	280	67	3	1 050 000	3 500 000	107 000	355 000	1 200	29334 E
	340	103	5	1 680 000	5 800 000	171 000	595 000	1 000	29434
180	300	73	3	1 230 000	4 200 000	125 000	430 000	1 100	29336 E
	360	109	5	1 870 000	6 500 000	190 000	660 000	900	29436
190	320	78	4	1 370 000	4 700 000	140 000	480 000	1 100	29338 E
	380	115	5	2 100 000	7 450 000	215 000	760 000	850	29438
200	280	48	2	540 000	2 310 000	55 000	236 000	1 500	29240
	340	85	4	1 570 000	5 450 000	160 000	555 000	1 000	29340 E
	400	122	5	2 290 000	8 150 000	234 000	835 000	800	29440

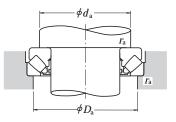
114.5	89	27	38	20	38	67	67	90	108	133	1.5	2.55
121.5	93	29.5	40.5	22	42	72	72	100	115	143	2	3.2
131.5	102	31	43	24	44	78	78	105	125	153	2	3.9
138	107	33.5	46	25	47	83	83	115	132	163		4.65
148	114.5	35	48.5	27	50	89	89	120	140	173	2	5.55
134.5	112	24.5	35.5	19	50	91	91	115	135	153	1.5	2.7
156.5	124	37	51.5	28	54	95	95	130	150	183	2	6.55
139.5	118	24.5	35	19	52	97	97	120	140	158	1.5	2.83
165.5	129.5	39	54.5	29	56	100	100	135	157	193	2	7.55
152	128	26.2	38	20.8	58	107	107	130	150	173	1.5	3.6
185	144	43	59.5	33	62	111	111	150	175	214	2.5	10.3
169.5	142.5	30.3	43.5	24	64	117	117	145	165	193	2	5.25
200	157	47	64.5	36	69	121	129	165	190	234	2.5	13.3
187.5	156.5	34	48.5	27	70	130	130	160	180	214	2	7.3
215	171	50.5	69.5	38	74	132	142	180	205	254		16.6
203.5	168.5	37	53.5	28	76	141	143	170	195	229	2 3	8.95
235	185	54	74.5	42	81	143	153	195	225	275		21.1
216.5	179	38.5	54	30	82	148	154	185	205	244	2	10.4
244.5	195.5	54	74.5	42	86	153	162	205	235	285		22.2
224	190	38	54.5	29	87	158	163	195	215	254	2	10.8
266	209	58	81	44	92	164	175	220	250	306		27.3
243	203	42	60	33	92	169	176	210	235	275	2.5	14.3
278	224.5	60.5	84.5	46	99	175	189	230	265	326	4	32.1
252	214.5	42.2	60.5	32	96	178	188	220	245	285	2.5	14.8
310	243	37	99	50	104	—	—	245	285	—	4	43.5
270	227	46	65.5	36	103	189	195	235	260	306	2.5	19
330	255	39	105	52	110	—	—	260	300		4	52
288.5	244	49	69	38	110	200	211	250	275	326	3	23
345	271	41	111	55	117	—		275	320	—	4	60
266 306.5 365	236 257 280	15 53.5 43	46 75 117	24 41 59	108 116 122	211 —	224 —	235 265 290	255 295 335	346 —	2 3 4	8.55 28.5 69
								•				

Note (1) For heavy load applications, a d_a value should be chosen which is large enough to support the shaft washer rib.

Bore Diameter 220 – 420 mm







Dynamic Equivalent Load $P=1.2F_{\rm r}+F_{\rm a}$ Static Equivalent Load $P_0=2.8F_{\rm r}+F_{\rm a}$ However, $F_{\rm r}/F_{\rm a} {\le} 0.55$ must be satisfied.

		Dimensior nm)	าร		Basic Load (N)	•	.gf}	Limiting Speeds	Bearing
d	D	T	r min.	C_{a}	C_{0a}	C_{a}	C_{0a}	(min ⁻¹) Oil	Numbers
220	300	48	2	560 000	2 500 000	57 000	255 000	1 400	29244
	360	85	4	1 340 000	5 200 000	137 000	530 000	950	29344
	420	122	6	2 350 000	8 650 000	240 000	880 000	800	29444
240	340	60	2.1	800 000	3 450 000	82 000	350 000	1 200	29248
	380	85	4	1 360 000	5 400 000	139 000	550 000	950	29348
	440	122	6	2 420 000	9 100 000	247 000	930 000	750	29448
260	360	60	2.1	855 000	3 850 000	87 500	395 000	1 200	29252
	420	95	5	1 700 000	6 800 000	173 000	695 000	800	29352
	480	132	6	2 820 000	10 700 000	287 000	1 090 000	710	29452
280	380	60	2.1	885 000	4 100 000	90 000	420 000	1 100	29256
	440	95	5	1 830 000	7 650 000	187 000	780 000	800	29356
	520	145	6	3 400 000	13 100 000	345 000	1 330 000	630	29456
	520	145	6	3 950 000	14 900 000	400 000	1 520 000	630	29456 EM
300	420	73	3	1 160 000	5 150 000	118 000	525 000	950	29260
	480	109	5	2 190 000	9 100 000	224 000	925 000	710	29360
	540	145	6	3 500 000	13 700 000	355 000	1 390 000	630	29460
320	440	73	3	1 190 000	5 450 000	122 000	555 000	950	29264
	500	109	5	2 230 000	9 400 000	227 000	960 000	670	29364
	580	155	7.5	3 650 000	14 600 000	370 000	1 490 000	560	29464
340	460	73	3	1 230 000	5 750 000	125 000	590 000	900	29268
	540	122	5	2 640 000	11 200 000	269 000	1 140 000	630	29368
	620	170	7.5	4 400 000	17 400 000	450 000	1 780 000	530	29468
360	500	85	4	1 550 000	7 300 000	158 000	745 000	800	29272
	560	122	5	2 670 000	11 500 000	272 000	1 180 000	600	29372
	640	170	7.5	4 200 000	17 200 000	430 000	1 750 000	500	29472
	640	170	7.5	5 450 000	20 400 000	555 000	2 800 000	500	29472 EM
380	520	85	4	1 620 000	7 800 000	165 000	795 000	800	29276
	600	132	6	3 300 000	14 500 000	335 000	1 480 000	560	29376
	670	175	7.5	4 800 000	19 500 000	490 000	1 990 000	480	29476
400	540	85	4	1 640 000	8 000 000	167 000	815 000	750	29280
	620	132	6	3 250 000	14 500 000	330 000	1 480 000	530	29380
	710	185	7.5	5 400 000	22 100 000	550 000	2 250 000	450	29480
420	580	95	5	2 010 000	9 800 000	205 000	1 000 000	670	29284
	650	140	6	3 500 000	15 700 000	355 000	1 600 000	500	29384
	730	185	7.5	5 650 000	23 500 000	575 000	2 400 000	450	29484

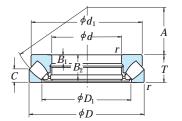
		Dimer (m					ment and ensions (r		Mass (kg)
$d_{\scriptscriptstyle 1}$	D_1	B_1	B_2	С	A	d _a (1) min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	approx.
285	254	15	46	24	117	260	275	2	9.2
335	280	29	81	41	125	285	315	3	33
385	308	43	117	58	132	310	355	5	74
325	283	19	57	30	130	285	305	2	16.5
355	300	29	81	41	135	300	330	3	35.5
405	326	43	117	59	142	330	375	5	79
345	302	19	57	30	139	305	325	2	18
390	329	32	91	45	148	330	365	4	48.5
445	357	48	127	64	154	360	405	5	105
365	323	19	57	30	150	325	345	2	19
410	348	32	91	46	158	350	390	4	52.5
480	384	52	140	68	166	390	440	5	132
480	380	52	140	70	166	410	445	5	134
400	353	21	69	38	162	355	380	2.5	30
450	379	37	105	50	168	380	420	4	74
500	402	52	140	70	175	410	460	5	140
420	372	21	69	38	172	375	400	2.5	32.5
470	399	37	105	53	180	400	440	4	77
555	436	55	149	75	191	435	495	6	175
440	395	21	69	37	183	395	420	2.5	33.5
510	428	41	117	59	192	430	470	4	103
590	462	61	164	82	201	465	530	6	218
480	423	25	81	44	194	420	455	3	51
525	448	41	117	59	202	450	495	4	107
610	480	61	164	82	210	485	550	6	228
580	474	61	164	83	210	495	550	6	220
496	441	27	81	42	202	440	475	3	52
568	477	44	127	63	216	480	525	5	140
640	504	63	168	85	230	510	575	6	254
517	460	27	81	42	212	460	490	3	55
590	494	44	127	64	225	500	550	5	150
680	536	67	178	89	236	540	610	6	306
553	489	30	91	46	225	490	525	4	72
620	520	48	135	68	235	525	575	5	170
700	556	67	178	89	244	560	630	6	323

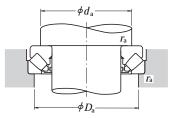
Note (1) For heavy load applications, a d_a value should be chosen which is large enough to support the shaft washer rib.

B 230 B 231

Bore Diameter 440 – 500 mm







Dynamic Equivalent Load $P=1.2F_{\rm r}+F_{\rm a}$ Static Equivalent Load $P_0=2.8F_{\rm r}+F_{\rm a}$ However, $F_{\rm r}/F_{\rm a}\!\leq\!0.55$ must be satisfied.

	,	Dimension nm)	S		Basic Load	Limiting Speeds	Bearing	
d	D	T	r min.	C_{a}	$C_{0\mathrm{a}}$	C_{a} C_{0a}	(min ⁻¹) Oil	Numbers
440	600 680 780 780	95 145 206 206	5 6 9.5 9.5	2 030 000 3 750 000 6 550 000 8 000 000	10 100 000 16 700 000 27 200 000 31 500 000	207 000	670 480 400 400	29288 29388 29488 29488 EM
460	620 710 800	95 150 206	5 6 9.5	2 060 000 4 100 000 6 750 000	10 300 000 18 400 000 28 600 000	210 000	670 450 380	29292 29392 29492
480	650 730 850	103 150 224	5 6 9.5	2 370 000 4 150 000 7 200 000	12 100 000 19 000 000 31 000 000	241 000	600 450 360	29296 29396 29496
500	670 750 870	103 150 224	5 6 9.5	2 390 000 4 350 000 7 850 000	12 400 000 20 400 000 33 000 000	244 000	600 450 340	292/500 293/500 294/500

Note (1) For heavy load applications, a d_a value should be chosen which is large enough to support the shaft washer rib.

			nsions m)			Abuti Dime	Mass (kg)		
$d_{\scriptscriptstyle 1}$	D_1	B_1	B_2	С	A	$d_{\!\!\!a}^{(1)}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	approx.
575	508	30	91	49	235	510	545	4	77
645	548	49	140	70	245	550	600	5	190
745	588	74	199	100	260	595	670	8	407
710	577	74	199	101	257	605	675	8	402
592	530	30	91	46	245	530	570	4	80
666	567	51	144	72	257	575	630	5	210
765	608	74	199	100	272	615	690	8	420
624	556	33	99	55	259	555	595	4	97
690	590	51	144	72	270	595	650	5	215
810	638	81	216	108	280	645	730	8	545
645	574	33	99	55	268	575	615	4	100
715	611	51	144	74	280	615	670	5	220
830	661	81	216	107	290	670	750	8	560

ANGULAR CONTACT THRUST BALL BEARINGS

DOUBLE-DIRECTION ANGULAR
CONTACT THRUST BALL BEARINGS
ANGULAR CONTACT THRUST

Bore Diameter 35 – 280mm B238

BALL BEARINGS FOR BALL SCREWS Bore Diameter 15 – 60mm B242





DOUBLE-DIRECTION ANGULAR CONTACT THRUST BALL BEARINGS

Double-Direction Angular Contact Thrust Ball Bearings are specially designed high precision bearings for the main spindles of machine tools.

Compared with the Thrust Ball Bearings in the 511 Series, this type contains more balls of smaller diameter and has a contact angle of 60°. Consequently, the influence of centrifugal force is less and they can withstand higher speed and have higher rigidity.

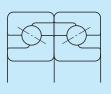
Bearings in Series 20 and 29 have the same inner and outer diameters as the

Bearings in Series 20 and 29 have the same inner and outer diameters as the double-row cylindrical roller bearings in Series NN30 and NN49 respectively, and they are both used for high axial loads.

Their cages are machined brass.

There are the BTR, BAR Series of highly rigid angular contact ball bearings suitable for high speed that can be easily replaced by these double- direction angular contact ball bearings. For more details, please contact NSK.





Bearings of this type were specially designed to support NSK Precision Ball Screws. They are usually used in combinations of more than two bearings and with a preload. Their contact angle is 60°. For more details, please refer to Catalog CAT. No. E1254 SUPER PRECISION BEARINGS.

Their cages are molded polyamide.

TOLERANCES AND RUNNING ACCURACY

DOUBLE-DIRECTION ANGULAR CONTACT THRUST
BALL BEARINGS Table 1

ANGULAR CONTACT THRUST BALL BEARINGS FOR
BALL SCREWS Table 2

The limiting chamfer dimensions of bearings of both types conform to Table 8.9.1

(Page A78).

Table 1 Tolerances for Double-Direction Angular Contact Thrust Ball Bearings (Class 7 (1))

Table 1. 1 Tolerances for Bearing Bore and Height and Running Accuracy

Units: μm

Nominal Boo	1	Δα	/ mp	Δ	l _{Ts}	K_{ia} (or K_{ea})	S_d	$S_{i\mathrm{a}}$ (or S_{ea})
over	incl.	high	low	high	low	max.	max.	max.
_	30	0	- 5	0	- 300	5	4	3
30	50	0	- 5	0	- 400	5	4	3
50	80	0	- 8	0	- 500	6	5	5
80	120	0	- 8	0	- 600	6	5	5
120	180	0	-10	0	- 700	8	8	5
180	250	0	-13	0	- 800	8	8	6
250	315	0	-15	0	- 900	10	10	6
315	400	0	-18	0	-1200	10	12	7

Note (1) Class 7 is NSK Standard.

Table 1. 2 Tolerances for Housing Washer

Outside Diameter Units : μm

Nominal Outsi		Δ	Ds
over	incl.	high	low
30	50	-25	- 41
50	80	-30	- 49
80	120	-36	- 58
120	180	-43	- 68
180	250	-50	- 79
250	315	-56	- 88
315	400	-62	- 98
400	500	-68	-108
500	630	-76	-120

Symbols in the tables are described on Page A59.

Table 2 Tolerances and Running Accuracy of Angular Contact Thrust Ball Bearings for Ball Screws (Class 7A (1))

Table 2. 1 Tolerances and Limits for Shaft and Housing Washer

Units: µm

									Offits . µIII
Nominal Bor d (mr	!	Δ_d	mp	Δ_{Bs} (c	or $arDelta_{\mathit{C}_{\mathbf{S}}}\!)$	$V_{B\mathrm{s}}$ (or $V_{C\mathrm{s}}$)	K_{ia}	S_d	$S_{i\mathrm{a}}$
over	incl.	high	low	high	low	max.	max.	max.	max.
10	18	0	- 4	0	-120	1.5	2.5	4	2.5
18	30	0	- 5	0	-120	1.5	3	4	2.5
30	50	0	- 6	0	-120	1.5	4	4	2.5
50	80	0	- 7	0	-150	1.5	4	5	2.5

Note (1) Class 7A is NSK Standard.

RECOMMENDED FITS

DOUBLE-DIRECTION ANGULAR CONTACT THRUST BALL BEARINGS

The shaft washer and shaft should be in soft contact with neither interference nor clearance, and the housing washer and housing bore should be loosely fitted. For a bearing arrangement with a double-row cylindrical roller bearing, the tolerances for the outside diameter should be ${\bf f6}$ to produce a loose fit.

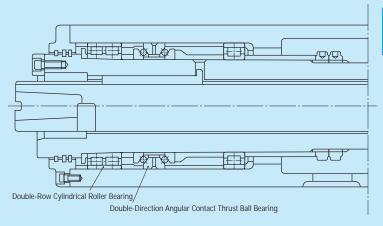
ANGULAR CONTACT THRUST BALL BEARINGS FOR BALL SCREWS

A tolerance of h5 is recommended for shafts and H6 for housing bores.

INTERNAL CLEARANCE AND PRELOAD

In order to produce an appropriate preload on bearings when they are mounted, the following axial internal clearances are recommended.

DOUBLE-ROW ANGULAR CONTACT THRUST	
BALL BEARINGS	Clearance C7
ANGULAR CONTACT THRUST BALL BEARINGS FOR	
BALL SCREWS	Clearance C10



Example of Application of Double-Direction Angular Contact Thrust Ball Bearing (Main Spindle of Machine Tool)

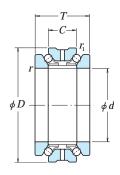
Table 2. 2 Tolerances and Running Accuracy of Housing Washer

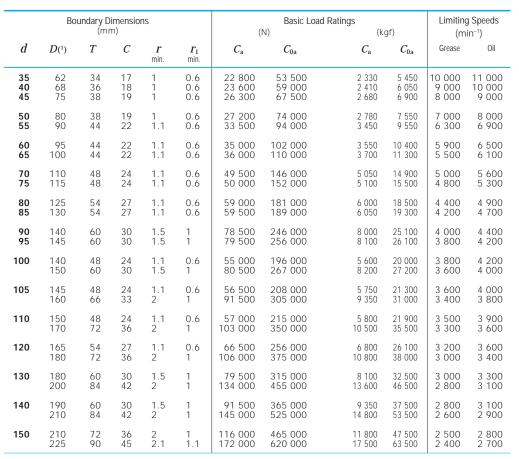
Units : µm

					Offits . µIII
Nominal Outs	side Diameter O m)	Δ	Ds	Kea	$S_{ m ea}$
over	incl.	high	low	max.	max.
30	50	0	- 6	5	2.5
50	80	0	- 7	5	2.5
80	120	0	- 8	5	2.5

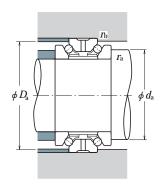
B 236 B 237

Bore Diameter 35 – 150 mm







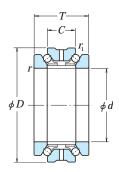


2	Abutm	nent and F (m	illet Dime m)	ensions	Mass (kg)
Bearing Numbers	$d_{\scriptscriptstyle \mathrm{a}}$	$D_{\rm a}$	$m{r}_{ m a}$ max.	$r_{ m b}$ max.	approx.
35 TAC 20X+L	46	58	1	0.6	0.375
40 TAC 20X+L	51	63	1	0.6	0.460
45 TAC 20X+L	57	70	1	0.6	0.580
50 TAC 20X+L	62	75	1	0.6	0.625
55 TAC 20X+L	69	84	1	0.6	0.945
60 TAC 20X+L	74	89	1	0.6	1.000
65 TAC 20X+L	79	94	1	0.6	1.080
70 TAC 20X+L	87	104	1	0.6	1.460
75 TAC 20X+L	92	109	1	0.6	1.550
80 TAC 20X+L	99	117	1	0.6	2.110
85 TAC 20X+L	104	122	1	0.6	2.210
90 TAC 20X+L	110	131	1.5	1	2.930
95 TAC 20X+L	115	136	1.5	1	3.050
100 TAC 29X+L	117	134	1	0.6	1.950
100 TAC 20X+L	120	141	1.5	1	3.200
105 TAC 29X+L	122	139	1	0.6	2.040
105 TAC 20X+L	127	150	2	1	4.100
110 TAC 29X+L	127	144	1	0.6	2.120
110 TAC 20X+L	134	158	2	1	5.150
120 TAC 29X+L	139	157	1	0.6	2.940
120 TAC 20X+L	144	168	2	1	5.500
130 TAC 29X+L	150	170	1.5	1	3.950
130 TAC 20X+L	160	187	2	1	8.200
140 TAC 29D+L	158	182	1.5	1	4.200
140 TAC 20D+L	167	198	2	1	8.750
150 TAC 29D+L	172	200	2	1	6.600
150 TAC 20D+L	178	213	2	1	10.700

Remarks Nominal bearing bore and outside diameters for 20X · 20D and 29X · 29D bearing series are the same as those for the NN30 and NNU49 · NN49 bearing series respectively.

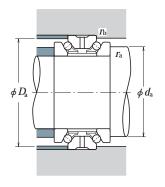


Bore Diameter 160 – 280 mm



	Вс	oundary D (mr		ns		Basic Load Ratings (N) {kgf}			.af}	Limiting Speeds (min ⁻¹)	
d	$D^{(1)}$	T	С	$m{r}$ min.	$r_{\scriptscriptstyle 1}$ min.	C_{a}	C_{0a}	C_{a}	C_{0a}	Grease	Oil
160	220 240	72 96	36 48	2 2.1	1 1.1	118 000 185 000	490 000 680 000	12 100 18 900	50 000 69 500	2 400 2 300	2 700 2 500
170	230 260	72 108	36 54	2 2.1	1 1.1	120 000 218 000	520 000 810 000	12 300 22 200	53 000 82 500	2 300 2 100	2 500 2 400
180	250 280	84 120	42 60	2 2.1	1 1.1	158 000 281 000	655 000 1 020 000	16 100 28 700	67 000 104 000	2 100 2 000	2 400 2 200
190	260 290	84 120	42 60	2 2.1	1 1.1	161 000 285 000	695 000 1 060 000	16 400 29 000	71 000 108 000	2 000 1 900	2 300 2 100
200	280 310	96 132	48 66	2.1 2.1	1.1 1.1	204 000 315 000	855 000 1 180 000	20 800 32 000	87 000 120 000	1 900 1 800	2 100 2 000
220	300	96	48	2.1	1.1	210 000	930 000	21 400	95 000	1 800	2 000
240	320	96	48	2.1	1.1	213 000	980 000	21 700	100 000	1 700	1 800
260	360	120	60	2.1	1.1	315 000	1 390 000	32 000	141 000	1 500	1 700
280	380	120	60	2.1	1.1	320 000	1 470 000	32 500	150 000	1 400	1 600

Note (1) Outside tolerance is f6.

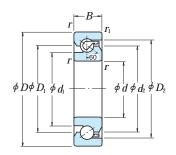


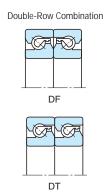
Davidso Nasakasa	Abutm	nent and F (m		nsions	Mass (kg)
Bearing Numbers	$d_{\scriptscriptstyle m a}$	$D_{\rm a}$	$oldsymbol{r_{\mathrm{a}}}{}_{\mathrm{max.}}$	$r_{ m b}$ max.	approx.
160 TAC 29D+L 160 TAC 20D+L	182 191	210 228	2 2	1 1	7.000 13.000
170 TAC 29D+L 170 TAC 20D+L	192 206	219 245	2 2	1 1	7.350 17.700
180 TAC 29D+L 180 TAC 20D+L	207 220	238 264	2 2	1 1	10.700 23.400
190 TAC 29D+L 190 TAC 20D+L	217 230	247 274	2 2	1 1	11.200 24.400
200 TAC 29D+L 200 TAC 20D+L	230 245	267 291	2 2	1 1	15.700 31.500
220 TAC 29D+L	250	287	2	1	17.000
240 TAC 29D+L	270	307	2	1	18.300
260 TAC 29D+L	300	344	2	1	31.500
280 TAC 29D+L	320	364	2	1	33.500

Remarks Nominal bearing bore and outside diameters for 20X · 20D and 29X · 29D bearing series are the same as those for the NN30 and NNU49 · NN49 bearing series respectively.

B 240 B 241

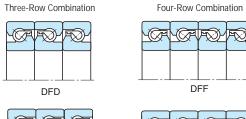
Bore Diameter 15 – 60 mm

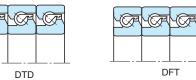




	Boundary Dimensions (mm)			5		Dimensions (mm)			Limiting S (mir		Dogring Numbers	Mass (kg)
d	D	В	$m{r}$ min.	$oldsymbol{r_1}{ ext{min.}}$	$d_{\scriptscriptstyle 1}$	d_2	D_1	D_2	Grease	Oil	Bearing Numbers	approx.
15 17 20 25	47 47 47 62	15 15 15 15	1 1 1 1	0.6 0.6 0.6 0.6	27.2 27.2 27.2 37	34 34 34 45	34 34 34 45	39.6 39.6 39.6 50.7	6 000 6 000 6 000 4 500	8 000 8 000 8 000 6 000	15 TAC 47B 17 TAC 47B 20 TAC 47B 25 TAC 62B	0.144 0.144 0.135 0.252
30 35	62 72	15 15	1 1	0.6 0.6	39.5 47	47 55	47 55	53.2 60.7	4 300 3 600	5 600 5 000	30 TAC 62B 35 TAC 72B	0.224 0.31
40	72 90	15 20	1 1	0.6 0.6	49 57	57 68	57 68	62.7 77.2	3 600 3 000	4 800 4 000	40 TAC 72B 40 TAC 90B	0.275 0.674
45 50	75 100 100	15 20 20	1 1 1	0.6 0.6 0.6	54 64 67.5	62 75 79	62 75 79	67.7 84.2 87.7	3 200 2 600 2 600	4 300 3 600 3 400	45 TAC 75B 45 TAC 100B 50 TAC 100B	0.27 0.842 0.778
55 60	100 120 120	20 20 20	1 1 1	0.6 0.6 0.6	67.5 82 82	79 93 93	79 93 93	87.7 102.2 102.2	2 600 2 200 2 200	3 400 3 000 3 000	55 TAC 100B 55 TAC 120B 60 TAC 120B	0.714 1.23 1.16

Note (1) These values apply when the standard preload (C10) is used.





Y	<u> </u>			Dynamic Eq $P_{ m a} = XI$	uivalent Lo F _r + <i>YF</i> _a	oad							
			Rows		Two Rows		Three Rows		Four Rows				
 DFF		L	L '	Con	nbination	DF	DT	DI	FD	DTD	DFT	DFF	DFT
JFF				e=2.17	Axial Load Sustained by	One Row	Two Rows	One Row	Two Rows	Three Rows	One Row	Two Rows	Three Rows
3\F	酒			E /E <	X	1.9	_	1.43	2.33	_	1.17	2.33	2.53
上	× \			$F_{\rm a}/F_{\rm r} \le$	Y	0.55	_	0.77	0.35	_	0.89	0.35	0.26
					Χ	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

	Basic Load Ratings $C_{ m a}$			Limiting Axial Load	
Sustained by	Sustained by	Sustained by	Sustained by	Sustained by	Sustained by
one row	two rows	three rows	one row	two rows	three rows
DF	DT, DFD, DFF	DTD, DFT	DF	DT, DFD, DFF	DTD, DFT
(N) {kgf}	(N) {kgf}	(N) {kgf}	(N) {kgf}	(N) {kgf}	(N) {kgf}
21 900 2 240	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
21 900 2 240	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
21 900 2 240	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
28 500 2 910	46 500 4 700	61 500 6 250	40 500 4 150	81 500 8 300	122 000 12 500
29 200 2 980	47 500 4 850	63 000 6 400	43 000 4 400	86 000 8 800	129 000 13 200
31 000 3 150	50 500 5 150	67 000 6 850	50 000 5 100	100 000 10 200	150 000 15 300
31 500 3 250	51 500 5 250	68 500 7 000	52 000 5 300	104 000 10 600	157 000 16 000
59 000 6 000	95 500 9 750	127 000 13 000	89 500 9 150	179 000 18 300	269 000 27 400
33 000 3 350	53 500 5 450	71 000 7 250	57 000 5 800	114 000 11 600	170 000 17 400
61 500 6 300	100 000 10 200	133 000 13 600	99 000 10 100	198 000 20 200	298 000 30 500
63 000 6 400	102 000 10 400	136 000 13 800	104 000 10 600	208 000 21 200	310 000 32 000
63 000 6 400	102 000 10 400	136 000 13 800	104 000 10 600	208 000 21 200	310 000 32 000
67 500 6 850	109 000 11 200	145 000 14 800	123 000 12 600	246 000 25 100	370 000 37 500
67 500 6 850	109 000 11 200	145 000 14 800	123 000 12 600	246 000 25 100	370 000 37 500



NEEDLE ROLLER BEARINGS

CAGE & NEEDLE ROLLER ASSEMBLIES Inscribed Circle Diameter 5 – 100mm···· B252

Cage & Needle Roller Assemblies for Connecting Rod Inscribed Circle Diameter 12 – 30mm··· B256

DRAWN CUP NEEDLE ROLLER BEARINGS

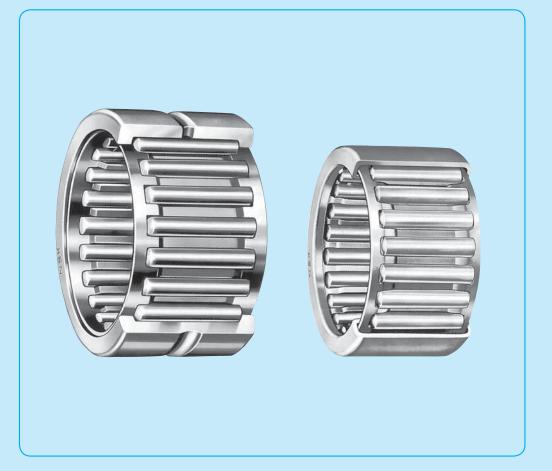
With Cage
Full Complement Type
Inscribed Circle Diameter
Inscribed Cir



For needle roller bearings, there are many designs and types bearings. Catalog

Specified catalog, NSK Needle Roller Bearings CAT.No.E1419 lists bearings shown in Table 1. Representative examples selected from them, are shown in this catalog. (shown with in Table 1) For details, please refer individual specified catalog.

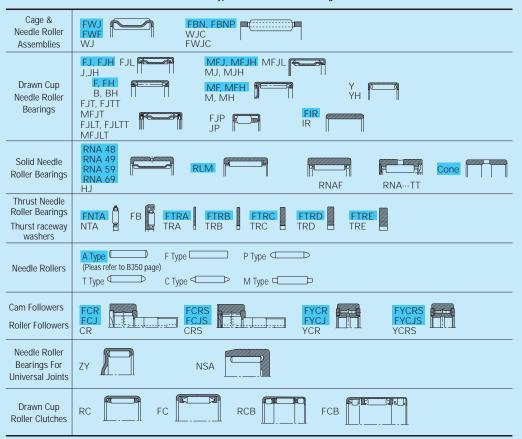
For bearing selection, please contact NSK.



B 244 B 245



Table 1 Types of Needle Roller Bearings



DIMENSIONAL ACCURACY · RUNNING ACCURACY

DRAWN CUP NEEDLE ROLLER BEARINGS

The correct form and dimensional accuracy of outer ring of drawn cup needle roller bearing is achieved only by press fitting into proper housing with appropriate interference. Therefore, roller inscribed circle diameter is measured after press fitted into a standard ring gauge.

The dimension of ring gauge and tolerance of roller inscribed circle diameter are shown in Tables 2 and 3.

Table 2 is applicable to standard drawn cup needle roller bearings (metric series), and Table 3 shows tolerance of roller inscribed circle diameter based on ISO Standards. For bearings assured by ISO Standards, please order by adding symbol of "-1" at the end of bearing number.

Table 2 Inspection Gauge Dimensions (General Metric) of Drawn Cup Needle Roller Bearings.

(FJ, FJH, MFJ, MFJH) F, FH, MF, MFH

	\1,111,1VII,1V	,	Units mm
Nominal Roller Inscribed	Bore Diameter	Plug	Gauge
Circle Diameter, $F_{ m w}$	of Ring Gauge	GO Gauge	NO-GO Gauge
4	7. 996	4. 023	4. 048
5	8. 996	5. 023	5. 048
6	9. 996	6. 028	6. 053
7	10. 995	7. 031	7. 056
8	11. 995	8. 031	8. 056
9	12. 995	9. 031	9. 056
10	13. 995	10. 031	10. 056
12	15. 995	12. 031	12. 056
FH 12	17. 995	12. 031	12. 056
13	18. 993	13. 034	13. 059
14	19. 993	14. 034	14. 059
15	20. 993	15. 034	15. 059
16	21. 993	16. 034	16. 059
17	22. 972	17. 013	17. 038
18	23. 972	18. 013	18. 038
20	25. 972	20. 013	20. 038
22	27. 972	22. 013	22. 038
25	31. 967	25. 013	25. 038
28	34. 967	28. 013	28. 038
30	36. 967	30. 013	30. 038
35	41. 967	35. 013	35. 043
40	46. 967	40. 013	40. 043
45	51. 961	45. 013	45. 043
50	57. 961	50. 013	50. 043
55	62. 961	55. 013	55. 043

Remarks This is the gauge dimension for Inspection of minimum diameter, F_{wmin} , of roller inscribed circle diameter.

Table 3 Ring Gauge of Drawn Cup Needle Roller Bearings and Tolerance of Roller Inscribed Circle Diameter (ISO Standards)

(FJ, FJH, MFJ and MFJH) F, FH, MF and MFH

Units mm							
Nominal Roller Inscribed	Bore Diameter of Ring Gauge	Tolerance for R Circle Diamet					
Circle Diameter, $F_{ m w}$	or King Gauge	min.	max.				
4	7. 984	4. 010	4. 028				
5	8. 984	5. 010	5. 028				
6	9. 984	6. 010	6. 028				
7	10. 980	7. 013	7. 031				
8	11. 980	8. 013	8. 031				
H 8	13. 980	8. 013	8. 031				
9	12. 980	9. 013	9. 031				
H 9	14. 980	9. 013	9. 031				
10	13. 980	10. 013	10. 031				
H 10	15. 980	10. 013	10. 031				
12	15. 980	12. 016	12. 034				
H 12	17. 980	12. 016	12. 034				
13	18. 976	13. 016	13. 034				
14	19. 976	14. 016	14. 034				
15	20. 976	15. 016	15. 034				
16	21. 976	16. 016	16. 034				
17	22. 976	17. 016	17. 034				
18	23. 976	18. 016	18. 034				
20	25. 976	20. 020	20. 041				
22	27. 976	22. 020	22. 041				
25	31. 972	25. 020	25. 041				
28	34. 972	28. 020	28. 041				
30	36. 972	30. 020	30. 041				
35	41. 972	35. 025	35. 050				
40	46. 972	40. 025	40. 050				
45	51. 967	45. 025	45. 050				
50	57. 967	50. 025	50. 050				
55	62. 967	55. 030	55. 060				

Note (1) When using a cylinder instead of an inner ring, F_{wmin} is the diameter of the cylinder at which the internal clearance is zero in at least one radial direction. (F_{wmin} is the minimum diameter of each inscribed circle diameter where deviation is assumed.)

Remarks To measure the roller inscribed circle diameter, use the following plug gauges:

GO gauge: The same dimensions as the minimum tolerance of the roller inscribed circle diameter $F_{
m wmin}$.

NO-GO gauge: The dimensions should be the maximum tolerance of roller inscribed circle diameter, $F_{
m wmin}$, plus 0.002 mm.

SOLID NEEDLE ROLLER BEARINGS Table 8. 2 (A60-63 pages)

Tolerance of roller inscribed circle diameter for solid needle roller bearings without inner rings are shown in Table 4.

Table 4 Inscribed Circle Diameter for Metric Solid
Needle Roller Bearings

Nee	die Roller Be	earings	Units µm
Nominal II Circle Dian (mr	neter, $F_{ m w}$	Deviation (F6) Diameter, F _w Inscribed Circle D △ F	_{min} , of Roller Diameter $F_{ m wmin}$
over	incl.	high	low
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) When using a cylinder instead of an inner ring, $F_{\rm wmin}$ is the diameter of the cylinder at which the internal clearance is zero in at least one radial direction. ($F_{\rm wmin}$ is the minimum diameter of each inscribed circle diameter where deviation is assumed.)

CAM FOLLOWERS · ROLLER FOLLOWERS · Table 8. 2 (A60-63 pages)

The tolerance zone class of stud diameter d of cam followers is h7, and the tolerance of assembled width of inner ring of roller followers is shown in bearing table.

These tolerances are applied to the bearings before surface treatment.

Cam Follower Dimensional Tolerences is always applited to the bearing before surface treatment.

RECOMMENDED FITTING AND BEARING INTERNAL CLEARANCE CAGE & NEEDLE ROLLER ASSEMBLIES

Recommended fitting of cage & roller under typical operating condition is shown in Table 5. By combining cage & roller, shaft, and housing, appropriate radial internal clearance is obtained. However, the fitting and the radial internal clearance of cage & roller for connecting rod should be determined by the type of engine, characteristic, and driving condition etc.. For details, please refer to specified catalog.

Table 5 Fitting Tolerances for Shafts and Housing Bores

	Fitting Tolerance				
Operating Conditions	sh	housing bore			
	$F_{\rm w} \leq$ 50 mm	$F_{\rm w}>$ 50 mm	Tiousing bore		
High Accuracy, Oscillating Motion	js5 (j5)	h5			
Normal	h5	g5	G6		
High Temperature, Large Shaft Deflection	f				
and Mounting Error of Bearings	1				

DRAWN CUP NEEDLE ROLLER BEARINGS

For FJ, FJH, and MFJH types and F, FH, and MFH types, if tolerance of fitting such as shaft:h6, and housing bore:N7 (in case of thick steel housing), are applied under general operating condition, appropriate radial internal clearance is obtained. In case that outer ring rotation, the fitting of shaft: f6, housing bore: R7, and light alloy housing or steel housing of less than 6mm thickness, the housing bore should be smaller than N7 by 0.013-0.025 mm.

SOLID NEEDLE ROLLER BEARINGS

Recommended fitting for solid needle roller bearings with inner rings

Table 9. 2 (Page A84) Table 9. 4 (Page A85)

Internal clearance of solid needle roller bearings with inner rings

Table 9. 14 (Page A91)

However, for needle roller bearing of wider bearing width, and with long needle rollers, bearings with CN clearance are not necessarily common, but large clearance is selected frequently. For the solid needle roller bearing without inner ring, it is possible to select radial internal clearance shown in Table 6 by selecting tolerance class of shaft, which is fitting to the bearing.

Table 6 Fitting Tolerances and Radial Internal clearance of Shafts Assembled with Solid Needle Roller Bearings without Inner Rings

Nominal Roll Circle Diamet			CN	C3	C4	
over	incl.					
6	180	k5	g5	f6	e6	
180	315	j6	f6	e6	d6	
315	490	h6	e6	d6	с6	

THRUST NEEDLE ROLLER BEARINGS

Recommended Fitting of Thrust Needle Roller Bearings and Thrust Raceway are shown in Table 7.

Table 7 Recommended Fitting of Thrust Needle Roller Bearings and Thrust Raceway

Units m

Classification	Tuno	Cage or	Tolerance class or dimension tolerance		
Ciassification	Type	raceway guide	Shaft	Housing bore	
Thrust Needle Bearing Cage	FNTA	Bore	h8	D _c (1)+over 1.0	
& Needle Roller Assemblies	FINIA	Outside	_	H10	
Thrust Bearing Rings	FTRA to FTRE	Bore	h8	D _c (1)+over 1.0	
Thrust bearing Rings	TINATOTIKE	Outside	_	H10	

Note (1) D_c represents outside diameter of the cage.

Remarks If the cage is guided by outside diameter, to prevent the wear of housing bore, it is necessary to harden the surface at least.

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CAM FOLLOWERS · ROLLER FOLLOWERS

The recommended fittings for the mounting area of cam follower studs are shown in Table 8. Recommended shaft fittings of roller follower are shown in Table 9.

Since cam followers are used with cantilevered mounting, they should be fixed with little clearance of the fitting surface as much as possible.

Since a roller follower is generally used with outer ring rotation, the fitting with shaft is transition or loose fit. In case that heavy loads impose to the roller follower, it is recommended to use the shaft of quench hardening treatment, and with tight fit.

For the details, please refer to specified catalog.

Table 8 Recommended Fitting for Stud Mounting Part of Cam Followers

Туре	Fitting Tolerance of Mounting Hole		
FCR, FCRS FCJ, FCJS	JS7 (J7)		
165, 1655			

Table 9 Recommended Staft Fittings of Roller Followers

Load	Fitting Tolerance of Shaft
Light Load/Normal Load	g6 or h6
Heavy Load	k6

SHAFT AND HOUSING SPECIFICATIONS

The specification of shaft and housing for radial needle roller bearings, which are used under general operating condition, is shown in Table 10.

Table 10 Shaft and housing Specifications of Radial Needle Roller Bearings (Cage & Needle Roller Assemblies/Drawn Cup Bearings/Solid Bearings)

Category	Sh	aft	Housing Bore			
Category	Raceway Surface	Fitting Surface	Raceway Surface	Fitting Surface		
Out-of-Roundness	IT3	IT3 IT4	IT3	IT4 IT5		
Tolerance	$\frac{\text{IT 3}}{2}$	$\frac{\text{IT3}}{2}$ to $\frac{\text{IT4}}{2}$	2	$\frac{IT4}{2}$ to $\frac{IT5}{2}$		
Cylindricity	IT3	IT3 IT3 IT4		IT4 IT5		
Tolerance	$\frac{\text{IT 3}}{2}$	$\frac{\text{IT 3}}{2}$ to $\frac{\text{IT 4}}{2}$	$\frac{\text{IT3}}{2}$	$\frac{\text{IT 4}}{2}$ to $\frac{\text{IT 5}}{2}$		
Roughness	0.4	0.8	0.8	1.6		
$R_a(\mu m)$	0.4		0.6	1.0		
Hardness	HRC58 to 64 Appropriate depth of hardening layer required	_	HRC58 to 64 Appropriate depth of hardening layer required	_		

Remarks 1. For the specification of shaft and housing of cage & needle roller assembly for connecting rod, please refer to specified catalog.

2. These are general recommendation by radius method. For the value of standard tolerance (IT), please refer to Appendix 11 (page C22)

Specifications of Thrust Bearings Raceway Surface are shown in Table 11.

Table 11 Specifications of Thrust Bearings Raceway Surface

Squareness A	0.5/1000 incl (mm/mm)	
Squareness B	1.0/1000 incl (mm/mm)	
Roughness R _a (µm)	0.4	_
Hardness	HRC58 to 64 (HRC60 to 64 is fovorable)	_

LIMITING INCLINATION ANGLES

The limiting inclination angle of radial needle roller bearing under general load condition is 0.001 radian (3.4') approximately. For the detail, please refer to specified catalog.,

PERMISSBLE TRACK LOAD

Table 12 Permissble Load

Hardness

(HRC)

20

25

30

35 40

45

50

55

58

Coefficient of Track

Coefficient

0.4

0.5

0.6

0.8

1.0

1.4

1.9

2.6

3.2

The permissble load of the track is determined by compression strength or hardness. The permissble load of the track shown in the bearing table is value of a track made of steel with a hardness of HRC40. Table 12 indicates the permissible load coefficient of the track for each hardness.

The permissible load of the track for each hardness can be obtained by multiplying the permissible load coefficient of the track corresponding to each hardness.

PRE-PACKED GREASE

The cam follower/roller follower with a seal is pre-lubricated with lithium soap-based grease. The range of operating temperature is -10 to $+110\,^{\circ}\text{C}$. For the cam follower/roller follower without seal, please lubricate with suitable lubricant.

MAXIMUM PERMISSIBLE LOAD AND MAXIMUM CLAMP TORQUE OF CAM FOLLOWERS.

The maximum radial Load that the cam follower can carry is determined by the bearing strengh and shear strengh of the stud rather than the Load rating for neele bearings. This value is given in the bearing table as the maximum permissible Load.

Since the stud of the cam follower receives bending stress and tensile stress from the bearing Load, the screw clamp torque should not exceed the value shown in the bearing table.

LIMITING SPEED

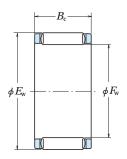
The limiting speeds of bearings are shown in bearing tables. However, depending on load condition of the bearing, the limiting speeds are necessary to compensate. Also, improvement of lubrication method allows to take higher limiting speed. For the detail, please refer to A37 page.

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FWF • FWJ

Inscribed Circle Diameter 5 – 22 mm



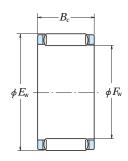
Bound	dary Dimen (mm)	sions		Basic Loa	ad Ratings	{kgf}			Limiting Speeds (min ⁻¹)	
$F_{ m W}$	$E_{ m W}$	$B_{ m C}^{^{-0.2}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	C		$C_{0\mathrm{r}}$	Grease	Oil	
5 6	8 9 9	8 8 10	2 330 2 200 3 350	1 860 1 780 3 050	2	37 24 40	189 182 310	60 000 48 000 48 000	95 000 75 000 75 000	
7	10 10	8 10	2 840 3 650	2 560 3 550	2	90 75	261 360	40 000 40 000	67 000 67 000	
8	11 11	10 13	3 950 4 750	4 000 5 150		00 85	410 525	34 000 34 000	56 000 56 000	
9	12 12	10 13	3 750 5 100	3 850 5 750		80 20	395 585	30 000 30 000	50 000 50 000	
10	13 13 14	10 13 13	3 950 5 400 6 500	4 300 6 350 6 750	5	05 50 60	435 650 690	28 000 28 000 28 000	45 000 45 000 45 000	
12	15 15 16	10 13 13	4 350 5 950 7 350	5 100 7 600 8 350	6	45 05 50	520 775 850	22 000 22 000 22 000	36 000 36 000 38 000	
14	18 18 20	10 13 17	6 750 8 050 13 400	7 750 9 750 14 600		90 20 70	790 995 1 490	19 000 19 000 20 000	32 000 32 000 32 000	
15	19 19 21	10 13 17	7 050 8 400 13 400	8 400 10 500 14 800			855 1 070 1 510	18 000 18 000 19 000	28 000 28 000 30 000	
16	20 20 22	10 13 17	7 350 8 800 14 700	9 000 11 300 16 900			920 1 150 1 720	17 000 17 000 17 000	26 000 26 000 28 000	
17	21 21 23	10 13 17	7 650 10 200 15 100	9 650 14 000 17 800	7 1 0 1 5		985 1 420 1 810	16 000 16 000 16 000	26 000 26 000 26 000	
18	22 22 24	10 13 17	7 900 9 450 17 400	10 300 12 900 21 600		65	1 050 1 310 2 210	15 000 15 000 15 000	24 000 24 000 24 000	
20	24 24 26	10 13 17	8 000 9 700 18 000	10 700 13 700 23 200		90	1 090 1 400 2 370	13 000 13 000 14 000	20 000 20 000 22 000	
22	26 26 28	10 13 17	8 600 10 300 17 300	12 200 15 300 22 700	8 1 0 1 7	50	1 240 1 560 2 310	12 000 12 000 12 000	19 000 19 000 20 000	

Note (*)	These bearings have polyamide cages. The maximum permissible operating temperature for these bearings is 100 °C
	for continued operation and 120 °C for short periods.

Bearing Numbers	Mass (g)
	approx.
* FBNP-588	1.0
* FBNP-698	1.2
* FBNP-6910	1.5
* FBNP-7108	1.3
* FBNP-71010	1.6
* FBNP-81110	1.8
* FBNP-81113	2.6
* FBNP-91210	2.0
* FBNP-91213	2.6
FBN-101310	2.2
FBN-101313	2.9
FWF-101413	4.0
FBN-121510	2.6
FBN-121513	3.4
FWF-121613	4.6
FWF-141810	4.1
FWF-141813	5.3
FWF-142017	11
FWF-151910	4.3
FWF-151913	5.6
FWF-152117	12
FWF-162010	4.6
FWF-162013	6.0
FWF-162217	12
FWF-172110	4.8
FWJ-172113	6.3
FWF-172317	14
FWF-182210	5.1
FWF-182213	6.6
FWJ-182417	14
FWF-202410	5.6
FWF-202413	7.3
FWJ-202617	15
FWF-222610	6.1
FWF-222613	7.9
FWF-222817	16

NSK

FWF • FWJ Inscribed Circle Diameter 25 – 100 mm



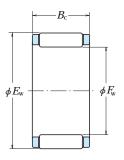
Boundary Dimensions				Basic Load		Limiting Speeds		
	(mm)	-0.2		(N)	{kgf}		(mir	1 ⁻¹)
$F_{ m W}$	$E_{ m W}$	$B_{ m C}$ $^{-0.55}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
25	29 29 31	10 13 17	9 350 11 300 19 200	14 100 18 000 26 800	1 150 1	440 830 740	10 000 10 000 10 000	17 000 17 000 17 000
28	33 33 34	13 17 17	13 700 17 600 19 900	20 400 28 300 29 100	1 800 2	080 890 970	9 500 9 500 9 500	15 000 15 000 15 000
30	35 35 37	13 17 20	14 000 18 700 26 000	21 600 31 500 38 000	1 910 3	200 200 850	8 500 8 500 9 000	14 000 14 000 14 000
32	37 37 39	13 17 20	15 100 18 500 27 300	24 400 31 500 41 000	1 880 3	480 200 200	8 000 8 000 8 500	13 000 13 000 13 000
35	40 40 42	13 17 20	14 900 20 500 30 000	24 600 37 000 47 500	2 090 3	500 750 850	7 500 7 500 7 500	12 000 12 000 12 000
40	45 45 48	17 27 25	21 000 32 000 40 500	40 000 68 000 66 500	3 250 6	050 900 800	6 300 6 300 6 700	10 000 10 000 10 000
45	50 50 53	17 27 25	21 600 34 000 44 000	43 000 77 500 77 000	3 500 7	350 900 850	5 600 5 600 5 600	9 000 9 000 9 500
50	55 55 58	20 27 25	26 900 35 000 48 500	59 000 83 000 90 500	3 600 8	050 450 200	5 000 5 000 5 300	8 000 8 000 8 500
55	61 61 63	20 30 25	31 000 47 000 50 000	64 000 109 000 97 500	4 750 11	500 100 950	4 500 4 500 4 800	7 500 7 500 7 500
60	66 66 68	20 30 25	33 000 50 000 52 000	71 500 122 000 105 000	5 100 12	300 400 700	4 300 4 300 4 300	6 700 6 700 6 700
65 70 75	73 78 83	30 30 30	61 000 63 000 65 000	132 000 140 000 151 000	6 400 14	400 300 400	4 000 3 600 3 400	6 300 6 000 5 600
80 85 90	88 93 98	30 30 30	69 000 71 000 70 000	166 000 176 000 177 000	7 250 17	000 900 000	3 200 3 000 2 800	5 000 4 800 4 500
95 100	103 108	30 30	69 500 75 500	177 000 201 000		100 500	2 600 2 400	4 300 4 000

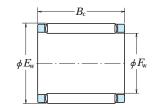
Danis a Novebore	Mass (g)
Bearing Numbers	
	approx.
FWF-252910	6.9
FWF-252913 FWF-253117	8.9 18
FWF-283313	13
FWF-283317 FWF-283417	16 20
FWF-303513	14
FWF-303517A FWF-303720	18 30
FWF-303720 FWF-323713	30 14
FWJ-323717	19
FWF-323920	32
FWF-354013 FWF-354017	16 20
FWJ-354220	34
FWF-404517A FWF-404527	23 36
FWF-404825	56
FWF-455017 FWF-455027	26 41
FWF-455325	62
FWF-505520	37
FWF-505527 FWF-505825	50 77
FWF-556120	53
FWF-556130 FWF-556325	81 85
FWF-606620	57
FWF-606630 FWF-606825	87
FWF-657330	91 120
FWF-707830	125
FWF-758330 FWF-808830	135 145
FWF-859330	150
FWF-909830	160
FWF-9510330 FWF-10010830	175 185

- NSK

Cage & Needle Roller Assemblies for Large Ends of Connecting Rods Inscribed Circle Diameter 12 – 30 mm







Bou	ndary Dimens	ions		Basic Load	Ratings {kgf	F)		Mass (g)
$F_{ m W}$	$E_{ m W}$	$B_{ m C}^{{ m -0.2 \over -0.4}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Bearing Numbers	approx.
12 14	16 19 20	10 10 12	6 100 7 800 8 900	6 500 8 050 8 600	620 795 910	665 820 880	FWF-121610-E FWF-141910-E FWF-142012-E	4.0 6.2 8.3
15	19	9	5 650	6 250	575	640	FWF-15199-E	4.1
	20	10	7 300	7 600	745	775	FWF-152010-E	6.0
	21	10	7 950	7 500	810	765	FWF-152110-E	8.5
16	21	11	8 650	9 600	880	980	FWF-162111-E	7.5
	22	12	9 500	9 600	965	980	FWF-162212-E	9.5
18	23	14	11 800	14 800	1 200	1 510	FWF-182314-E	10
	24	12	10 000	10 600	1 020	1 080	FWF-182412-E	11
20	26	12	12 200	14 100	1 250	1 440	FWF-202612-E	13
	26	17	16 800	21 200	1 710	2 160	FWF-202617-E	17
	28	18	18 100	19 400	1 840	1 970	FWF-202818-E	25
22	28	14	13 900	17 100	1 420	1 740	FWF-222814-E	14
	29	15	16 300	19 000	1 660	1 930	FWF-222915-E	19
	32	16	19 700	19 400	2 010	1 970	FWF-223216-E	31
23 24	31 30 30 31	16 15 17 20	17 600 15 600 17 900 21 600	19 400 20 300 24 300 27 800	1 800 1 590 1 830 2 200	1 980 2 070 2 480 2 840	FWF-233116-E FWF-243015-E FWF-243017-E FWF-243120-E	23 17 19 30
25	32	16	17 700	21 900	1 810	2 230	FWF-253216-E	24
28	35	16	18 400	23 700	1 880	2 410	FWF-283516-E	25
29.75	36.75	16.5	19 600	26 000	1 990	2 650	FWF-293616 Z -E	28
30	37	16	21 900	30 500	2 230	3 100	FWF-303716-E	29
	38	18	25 500	34 000	2 600	3 450	FWF-303818-E	35

Воц	undary Dimens (mm)			Basic Loa		Mass (g)		
$F_{ m W}$	$E_{ m W}$	$B_{ m C}^{^{-0.2}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	$egin{aligned} & \{kgf \ & \mathcal{C}_{\mathrm{r}} \end{aligned}$	$C_{0\mathrm{r}}$	Bearing Numbers	approx.
9	12	11.5	4 300	4 650	440	475	FBN-91211Z-E	3.5
10	14	12.7	5 900	5 950	605	610	FBN-101412Z-E	5.0
12	15 16 16 16	14.3 13 15.5 16	6 400 7 250 8 500 8 500	8 400 8 200 10 000 10 000	655 740 865 865	855 835 1 020 1 020	FBN-121514Z-E FBN-121613-E FBN-121615Z-E FBN-121616-E	4.8 6.4 7.0 7.5
14	18 18 18 18	12 16.5 18 20	6 950 9 250 10 700 9 550	8 050 11 600 14 000 12 000	710 945 1 090 975	820 1 180 1 430 1 230	FBN-141812-E FBN-141816Z-E FBN-141818-E FBN-141820-E1	6.5 8.5 11.5 13
15	19 21	18 18	11 300 12 900	15 300 13 900	1 150 1 310	1 560 1 420	FBN-151918-E FBN-152118-E	11 13
16	20 20 21	22 23.5 20	13 700 14 900 14 200	20 000 22 300 18 100	1 400 1 520 1 450	2 040 2 280 1 840	FBN-162022-E FBN-162023Z-E FBN-162120-E	14 15 16
17	21	23	14 800	22 500	1 510	2 290	FBN-172123-E	16
18	22 22 22	17 22 23.6	11 500 14 200 15 400	16 500 21 600 24 100	1 170 1 440 1 570	1 680 2 200 2 460	FBN-182217-E FBN-182222-E FBN-182223Z-E	12 15 16
19	23	23.7	16 000	25 800	1 630	2 630	FBN-192323Z-E	17

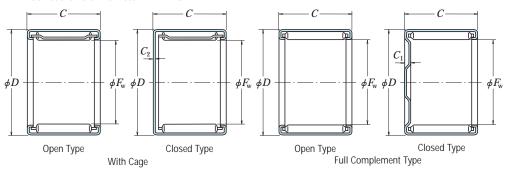
B 256 B 257



FJ · MFJ (With Cage)

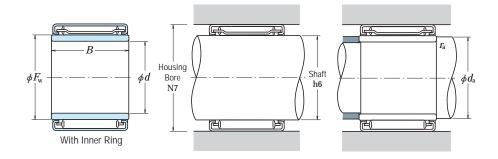
F • MF (Full Complement Type)

Inscribed Circle Diameter 4 – 16 mm



Boundary Dimensions (mm)		Basic Dynamic L	oad Ratings. {kgf}	Limiting (N)	Loads {kgf}	Limiting (mi			Bearing		
F_{W}	D	$C^{-0.25}$	C_1, C_2 max.			$P_{ m ma}$		Grease	Oil	Wit Open	h Cage Closed
4 5 6 7	8 9 10 11	8 9 9	0.8 0.8 0.8 0.8	1 720 1 860 2 320 2 550	175 190 237 260	675 745 985 1 110	69 76 101 113	45 000 43 000 36 000 30 000	75 000 71 000 56 000 48 000	* FJP-48 FJ-59 FJ-69 FJ-79	 MFJ-59 MFJ-69 MFJ-79
8	12 14 14	10 10 10	0.8 1.0 1.9	2 840 4 300 5 550	289 435 565	1 270 1 770 2 980	130 180 305	26 000 28 000 6 300	43 000 45 000 10 000	FJ-810 FJH-810 —	MFJ-810 MFJH-810
9	13 15 15	10 10 10	0.8 1.0 1.8	3 300 4 550 6 100	335 465 625	1 600 1 910 3 350	163 194 340	22 000 24 000 6 000	36 000 40 000 10 000	FJ-910 FJH-910 —	MFJ-910 MFJH-910
10	14 16 16	10 10 10	0.8 1.0 1.9	3 500 4 900 6 650	360 500 680	1 760 2 100 3 700	179 214 375	20 000 22 000 5 600	32 000 34 000 9 000	FJ-1010 FJH-1010	MFJ-1010 MFJH-1010
12	16 18 18	10 12 12	0.8 1.0 1.9	4 150 6 450 9 000	420 655 920	2 210 3 050 5 700	225 310 580	17 000 17 000 4 500	26 000 28 000 7 500	FJ-1210 FJH-1212	MFJ-1210 MFJH-1212
13	19 19	12 12	1.0 1.9	6 950 9 550	710 975	3 400 6 100	345 625	16 000 4 300	26 000 7 100	FJ-1312 —	MFJ-1312 —
14	20 20 20 20	12 12 16 16	1.0 2.2 1.0 2.2	6 500 9 450 9 500 13 300	665 965 970 1 360	3 250 6 350 5 300 9 850	335 645 540 1 000	15 000 3 800 15 000 3 800	24 000 6 000 24 000 6 000	FJ-1412 FJ-1416	MFJ-1412 MFJ-1416
15	21 21 21	12 12 14	1.0 1.8 1.8	7 650 10 300 12 400	780 1 050 1 270	3 900 6 900 8 800	400 705 895	14 000 3 800 3 800	22 000 6 000 6 000	FJ-1512 — —	MFJ-1512 _
	21 21	16 16	1.0 1.8	11 000 14 500	1 120 1 480	6 200 10 700	635 1 090	14 000 3 800	22 000 6 000	FJ-1516 —	MFJ-1516 —
16	22 22 22 22	12 12 16 16	1.0 2.2 1.0 2.2	7 100 10 200 10 400 14 400	725 1 040 1 060 1 460	3 750 7 100 6 050 11 100	380 725 620 1 130	12 000 3 400 12 000 3 400	20 000 5 300 20 000 5 300	FJ-1612 FJ-1616 	MFJ-1612 MFJ-1616

Note (*) These bearing have polyamide cages. The maximum permissible operating temperature for these bearings is 100 °C for continued operation and 120 °C for short periods.

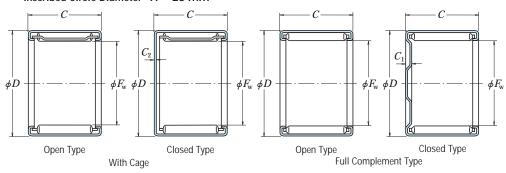


Numbers		In c	ase of in	ner ring is	used		Mass Withou	
Full Comp Open	lement Type Closed	Bearing Numbers of Inner Ring		indary ions (mm) $oldsymbol{B}$	Dįmensi	t and Fillet ons (mm) r_a (max.)	app Open	
_ _ _ _	- - - -	_ _ _ _	_ _ _	=	_ _ _	_ _ _	1.3 1.7 2.2 2.3	1.9 2.4 2.7
_ _ FH-810	 MFH-810	_ _ _	_	=	_	_ _ _	2.7 5.2 6.0	3.2 5.5 6.3
_ FH-910	_ MFH-910	_ _ _	_	=	_		3.2 5.7 6.4	3.6 6.1 6.8
 FH-1010	_ MFH-1010	FIR-71010 FIR-71010 FIR-71010	7 7 7	10.5 10.5 10.5	9 9 9	0.3 0.3 0.3	3.6 6.1 6.9	4.1 6.6 7.3
_ FH-1212	_ MFH-1212	FIR-81210 FIR-81212 FIR-81212	8 8 8	10.5 12.5 12.5	10 10 10	0.3 0.3 0.3	4.1 7.7 10	4.5 8.2 11
F-1312	 MF-1312	FIR-101312 FIR-101312	10 10	12.5 12.5	12 12	0.3 0.3	8.6 11	9.5 12
F-1412 F-1416	MF-1412 MF-1416	FIR-101412 FIR-101412 FIR-101416 FIR-101416	10 10 10 10	12.5 12.5 16.5 16.5	12 12 12 12	0.3 0.3 0.3 0.3	10 12 13 18	11 14 14 19
F-1512 F-1514	MF-1512 MF-1514	FIR-121512 FIR-121512 —	12 12 —	12.5 12.5 —	14 14 —	0.3 0.3 —	10 12 15	11 14 16
_ F-1516	 MF-1516	FIR-121516 FIR-121516	12 12	16.5 16.5	14 14	0.3 0.3	13 17	14 18
F-1612 F-1616	MF-1612 MF-1616	FIR-121612 FIR-121612 FIR-121616 FIR-121616	12 12 12 12	12.5 12.5 16.5 16.5	14 14 14 14	0.3 0.3 0.3 0.3	11 14 14 18	12 15 15 20

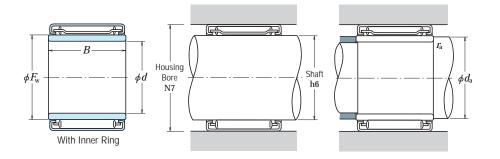


FJ·MFJ (With Cage) F·MF (Full Complement Type)

Inscribed Circle Diameter 17 – 28 mm



Bou		Dimens	ions	Basic Dynamic L (N)	.oad Ratings {kgf}	Limiting (N)	Loads {kgf}	Limiting (mi			Bearing
$F_{ m W}$	D	$C^{-0.25}$	C_1, C_2 max.	$C_{\rm r}$		$P_{ m ma}$	x	Grease	Oil	With Open	Cage Closed
17	23 23 23 23	12 12 16 16	1.0 1.8 1.0 1.8	8 450 11 300 12 100 15 800	860 1 150 1 230 1 610	4 450 7 750 7 100 12 000	455 790 720 1 220	12 000 3 400 12 000 3 400	19 000 5 600 19 000 5 600	FJ-1712 — FJ-1716 —	MFJ-1712 — MFJ-1716 —
18	24 24 24 24	12 12 16 16	1.0 2.2 1.0 2.2	7 650 10 900 11 200 15 300	780 1 110 1 140 1 560	4 200 7 900 6 800 12 300	430 805 695 1 250	11 000 3 000 11 000 3 000	18 000 5 000 18 000 5 000	FJ-1812 FJ-1816	MFJ-1812 MFJ-1816
20	26 26 26	12 12 16	1.0 2.2 1.0	8 150 11 500 11 900	835 1 170 1 210	4 650 8 700 7 550	475 885 770	10 000 2 800 10 000	16 000 4 500 16 000	FJ-2012 FJ-2016	MFJ-2012 — MFJ-2016
	26 26 26	16 20 20	2.2 1.0 2.2	16 200 15 300 20 500	1 650 1 560 2 090	13 500 10 500 18 300	1 380 1 070 1 870	2 800 10 000 2 800	4 500 16 000 4 500	FJ-2020	MFJ-2020
22	28 28 28	12 12 16	1.0 2.2 1.0	8 650 12 100 12 600	880 1 230 1 290	5 150 9 500 8 350	525 970 850	9 000 2 400 9 000	14 000 4 000 14 000	FJ-2212 FJ-2216	MFJ-2212 — MFJ-2216
	28 28 28	16 20 20	2.2 1.0 2.2	17 100 16 200 21 600	1 740 1 660 2 200	14 800 11 500 20 000	1 510 1 180 2 040	2 400 9 000 2 400	4 000 14 000 4 000	FJ-2220 —	MFJ-2220
25	32 32 32	16 16 20	1.0 2.5 1.0	15 200 20 200 19 800	1 550 2 060 2 020	9 350 16 200 13 100	955 1 650 1 340	8 000 2 800 8 000	13 000 4 500 13 000	FJ-2516 FJ-2520	MFJ-2516 — MFJ-2520
	32 32 32	20 26 26	2.5 1.0 2.5	25 900 26 200 34 000	2 640 2 670 3 450	22 200 18 800 31 500	2 260 1 920 3 200	2 800 8 000 2 800	4 500 13 000 4 500	FJ-2526	MFJ-2526
28	35 35 35	16 16 20	1.0 2.5 1.0	15 600 21 300 20 500	1 590 2 170 2 090	9 950 17 900 14 200	1 020 1 820 1 450	7 100 2 400 7 100	11 000 4 000 11 000	FJ-2816 FJ-2820	MFJ-2816 — MFJ-2820
	35 35 35	20 26 26	2.5 1.0 2.5	27 300 26 900 35 500	2 780 2 750 3 650	24 600 20 200 34 500	2 510 2 060 3 550	2 400 7 100 2 400	4 000 11 000 4 000	FJ-2826 —	MFJ-2826



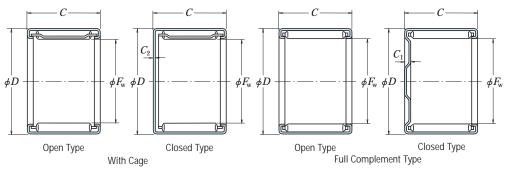
Numbers		In case of inner ring is used					Mass Without Inner Ring (g)		
Full Compler Open	ment Type Closed	Bearing Numbers of Inner Ring		undary sions (mm) B				orox. Closed	
F-1712 F-1716	MF-1712 MF-1716	_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _	10 14 14 18	11 15 16 20	
F-1812 F-1816	MF-1812 MF-1816	FIR-151812 FIR-151812 FIR-151816 FIR-151816	15 15 15 15	12.5 12.5 16.5 16.5	17 17 17 17	0.3 0.3 0.3 0.3	12 14 16 19	14 16 18 22	
F-2012	MF-2012	FIR-172012 FIR-172012 FIR-172016	17 17 17	12.5 12.5 16.5	19 19 19	0.3 0.3 0.3	13 17 17	15 19 19	
F-2016 F-2020	MF-2016 — MF-2020	FIR-172016 FIR-172020 FIR-172020	17 17 17	16.5 20.5 20.5	19 19 19	0.3 0.3 0.3	22 22 28	25 24 30	
F-2212	MF-2212	FIR-172212 FIR-172212 FIR-172216	17 17 17	12.5 12.5 16.5	19 19 19	0.3 0.3 0.3	14 18 19	17 21 22	
F-2216 - F-2220	MF-2216 MF-2220	FIR-172216 FIR-172220 FIR-172220	17 17 17	16.5 20.5 20.5	19 19 19	0.3 0.3 0.3	24 23 30	27 26 33	
F-2516	MF-2516	FIR-202516 FIR-202516 FIR-202520	20 20 20	16.5 16.5 20.5	22 22 22	0.3 0.3 0.3	24 31 31	27 35 34	
F-2520 F-2526	MF-2520 MF-2526	FIR-202520 FIR-202526 FIR-202526	20 20 20	20.5 26.5 26.5	22 22 22	0.3 0.3 0.3	40 40 52	43 43 55	
F-2816	MF-2816	FIR-222816 FIR-222816 FIR-222820	22 22 22	16.5 16.5 20.5	24 24 24	0.3 0.3 0.3	27 35 34	31 40 38	
F-2820 F-2826	MF-2820 MF-2826	FIR-222820 FIR-222826 FIR-222826	22 22 22	20.5 26.5 26.5	24 24 24	0.3 0.3 0.3	44 45 57	48 49 62	

B 260 B 261

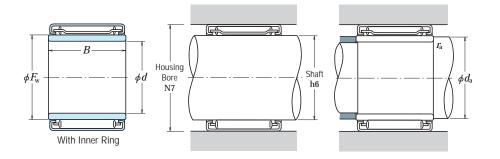


FJ·MFJ (With Cage) F·MF (Full Complement Type)

Inscribed Circle Diameter 30 – 55 mm



D.	1	D'		D		125-191	L I .	1 : :	Carada		D d
BOL		Dimens	ions	Basic Dynamic L (N)	.oad Katings {kgf}	Limiting (N)	Loads {kgf}	Limiting (min	•		Bearing
F_{W}	D	$C^{-0.25}$	C_1, C_2	$C_{\rm r}$		$P_{ m ma}$	ıx	Grease	Oil	With	3
			max.							Open	Closed
30	37 37	16 16	1.0 2.5	15 600 22 100	1 590 2 250	10 100 18 900	1 030 1 930	6 700 2 400	10 000 3 800	FJ-3016L	MFJ-3016
	37	20	1.0	19 400	1 970	13 300	1 360	6 700	10 000	FJ-3020	MFJ-3020
	37	20	2.5	28 400	2 900	26 200	2 670	2 400	3 800	_	_
	37 37	26 26	1.0 2.5	26 000 37 000	2 660 3 800	19 500 37 000	1 990 3 750	6 700 2 400	10 000 3 800	FJ-3026	MFJ-3026
	4.0		4.0	10.100	4.050	10.000	4 000	F (00			
35	42 42	16 16	1.0 2.5	18 100 24 000	1 850 2 450	12 800 22 000	1 300 2 240	5 600 2 000	9 000 3 400	FJ-3516 —	MFJ-3516
	42	20	1.0	23 600	2 410	17 900	1 830	5 600	9 000	FJ-3520	MFJ-3520
	42	20	2.5	31 000	3 150	30 000	3 100	2 000	3 400		
	42 42	26 26	1.0 2.5	31 500 40 000	3 200 4 100	25 800 42 500	2 630 4 350	5 600 2 000	9 000 3 400	FJ-3526	MFJ-3526
40	47	16	1.0	18 600	1 890	13 600	1 390	4 800	7 500	FJ-4016	MFJ-4016
40	47 47	16 20	2.5 1.0	25 700 23 500	2 620 2 400	24 900 18 500	2 540 1 890	1 800 4 800	3 000 7 500	FJ-4020	MFJ-4020
	4 /	20	1.0	23 300	2 400	16 300	1 090	4 600	7 300	FJ-4020	WIFJ-4020
	47 47	20 26	2.5 1.0	32 500 31 500	3 350 3 200	34 000 26 900	3 450 2 740	1 800 4 800	3 000 7 500	 FJ-4026	MFJ-4026
45	52 52	16 16	1.0 2.5	19 900 27 300	2 030 2 790	15 400 27 800	1 570 2 840	4 300 1 600	6 700 2 600	FJ-4516	MFJ-4516
	52 52	20 20	1.0 2.5	25 500 35 000	2 600 3 550	21 200 38 500	2 160 3 900	4 300 1 600	6 700 2 600	FJ-4520	MFJ-4520
50	58 58	20 20	1.1 2.8	28 900 39 500	2 940 4 050	23 100 41 500	2 350 4 250	3 800 1 700	6 300 2 800	FJ-5020L	MFJ-5020
	58 58	24 24	1.1 2.8	36 000 48 000	3 700 4 900	30 500 53 000	3 150 5 400	3 800 1 700	6 300 2 800	FJ-5024	MFJ-5024
55	63 63	20 20	1.1 2.8	30 000 41 500	3 100 4 250	25 100 45 500	2 560 4 650	3 400 1 600	5 600 2 400	FJ-5520 —	MFJ-5520
	63 63	24 24	1.1 2.8	37 500 50 500	3 850 5 150	33 500 58 000	3 400 5 950	3 400 1 600	5 600 2 400	FJ-5524	MFJ-5524

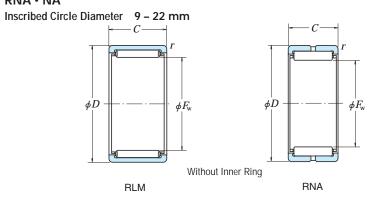


Numbers		In c		Mass Without Inner Ring (g)				
Full Compler Open	ment Type Closed	Bearing Numbers of Inner Ring		indary ions (mm) $oldsymbol{B}$	Dįmens	nt and Fillet ions (mm) r_a (max.)		orox. Closed
F-3016	MF-3016	_ _ FIR-253020	_ _ 25	_ _ 20.5	_ _ 27	_ _ 0.3	26 35 35	31 40 39
F-3020 F-3026	MF-3020 MF-3026	FIR-253020 FIR-253026 FIR-253026	25 25 25	20.5 26.5 26.5	27 27 27	0.3 0.3 0.3	46 46 61	51 50 66
F-3516	MF-3516	 FIR-303520	_ _ 30	_ 20.5	_ 34	_ _ 0.6	32 53 41	38 60 45
F-3520 F-3526	MF-3520 MF-3526	FIR-303520 FIR-303526 FIR-303526	30 30 30	20.5 26.5 26.5	34 34 34	0.6 0.6 0.6	42 54 70	49 58 76
F-4016	MF-4016	 FIR-354020	_ _ 35	 20.5	_ 39	_ _ 0.6	34 48 46	43 56 51
F-4020 —	MF-4020 —	FIR-354020 FIR-354026	35 35	20.5 26.5	39 39	0.6 0.6	60 60	69 65
F-4516 F-4520	MF-4516 MF-4520	 FIR-404520 FIR-404520	- 40 40	20.5 20.5	_ 44 44	 0.6 0.6	39 53 53 67	50 64 59 78
F-5020 F-5024	MF-5020 MF-5024	FIR-455020 — — — —	45 - - -	20.5 	49 _ _ _	0.6 _ _ _	56 81 69 98	71 95 84 110
F-5524	MF-5520 MF-5524	_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _	60 88 72 105	79 105 90 125

B 262 B 263

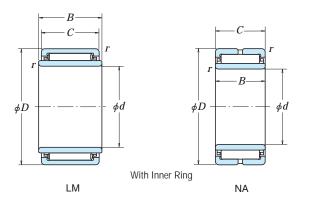


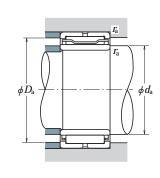
RLM • LM RNA • NA



Вог	undary D (mi		ons	(1	Basic Load	Ratings {kg	nf)	١ ،	g Speeds in ⁻¹)	Bearing
F_{W}	D	С	$m{r}$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Without Inner Ring
9	16	12	0.3	6 150	5 400	625	550	24 000	40 000	RLM 912
	16	16	0.3	7 900	7 450	805	760	24 000	40 000	RLM 916
10	17 17	10 15	0.3	5 350 8 050	4 650 7 800	545 820	470 795	22 000 22 000	36 000 36 000	RLM 101710 RLM 101715
12	17	12	0.3	6 150	7 650	625	780	18 000	30 000	RLM 1212
	19	12	0.3	7 300	7 150	745	730	18 000	30 000	RLM 121912
14	22 22 22	13 16 20	0.3 0.3 0.3	9 150 12 100 15 500	9 950 12 700 17 500	930 1 230 1 580	1 010 1 300 1 790	20 000 15 000 15 000	32 000 24 000 24 000	RLM 1416 RLM 1420
15	20	15	0.3	8 100	11 700	825	1 190	14 000	24 000	RLM 1515
	20	20	0.3	11 100	17 400	1 130	1 770	14 000	24 000	RLM 1520
	22	15	0.3	9 900	11 100	1 010	1 140	14 000	24 000	RLM 152215
16	24 24 24 24	13 16 20 22	0.3 0.3 0.3 0.3	10 100 12 900 16 500 17 900	11 700 14 200 19 500 24 500	1 030 1 310 1 680 1 830	1 190 1 450 1 990 2 500	17 000 13 000 13 000 17 000	28 000 22 000 22 000 28 000	RLM 1616 RLM 1620
17	22	10	0.3	5 850	7 950	595	810	13 000	20 000	RLM 1710
	24	25	0.5	18 200	25 300	1 850	2 580	13 000	20 000	RLM 172425
18	25	15	0.5	11 500	14 300	1 170	1 450	12 000	20 000	RLM 1815
	25	20	0.5	15 800	21 500	1 610	2 190	12 000	20 000	RLM 1820
20	27	10	0.5	7 950	9 150	810	930	11 000	18 000	RLM 2010
	27	15	0.5	11 900	15 400	1 220	1 570	11 000	18 000	RLM 2015
	27	20	0.5	16 400	23 200	1 670	2 370	11 000	18 000	RLM 2020
	27	25	0.5	19 800	29 500	2 010	3 000	11 000	18 000	RLM 2025
	28 28 28	13 18 23	0.3 0.3 0.3	10 800 15 700 19 300	13 600 21 900 28 600	1 100 1 600 1 960	1 390 2 240 2 920	13 000 13 000 13 000	22 000 22 000 22 000	
22	29	20	0.5	17 700	26 400	1 810	2 690	10 000	16 000	RLM 2220
	29	25	0.5	21 300	33 500	2 170	3 400	10 000	16 000	RLM 2225
	30 30 30 30	13 18 20 23	0.3 0.3 0.5 0.3	11 600 16 800 20 000 20 700	15 400 24 800 27 200 32 500	1 190 1 720 2 030 2 110	1 570 2 530 2 780 3 300	12 000 12 000 10 000 12 000	20 000 20 000 16 000 20 000	 RLM 223020

Remarks If a full complement roller bearing is required, please contact NSK.



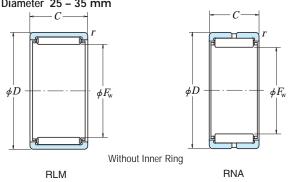


Numbers			Dimensions nm)	Abutment	and Fillet Di	mensions	Mass (kg)		
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	appr Without Inner Ring		
=	LM 91612-1 —	6 —	12 —	8 —	14 14	0.3 0.3	0.009 0.011	0.013	
=	_	_	_	_ _	15 15	0.3 0.3	0.008 0.012	_	
_	LM 1212 LM 121912	8 8	12.2 12.2	10 10	15 17	0.3 0.3	0.007 0.011	0.013 0.017	
RNA 4900 	NA 4900 LM 1416 LM 1420	10 10 10	13 16.2 20.2	12 12 12	20 20 20	0.3 0.3 0.3	0.016 0.019 0.024	0.024 0.028 0.036	
	LM 1515 LM 1520 LM 152215	10 10 10	15.2 20.2 15.2	12 12 12	18 18 20	0.3 0.3 0.3	0.011 0.015 0.016	0.022 0.03 0.027	
RNA 4901 — RNA 6901	NA 4901 LM 1616 LM 1620 NA 6901	12 12 12 12	13 16.2 20.2 22	14 14 14 14	22 22 22 22	0.3 0.3 0.3 0.3	0.018 0.021 0.027 0.03	0.027 0.032 0.041 0.045	
=	LM 1710 LM 172425	12 12	10.2 25.2	14 16	20 20	0.3 0.5	0.008 0.03	0.017 0.052	
_	LM 1815 LM 1820	15 15	15.2 20.2	19 19	21 21	0.5 0.5	0.019 0.025	0.028 0.037	
_ _ _	LM 2010 LM 2015 LM 2020 LM 2025	15 15 15 15	10.2 15.2 20.2 25.2	19 19 19 19	23 23 23 23	0.5 0.5 0.5 0.5	0.014 0.021 0.028 0.035	0.025 0.037 0.049 0.061	
RNA 4902 RNA 5902 RNA 6902	NA 4902 NA 5902 NA 6902	15 15 15	13 18 23	17 17 17	26 26 26	0.3 0.3 0.3	0.021 0.032 0.039	0.035 0.051 0.064	
=	LM 2220 LM 2225	17 17	20.2 25.2	21 21	25 25	0.5 0.5	0.03 0.038	0.054 0.068	
RNA 4903 RNA 5903 RNA 6903	NA 4903 NA 5903 LM 223020 NA 6903	17 17 17 17	13 18 20.2 23	19 19 21 19	28 28 26 28	0.3 0.3 0.5 0.3	0.023 0.034 0.035 0.041	0.038 0.055 0.06 0.068	



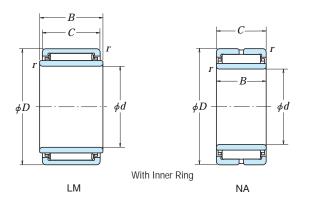
RLM • LM RNA • NA

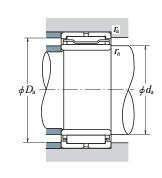
Inscribed Circle Diameter 25 – 35 mm



Вог	undary D (mr		ons		Basic Load	Ratings {kc	vf)	`	J Speeds in-1)	Bearing
F_{W}	D	C	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Without Inner Ring
25	32	12	0.5	10 300	13 700	1 050	1 400	8 500	14 000	RLM 2512
	32	20	0.5	18 800	29 700	1 920	3 050	8 500	14 000	RLM 2520
	32	25	0.5	22 700	37 500	2 310	3 850	8 500	14 000	RLM 2525
	37	17	0.3	19 700	22 900	2 010	2 340	11 000	18 000	_
	37	23	0.3	27 800	35 500	2 830	3 650	11 000	18 000	_
	37	30	0.3	36 500	50 500	3 700	5 150	11 000	18 000	_
28	35	20	0.5	19 900	33 000	2 030	3 350	7 500	12 000	RLM 2820
	35	25	0.5	23 900	42 000	2 440	4 250	7 500	12 000	RLM 2825
	37	30	0.5	34 000	52 500	3 450	5 350	7 500	12 000	RLM 283730
	39 39 39	17 23 30	0.3 0.3 0.3	22 400 28 300 37 000	30 500 41 500 58 500	2 290 2 890 3 800	3 150 4 200 6 000	9 500 9 500 9 500	15 000 15 000 15 000	
30	37	25	0.5	24 500	44 000	2 490	4 500	7 100	12 000	RLM 3025
	40	20	0.5	25 000	36 000	2 550	3 650	7 100	12 000	RLM 304020
	40	30	0.5	35 000	56 000	3 600	5 700	7 100	12 000	RLM 304030
	42	17	0.3	21 400	26 800	2 180	2 740	9 000	14 000	_
	42	23	0.3	30 000	41 500	3 100	4 250	9 000	14 000	_
	42	30	0.3	39 500	59 000	4 050	6 050	9 000	14 000	_
32	42	20	0.5	25 800	38 000	2 630	3 900	6 700	11 000	RLM 3220
	42	30	0.5	36 500	59 000	3 700	6 050	6 700	11 000	RLM 3230
	45	17	0.3	22 200	28 700	2 270	2 930	8 500	13 000	_
	45	23	0.3	31 500	44 500	3 200	4 550	8 500	13 000	_
	45	30	0.3	41 000	63 500	4 200	6 450	8 500	13 000	_
35	42	20	0.5	22 300	41 000	2 270	4 200	6 300	10 000	RLM 3520
	42	30	0.5	31 000	63 500	3 200	6 450	6 300	10 000	RLM 3530
	45	20	0.5	27 500	42 500	2 800	4 350	6 300	10 000	RLM 354520
	45	25	0.5	33 000	54 500	3 400	5 550	6 300	10 000	RLM 354525
	45	30	0.5	38 500	66 000	3 950	6 750	6 300	10 000	RLM 354530
	47 47 47	17 23 30	0.3 0.3 0.3	23 900 33 500 44 000	32 500 50 500 71 500	2 430 3 450 4 500	3 300 5 150 7 300	7 500 7 500 7 500	12 000 12 000 12 000	

Remarks If a full complement roller bearing is required, please contact NSK.



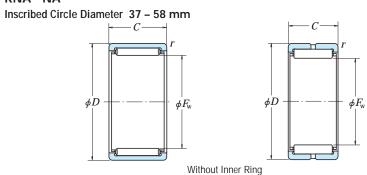


Numbers	I		Dimensions nm)	Abutment	and Fillet Dir (mm)	mensions	Ma: (kg	
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	appr Without Inner Ring	
_	LM 2512	20	12.2	24	28	0.5	0.02	0.036
_	LM 2520	20	20.2	24	28	0.5	0.034	0.061
_	LM 2525	20	25.2	24	28	0.5	0.042	0.076
RNA 4904	NA 4904	20	17	22	35	0.3	0.055	0.077
RNA 5904	NA 5904	20	23	22	35	0.3	0.089	0.12
RNA 6904	NA 6904	20	30	22	35	0.3	0.098	0.14
=	LM 2820	22	20.2	26	31	0.5	0.038	0.062
	LM 2825	22	25.2	26	31	0.5	0.047	0.092
	LM 283730	22	30.2	26	33	0.5	0.075	0.13
RNA 49/22	NA 49/22	22	17	24	37	0.3	0.056	0.086
RNA 59/22	NA 59/22	22	23	24	37	0.3	0.091	0.135
RNA 69/22	NA 69/22	22	30	24	37	0.3	0.096	0.15
=	LM 3025	25	25.2	29	33	0.5	0.05	0.092
	LM 304020	25	20.2	29	36	0.5	0.06	0.093
	LM 304030	25	30.2	29	36	0.5	0.09	0.14
RNA 4905	NA 4905	25	17	27	40	0.3	0.063	0.091
RNA 5905	NA 5905	25	23	27	40	0.3	0.10	0.14
RNA 6905	NA 6905	25	30	27	40	0.3	0.11	0.16
_	LM 3220	28	20.2	32	38	0.5	0.064	0.09
	LM 3230	28	30.2	32	38	0.5	0.096	0.14
RNA 49/28	NA 49/28	28	17	30	43	0.3	0.076	0.099
RNA 59/28	NA 59/28	28	23	30	43	0.3	0.11	0.145
RNA 69/28	NA 69/28	28	30	30	43	0.3	0.13	0.175
Ξ	LM 3520	30	20.2	34	38	0.5	0.046	0.085
	LM 3530	30	30.2	34	38	0.5	0.07	0.13
=	LM 354520	30	20.2	34	41	0.5	0.069	0.11
	LM 354525	30	25.2	34	41	0.5	0.086	0.135
	LM 354530	30	30.2	34	41	0.5	0.10	0.16
RNA 4906	NA 4906	30	17	32	45	0.3	0.072	0.105
RNA 5906	NA 5906	30	23	32	45	0.3	0.11	0.15
RNA 6906	NA 6906	30	30	32	45	0.3	0.13	0.19

B 266 B 267



RLM • LM RNA • NA



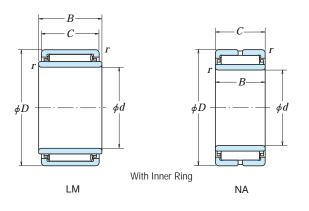
RLM

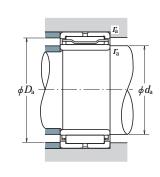
Boundary Dimensions (mm)			ons		Basic Load	3		١ ٠	Speeds	Bearing
$F_{ m W}$	D	m) C	r	$C_{ m r}$	(N) $C_{0\mathrm{r}}$	$C_{ m r}$	gf} $C_{0\mathrm{r}}$	(mi Grease	n ⁻¹) Oil	Without Inner Ring
37	47 47	20 30	min. 0.6 0.6	28 200 39 500	45 000 69 500	2 880 4 050	4 550 7 100	6 000 6 000	9 500 9 500	RLM 3720 RLM 3730
38	48	20	0.6	29 000	47 000	2 960	4 800	5 600	9 000	RLM 3820
	48	30	0.6	41 000	73 000	4 150	7 450	5 600	9 000	RLM 3830
40	50	20	0.6	29 700	49 000	3 050	5 000	5 300	9 000	RLM 4020
	50	30	0.6	42 000	76 500	4 250	7 800	5 300	9 000	RLM 4030
	52	20	0.6	29 900	45 000	3 050	4 600	6 700	10 000	_
	52	27	0.6	40 500	66 000	4 100	6 750	6 700	10 000	_
	52	36	0.6	56 000	101 000	5 700	10 300	6 700	10 000	_
42	55 55 55	20 27 36	0.6 0.6 0.6	30 500 41 500 57 500	47 500 69 500 106 000	3 100 4 200 5 850	4 800 7 100 10 900	6 300 6 300 6 300	10 000 10 000 10 000	=
45	55	20	0.6	31 000	53 500	3 150	5 500	4 800	8 000	RLM 4520
	55	30	0.6	43 500	83 500	4 450	8 500	4 800	8 000	RLM 4530
48	62 62 62	22 30 40	0.6 0.6 0.6	39 000 54 500 72 000	61 500 95 000 137 000	3 950 5 550 7 350	6 300 9 700 13 900	5 600 5 600 5 600	9 000 9 000 9 000	
50	62	20	0.6	35 500	60 500	3 600	6 150	4 300	7 100	RLM 506220
	62	25	0.6	43 000	77 500	4 400	7 900	4 300	7 100	RLM 506225
52	68	22	0.6	41 000	67 500	4 150	6 900	5 000	8 000	_
	68	30	0.6	57 000	104 000	5 800	10 600	5 000	8 000	_
	68	40	0.6	76 000	149 000	7 750	15 200	5 000	8 000	_
55	65	30	0.6	49 000	104 000	5 000	10 600	4 000	6 300	RLM 5530
	67	20	0.6	38 000	68 000	3 850	6 900	4 000	6 300	RLM 556720
58	72 72 72	22 30 40	0.6 0.6 0.6	42 500 59 500 79 000	73 500 113 000 163 000	4 350 6 050 8 050	7 500 11 500 16 600	4 500 4 500 4 500	7 100 7 100 7 100	Ξ

RNA

72 40 0.6 79 000 163 000 8 050 16

Remarks If a full complement roller bearing is required, please contact NSK.



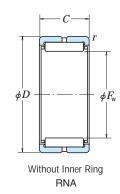


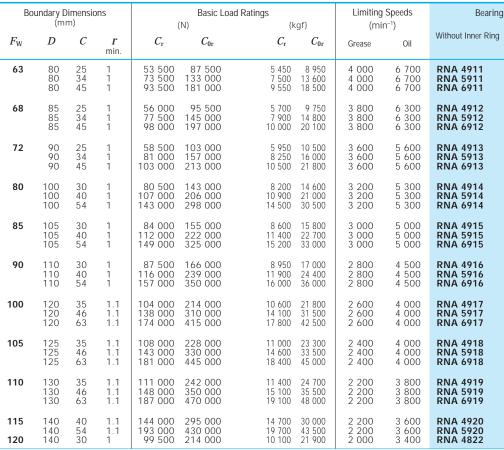
Numbers			Dimensions nm)	Abutment	and Fillet Di (mm)	mensions	Ma (kạ	
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	appr Without Inner Ring	OX. With Inner Rin
=	LM 3720	32	20.3	36	43	0.6	0.072	0.115
	LM 3730	32	30.3	36	43	0.6	0.11	0.17
_	LM 3820	32	20.3	36	44	0.6	0.074	0.125
	LM 3830	32	30.3	36	44	0.6	0.11	0.195
=	LM 4020	35	20.3	39	46	0.6	0.078	0.125
	LM 4030	35	30.3	39	46	0.6	0.12	0.19
RNA 49/32	NA 49/32	32	20	36	48	0.6	0.092	0.16
RNA 59/32	NA 59/32	32	27	36	48	0.6	0.15	0.24
RNA 69/32	NA 69/32	32	36	36	48	0.6	0.17	0.29
RNA 4907	NA 4907	35	20	39	51	0.6	0.11	0.17
RNA 5907	NA 5907	35	27	39	51	0.6	0.175	0.25
RNA 6907	NA 6907	35	36	39	51	0.6	0.20	0.315
_	LM 4520	40	20.3	44	51	0.6	0.086	0.14
	LM 4530	40	30.3	44	51	0.6	0.13	0.21
RNA 4908	NA 4908	40	22	44	58	0.6	0.15	0.24
RNA 5908	NA 5908	40	30	44	58	0.6	0.23	0.355
RNA 6908	NA 6908	40	40	44	58	0.6	0.265	0.435
=	LM 506220	42	20.3	46	58	0.6	0.12	0.21
	LM 506225	42	25.3	46	58	0.6	0.155	0.265
RNA 4909	NA 4909	45	22	49	64	0.6	0.19	0.28
RNA 5909	NA 5909	45	30	49	64	0.6	0.27	0.39
RNA 6909	NA 6909	45	40	49	64	0.6	0.335	0.495
=	LM 5530	45	30.3	49	61	0.6	0.16	0.34
	LM 556720	45	20.3	49	63	0.6	0.13	0.25
RNA 4910	NA 4910	50	22	54	68	0.6	0.18	0.295
RNA 5910	NA 5910	50	30	54	68	0.6	0.25	0.405
RNA 6910	NA 6910	50	40	54	68	0.6	0.32	0.53



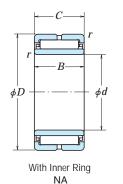
RNA · NA

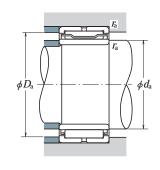
Inscribed Circle Diameter 63 - 120 mm





Remarks If a full complement roller bearing is required, please contact NSK.



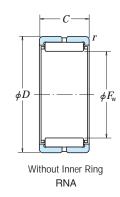


Numbers		Dimensions nm)	Abutment	and Fillet Dir (mm)	Mass (kg)		
With Inner Ring	d	В	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{\rm a}$ max.	appro Without Inner Ring	
NA 4911	55	25	60	75	1	0.26	0.40
NA 5911	55	34	60	75	1	0.37	0.56
NA 6911	55	45	60	75	1	0.475	0.73
NA 4912	60	25	65	80	1	0.28	0.435
NA 5912	60	34	65	80	1	0.415	0.625
NA 6912	60	45	65	80	1	0.485	0.76
NA 4913	65	25	70	85	1	0.32	0.465
NA 5913	65	34	70	85	1	0.48	0.675
NA 6913	65	45	70	85	1	0.53	0.79
NA 4914	70	30	75	95	1	0.47	0.74
NA 5914	70	40	75	95	1	0.69	1.05
NA 6914	70	54	75	95	1	0.89	1.4
NA 4915	75	30	80	100	1	0.5	0.79
NA 5915	75	40	80	100	1	0.735	1.1
NA 6915	75	54	80	100	1	0.96	1.5
NA 4916	80	30	85	105	1	0.53	0.835
NA 5916	80	40	85	105	1	0.75	1.15
NA 6916	80	54	85	105	1	0.99	1.55
NA 4917	85	35	91.5	113.5	1	0.68	1.25
NA 5917	85	46	91.5	113.5	1	0.99	1.75
NA 6917	85	63	91.5	113.5	1	1.2	2.25
NA 4918	90	35	96.5	118.5	1	0.72	1.35
NA 5918	90	46	96.5	118.5	1	1.05	1.85
NA 6918	90	63	96.5	118.5	1	1.35	2.45
NA 4919	95	35	101.5	123.5	1	0.74	1.4
NA 5919	95	46	101.5	123.5	1	1.15	2.0
NA 6919	95	63	101.5	123.5	1	1.5	2.65
NA 4920	100	40	106.5	133.5	1	1.15	1.95
NA 5920	100	54	106.5	133.5	1	1.8	2.85
NA 4822	110	30	115	135	1	0.67	1.1



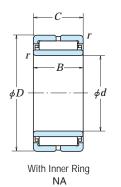
RNA · NA

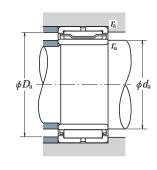
Inscribed Circle Diameter 125 – 390 mm



Вс	undary D (mi		ons		Basic Load R N)	5	kgf}	Limiting (mir	•	Bearing
$F_{ m W}$	D	C	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil	Without Inner Ring
125	150	40	1.1	149 000	315 000	15 200	32 500	2 000	3 200	RNA 4922
	150	54	1.1	200 000	460 000	20 300	47 000	2 000	3 200	RNA 5922
130	150	30	1	105 000	238 000	10 700	24 300	1 900	3 200	RNA 4824
135	165	45	1.1	192 000	395 000	19 600	40 500	1 900	3 000	RNA 4924
	165	60	1.1	253 000	565 000	25 800	58 000	1 900	3 000	RNA 5924
145	165	35	1.1	127 000	315 000	12 900	32 000	1 700	2 800	RNA 4826
150	180	50	1.5	228 000	515 000	23 200	52 500	1 700	2 800	RNA 4926
	180	67	1.5	299 000	725 000	30 500	74 000	1 700	2 800	RNA 5926
155	175	35	1.1	133 000	340 000	13 600	35 000	1 600	2 600	RNA 4828
160	190	50	1.5	235 000	545 000	24 000	55 500	1 600	2 600	RNA 4928
	190	67	1.5	310 000	775 000	31 500	79 000	1 600	2 600	RNA 5928
165	190	40	1.1	180 000	440 000	18 300	45 000	1 500	2 400	RNA 4830
175	200	40	1.1	184 000	465 000	18 700	47 000	1 400	2 200	RNA 4832
185	215	45	1.1	224 000	540 000	22 900	55 000	1 400	2 200	RNA 4834
195	225	45	1.1	230 000	570 000	23 500	58 000	1 300	2 000	RNA 4836
210	240	50	1.5	268 000	705 000	27 300	72 000	1 200	1 900	RNA 4838
220	250	50	1.5	274 000	740 000	27 900	75 500	1 100	1 800	RNA 4840
240	270	50	1.5	286 000	805 000	29 100	82 000	1 000	1 700	RNA 4844
265	300	60	2	375 000	1 070 000	38 500	109 000	950	1 500	RNA 4848
285	320	60	2	395 000	1 160 000	40 000	118 000	900	1 400	RNA 4852
305	350	69	2	510 000	1 390 000	52 000	142 000	800	1 300	RNA 4856
330	380	80	2.1	660 000	1 810 000	67 500	185 000	750	1 200	RNA 4860
350	400	80	2.1	675 000	1 900 000	69 000	194 000	710	1 100	RNA 4864
370	420	80	2.1	690 000	1 990 000	70 500	203 000	670	1 100	RNA 4868
390	440	80	2.1	705 000	2 080 000	72 000	212 000	630	1 000	RNA 4872

Remarks If a full complement roller bearing is required, please contact NSK.





Numbers		Dimensions nm)	Abutment	and Fillet Dir (mm)	mensions	Ma (kự	
With Inner Ring	d	В	$d_{ m a}$ min.	$D_{ m a}$ max.	$r_{ m a}$ max.	appr Without Inner Ring	
NA 4922	110	40	116.5	143.5	1	1.25	2.1
NA 5922	110	54	116.5	143.5	1	1.95	3.05
NA 4824	120	30	125	145	1	0.71	1.15
NA 4924	120	45	126.5	158.5	1	1.9	2.9
NA 5924	120	60	126.5	158.5	1	2.7	4.05
NA 4826	130	35	136.5	158.5	1	0.92	1.8
NA 4926	130	50	138	172	1.5	2.3	4.0
NA 5926	130	67	138	172	1.5	3.3	5.55
NA 4828	140	35	146.5	168.5	1	0.98	1.9
NA 4928	140	50	148	182	1.5	2.45	4.25
NA 5928	140	67	148	182	1.5	3.55	6.0
NA 4830	150	40	156.5	183.5	1	1.6	2.75
NA 4832	160	40	166.5	193.5	1	1.75	2.95
NA 4834	170	45	176.5	208.5	1	2.55	4.0
NA 4836	180	45	186.5	218.5	1	2.65	4.2
NA 4838	190	50	198	232	1.5	3.2	5.6
NA 4840	200	50	208	242	1.5	3.35	5.9
NA 4844	220	50	228	262	1.5	3.65	6.45
NA 4848	240	60	249	291	2	5.45	10
NA 4852	260	60	269	311	2	5.9	11
NA 4856	280	69	289	341	2	9.5	15.5
NA 4860	300	80	311	369	2	13	22
NA 4864	320	80	331	389	2	13.5	23.5
NA 4868	340	80	351	409	2	14	24.5
NA 4872	360	80	371	429	2	15	26

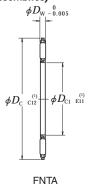


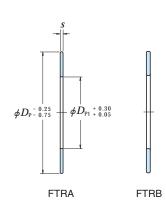
FNTA (Thrust Cage & Needle Roller Assemblies)

Thrust raceway washers FTRA (s=1.0) FTRB (s=1.5) FTRC (s=2.0)

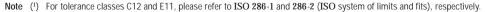
FTRD (s=2.5) FTRE (s=3.0)

Bore Diameter 10 – 100 mm

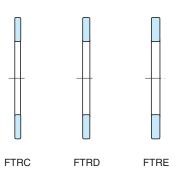


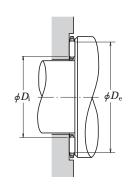


	y Dimens (mm)	ions	(Basic Load	3	gf}	Limiting Speeds (min ⁻¹)		
D_{c1} , D_{p1}	$D_{\rm c}$, $D_{\rm p}$	D_{W}	C_{a}	C_{0a}	$C_{\rm a}$	C_{0a}	Oil	Bearing Numbers	$s=1.0^{\pm0.05}$
10	24	2	7 750	23 000	790	2 350	17 000	FNTA-1024	*FTRA-1024
12	26	2	8 350	26 300	855	2 680	16 000	FNTA-1226	FTRA-1226
15	28	2	7 950	25 800	810	2 630	15 000	FNTA-1528	FTRA-1528
16	29	2	8 200	27 100	835	2 770	14 000	FNTA-1629	FTRA-1629
17	30	2	8 400	28 400	855	2 900	14 000	FNTA-1730	FTRA-1730
18	31	2	8 600	29 700	875	3 050	13 000	FNTA-1831	FTRA-1831
20	35	2	11 900	47 000	1 220	4 800	12 000	FNTA-2035	FTRA-2035
25	42	2	14 800	66 000	1 510	6 750	9 500	FNTA-2542	FTRA-2542
30	47	2	16 500	79 000	1 680	8 100	8 500	FNTA-3047	FTRA-3047
35	52	2	17 300	88 000	1 770	8 950	8 000	FNTA-3552	FTRA-3552
40	60	3	26 900	122 000	2 740	12 400	6 700	FNTA-4060	FTRA-4060
45	65	3	28 700	137 000	2 930	14 000	6 300	FNTA-4565	FTRA-4565
50	70	3	30 500	152 000	3 100	15 500	5 600	FNTA-5070	FTRA-5070
55	78	3	37 000	201 000	3 750	20 500	5 300	FNTA-5578	FTRA-5578
60	85	3	43 000	252 000	4 400	25 700	4 800	FNTA-6085	FTRA-6085
65	90	3	45 500	274 000	4 600	28 000	4 500	FNTA-6590	FTRA-6590
70	95	4	59 000	320 000	6 000	33 000	4 300	FNTA-7095	FTRA-7095
75	100	4	60 000	335 000	6 150	34 500	4 000	FNTA-75100	FTRA-75100
80 85 90 100	105 110 120 135	4 4 4	63 000 64 500 80 000 98 500	365 000 380 000 515 000 695 000	6 450 6 550 8 150 10 000	37 500 39 000 52 500 71 000	3 800 3 600 3 400 3 000	FNTA-80105 FNTA-85110 FNTA-90120 FNTA-100135	FTRA-80105 FTRA-85110 FTRA-90120 FTRA-100135



^(*) The tolerance of this bearing bore diameter is +0.025 to +0.175mm and outside diameter tolerance is





Bearing Numbers	Bearing Numbers of Matching Bearing Rings						ss)
$S=1.5^{-0.08}$	$s=2.0^{-0.08}$	$S=2.5^{+0.08}$	$s=3.0^{-0.08}$	(m Outside Diameter $D_{ m e}$ min.		appr FNTA	
FTRB-1024	FTRC-1024	<u> </u>	—	22.0	11.5	2.3	2.9
FTRB-1226	FTRC-1226		—	24.0	13.5	3.4	3.3
FTRB-1528	FTRC-1528		FTRE-1528	26.0	16.5	3.5	3.5
FTRB-1629	FTRC-1629	FTRD-1629	FTRE-1629	27.0	17.5	3.7	3.6
FTRB-1730	FTRC-1730	FTRD-1730	FTRE-1730	28.0	18.5	3.8	3.8
FTRB-1831	FTRC-1831	FTRD-1831	FTRE-1831	29.0	19.5	4	3.9
FTRB-2035	FTRC-2035	FTRD-2035	FTRE-2035	33.0	21.5	5.4	5.1
FTRB-2542	FTRC-2542	FTRD-2542	FTRE-2542	40.0	26.5	7.7	7
FTRB-3047	FTRC-3047	FTRD-3047	FTRE-3047	45.0	31.5	8.9	7.9
FTRB-3552	FTRC-3552	FTRD-3552	FTRE-3552	50.5	36.5	9.7	9.1
FTRB-4060	FTRC-4060	FTRD-4060	FTRE-4060	57.0	42.0	18	12
FTRB-4565	FTRC-4565	FTRD-4565	FTRE-4565	62.0	47.0	20	13
FTRB-5070	FTRC-5070	FTRD-5070	FTRE-5070	67.0	51.5	22	15
FTRB-5578	FTRC-5578	FTRD-5578	FTRE-5578	75.0	57.0	29	19
FTRB-6085	FTRC-6085	FTRD-6085	FTRE-6085	82.0	61.5	35	22
FTRB-6590	FTRC-6590	FTRD-6590	FTRE-6590	87.5	66.5	38	24
FTRB-7095	FTRC-7095	FTRD-7095	FTRE-7095	92.5	71.5	52	25
FTRB-75100	FTRC-75100	FTRD-75100	FTRE-75100	97.5	76.5	54	27
FTRB-80105	FTRC-80105	FTRD-80105	FTRE-80105	102.5	81.5	58	28
FTRB-85110	FTRC-85110	FTRD-85110	FTRE-85110	107.5	86.5	63	30
FTRB-90120	FTRC-90120	FTRD-90120	FTRE-90120	117.5	91.5	80	38
FTRB-100135	FTRC-100135	FTRD-100135	FTRE-100135	132.5	101.5	105	50

B 275 B 274

^{-0.040} to -0.370mm

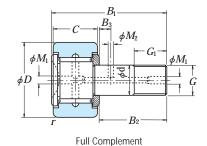
FCR (Full Complement)

FCRS Full Complement, Sealed With Thrust Washer

FCJ (With Cage)

FCJS Sealed, with Cage and Thrust Washer

Outside Diameter 16 – 90 mm



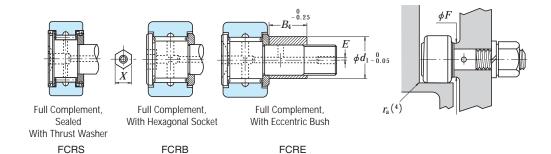
FCR

Bound	ary Dime (mm)	ensions			Di	mensions (mm)					Bearing	J Numbers
D	C	d	Screw <i>G</i>	G_1	B_1	B_2	B_3	M_2	M_1	$r \atop { m min.}$	FCR FCJ	FCRS FCJS
16	11 11	6 6	M 6×1 M 6×1	8 8	28 28	16 16	_	_	4(1) 4(1)	0.3 0.3	FCR-16 FCJ-16	FCRS-16 FCJS-16
19	11 11	8	M 8×1.25 M 8×1.25	10 10	32 32	20 20	=	=	4(1) 4(1)	0.3 0.3	FCR-19 FCJ-19	FCRS-19 FCJS-19
22	12 12	10 10	M10×1.25 M10×1.25	12 12	36 36	23 23	_	_	4(1) 4(1)	0.3 0.3	FCR-22 FCJ-22	FCRS-22 FCJS-22
26	12 12	10 10	M10×1.25 M10×1.25	12 12	36 36	23 23	=	=	4(1) 4(1)	0.3 0.3	FCR-26 FCJ-26	FCRS-26 FCJS-26
30	14 14	12 12	M12×1.5 M12×1.5	13 13	40 40	25 25	6 6	3	6 6	0.6 0.6	FCR-30 FCJ-30	FCRS-30 FCJS-30
32	14 14	12 12	M12×1.5 M12×1.5	13 13	40 40	25 25	6 6	3 3	6 6	0.6 0.6	FCR-32 FCJ-32	FCRS-32 FCJS-32
35	18 18	16 16	M16×1.5 M16×1.5	17 17	52 52	32.5 32.5	8 8	3	6 6	0.6 0.6	FCR-35 FCJ-35	FCRS-35 FCJS-35
40	20 20	18 18	M18×1.5 M18×1.5	19 19	58 58	36.5 36.5	8 8	3	6 6	1 1	FCR-40 FCJ-40	FCRS-40 FCJS-40
47	24 24	20 20	M20×1.5 M20×1.5	21 21	66 66	40.5 40.5	9 9	4 4	8	1 1	FCR-47 FCJ-47	FCRS-47 FCJS-47
52	24 24	20 20	M20×1.5 M20×1.5	21 21	66 66	40.5 40.5	9 9	4 4	8	1 1	FCR-52 FCJ-52	FCRS-52 FCJS-52
62	29 29	24 24	M24×1.5 M24×1.5	25 25	80 80	49.5 49.5	11 11	4 4	8	1 1	FCR-62 FCJ-62	FCRS-62 FCJS-62
72	29 29	24 24	M24×1.5 M24×1.5	25 25	80 80	49.5 49.5	11 11	4 4	8	1 1	FCR-72 FCJ-72	FCRS-72 FCJS-72
80	35 35	30 30	M30×1.5 M30×1.5	32 32	100 100	63 63	15 15	4 4	8	1 1	FCR-80 FCJ-80	FCRS-80 FCJS-80
85	35 35	30 30	M30×1.5 M30×1.5	32 32	100 100	63 63	15 15	4 4	8	1 1	FCR-85 FCJ-85	FCRS-85 FCJS-85
90	35 35	30 30	M30×1.5 M30×1.5	32 32	100 100	63 63	15 15	4 4	8 8	1 1	FCR-90 FCJ-90	FCRS-90 FCJS-90

Notes (1) Only the head of the stud has on oil hole.

(2) Applicable to FCRB only.

Remarks Standard grease is packed in sealed cam followers, but not in cam followers without seals.



Basic Dynamic L	oad Ratings {kgf}	Limiting (N)	{kgf}	Limiting Tra	ck Loads {kgf}	Mass (kg)	Dimensions of Hexagonal Socket (2)(width across flats)		Bush Dime (mm)		Shoulder Dimensions (mm)	Tightening (N·cm) {I	
$C_{\rm r}$		$P_{ m ma}$	х			approx.	(mm) X	B_4	$d_{\scriptscriptstyle 1}$	Ε	F (min.)	(max.)	(max.)
5 800	590	2 360	240	3 350	340	0.020	4	8	9	0.5	11	226	23
2 830	288	2 360	240	3 350	340	0.018	4	8	9	0.5	11	226	23
6 600	670	4 200	425	4 150	425	0.031	4 4	10	11	0.5	13	550	56
3 450	355	4 200	425	4 150	425	0.030		10	11	0.5	13	550	56
8 550	875	6 550	665	5 300	540	0.047	5	11	13	0.5	15	1 060	108
4 350	445	6 550	665	5 300	540	0.045	5	11	13	0.5	15	1 060	108
8 550	875	6 550	665	6 000	610	0.060	5	11	13	0.5	15	1 060	108
4 350	445	6 550	665	6 000	610	0.058	5	11	13	0.5	15	1 060	108
12 500	1 280	9 250	945	7 800	795	0.088	6	12	17	1	20	1 450	148
7 200	735	9 250	945	7 800	795	0.086	6	12	17	1	20	1 450	148
12 500	1 280	9 250	945	8 050	820	0.099	6	12	17	1	20	1 450	148
7 200	735	9 250	945	8 050	820	0.096	6	12	17	1	20	1 450	148
18 600	1 900	17 000	1 740	11 800	1 200	0.17	10	15.5	22	1	24	4 000	410
9 700	990	17 000	1 740	11 800	1 200	0.165	10	15.5	22	1	24	4 000	410
20 500	2 090	21 700	2 220	14 300	1 460	0.25	10	17.5	24	1	26	5 950	605
10 300	1 050	21 700	2 220	14 300	1 460	0.24	10	17.5	24	1	26	5 950	605
28 200	2 880	26 400	2 690	20 800	2 120	0.39	12	19.5	27	1	31	8 450	860
19 200	1 950	26 400	2 690	20 800	2 120	0.38	12	19.5	27	1	31	8 450	860
28 200	2 880	26 400	2 690	22 900	2 340	0.47	12	19.5	27	1	31	8 450	860
19 200	1 950	26 400	2 690	22 900	2 340	0.455	12	19.5	27	1	31	8 450	860
40 000	4 100	38 500	3 950	34 000	3 450	0.80	14	24.5	34	1	45	15 200	1 550
24 900	2 540	38 500	3 950	34 000	3 450	0.79	14	24.5	34	1	45	15 200	1 550
40 000	4 100	38 500	3 950	38 000	3 860	1.05	14	24.5	34	1	45	15 200	1 550
24 900	2 540	38 500	3 950	38 000	3 860	1.05	14	24.5	34	1	45	15 200	1 550
60 500	6 200	61 000	6 200	52 000	5 300	1.55	17	31	40	1.5	52	30 500	3 120
39 000	4 000	61 000	6 200	52 000	5 300	1.55	17	31	40	1.5	52	30 500	3 120
60 500	6 200	61 000	6 200	55 500	5 650	1.75	17	31	40	1.5	52	30 500	3 120
39 000	4 000	61 000	6 200	55 500	5 650	1.75	17	31	40	1.5	52	30 500	3 120
60 500	6 200	61 000	6 200	59 000	6 000	1.95	17	31	40	1.5	52	30 500	3 120
39 000	4 000	61 000	6 200	59 000	6 000	1.95	17	31	40	1.5	52	30 500	3 120

Notes (3) Applicable to FCRE only.

(4) Should not be greater than r (min).



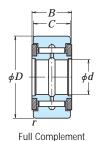
FYCR (Full Complement)

FYCRS Full Complement, Sealed with Thrust Washer

FYCJ (With Cage)

FYCJS Sealed, with Cage and Thrust Washer

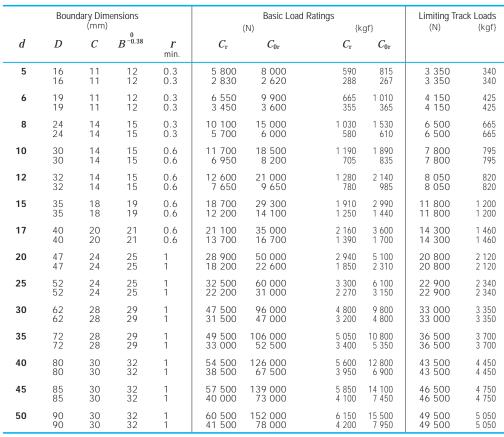
Bore Diameter 5 – 50 mm



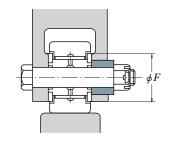
Full Complement, Sealed with Thrust Washer

FYCR

FYCRS







Bearing	Numbers	Mass (kg)	Shoulder Dimensions
FYCR FYCJ	FYCRS FYCJS	approx.	(mm) F min.
FYCR-5	FYCRS-5	0.016	10
FYCJ-5	FYCJS-5	0.014	10
FYCR-6	FYCRS-6	0.022	12
FYCJ-6	FYCJS-6	0.020	12
FYCR-8	FYCRS-8	0.044	14
FYCJ-8	FYCJS-8	0.042	14
FYCR-10	FYCRS-10	0.069	17
FYCJ-10	FYCJS-10	0.067	17
FYCR-12	FYCRS-12	0.076	19
FYCJ-12	FYCJS-12	0.074	19
FYCR-15	FYCRS-15	0.105	23
FYCJ-15	FYCJS-15	0.097	23
FYCR-17	FYCRS-17	0.145	25
FYCJ-17	FYCJS-17	0.14	25
FYCR-20	FYCRS-20	0.255	29
FYCJ-20	FYCJS-20	0.245	29
FYCR-25	FYCRS-25	0.285	34
FYCJ-25	FYCJS-25	0.275	34
FYCR-30	FYCRS-30	0.48	51
FYCJ-30	FYCJS-30	0.47	51
FYCR-35	FYCRS-35	0.64	58
FYCJ-35	FYCJS-35	0.635	58
FYCR-40	FYCRS-40	0.88	66
FYCJ-40	FYCJS-40	0.865	66
FYCR-45	FYCRS-45	0.93	72
FYCJ-45	FYCJS-45	0.91	72
FYCR-50	FYCRS-50	0.995	76
FYCJ-50	FYCJS-50	0.965	76



BALL BEARING UNITS

SET SCREW TYPE PILLOW BLOCKS CAST HOUSING

UCP2 Shaft Diameter 12 – 90mm B286

1/2 – 3 1/2 inch

SET SCREW TYPE FLANGED UNITS CAST HOUSING

UCF2 Shaft Diameter 12 – 90mm B292

1/2 – 3 1/2 inch

1/2 – 3 1/2 inch

B 280 B 281

1. CONSTRUCTION

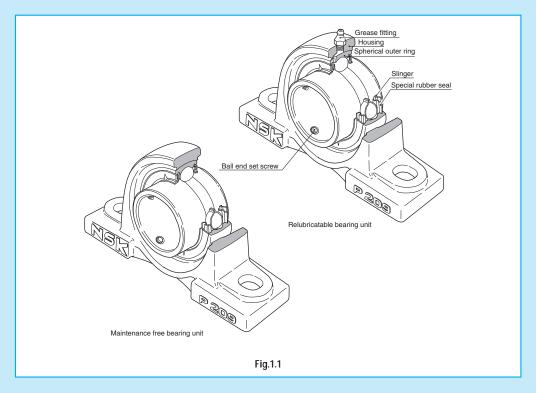
The NSK bearing unit is a combination of a radial ball bearing, seal, and a housing of high-grade cast iron or pressed steel, which comes in various shapes.

The outer surface of the bearing and the internal surface of the housing are spherical, so that the unit is self-aligning.

The inside construction of the ball bearing for the unit is such that steel balls and retainers of the same type as in series 62 and 63 of the deep groove ball bearing are used. A duplex seal consisting of a combination of an oil-proof synthetic rubber seal and a slinger is provided on both sides.

Depending on the type, the following methods of fitting to the shaft are employed:

- The inner ring is fastened onto the shaft in two places by set screws.
- (2) The inner ring has a tapered bore and is fitted to the shaft by means of an adapter.
- (3) In the eccentric locking collar system the inns ring is fastened to the shaft by means of eccentrics grooves provided at the side of the inner ring and on the collar.



2. DESIGN FEATURES AND ADVANTAGES

2.1 MAINTENANCE FREE TYPE

The NSK Maintenance free bearing unit contains a high-grade lithium-based grease, good for use over a long period, which is ideally suited to sealed-type bearing. Also provided is an excellent sealing device, which prevents any leakage of grease or penetration of dust and water from outside.

It is designed so that the rotation of the shaft causes the sealed-in grease to circulate through the inside space, effectively providing maximum lubrication. The lubrication effect is maintained over a long period with no need for replenishment of grease.

To summarize the advantages of the NSK maintenance free bearing unit:

- (1) As an adequate amount of good quality grease is sealed in at the time of manufacture, there is no need for replenishment. This means savings in terms of time and maintenance costs.
- (2) Since there is no need for any regreasing facilities, such as piping, a more compact design is possible.
- (3) The sealed-in design eliminates the possibility of grease leakage, which could lead to stained products.

2.2 RELUBRICATABLE TYPE

The NSK relubricatable type bearing unit has an advantage over other similar, units being so designed as to permit regreasing even in the case of misalignment of 2° to the right or left. The hole through which the grease fitting is mounted usually causes structural weakening of the housing.

However, as a result of extensive testing, in the NSK bearing unit the hole is positioned so as to minimize this adverse effect. In addition, the regreasing groove has been designed to minimize weakening of the housing.

While the NSK maintenance free type bearing unit is satisfactory for use under normal operating conditions in-doors, in the following circumstances it is necessary to use the relubricatable type bearing unit:

- (1) Cases where the temperature of the bearing rises above 100°C, 212°F:
 - *-Normal temperature of up to 130°C, 266°F heat-resistant bearing units.
- (2) Cases where there is excessive dust, but space does not permit using a bearing unit with a cover.
- (3) Cases where the bearing unit is constantly exposed to splashes of water or any other liquid, but space does not permit using a bearing unit with a cover.
- (4) Cases in which the humidity is very high, and the machine in which the bearing unit is used is run only intermittently.

- (5) Cases involving a heavy load of which the Cr/Pr value is about 10 or below, and the speed is 10 min⁻¹ or below, or the movement is oscillatory.
- (6) Cases where the number of revolutions is relatively high and the noise problem has to be considered; for example, when the bearing is used with the fan of an air conditioner.

2.3 SPECIAL SEALING FEATURE

2.3.1 STANDARD BEARING UNITS

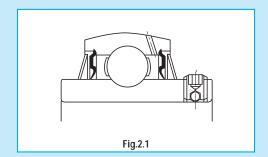
The sealing device of the ball bearing for the NSK bearing unit is a combination of a heat-resistant and oil-proof synthetic rubber seal and a slinger of an exclusive design.

The seal, which is fixed in the outer ring, is steel-reinforced, and its lip, in contact with the inner ring, is designed to minimize frictional torque.

The slinger is fixed to the inner ring of the bearing with which it rotates. There is a small clearance between its periphery and the outer ring.

There are triangular protrusions on the outside face of the slinger and, as the bearing rotates, these protrusions on the slinger create a flow of air outward from the bearing. In this way, the slinger acts as a fan which-keeps dust and water away from the bearing.

These two types of seals on both sides of the bearing prevent grease leakage, and foreign matter is prevented from entering the bearing from outside.





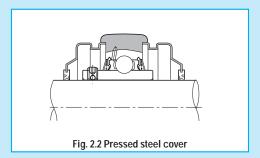
2.3.2 BEARING UNITS WITH COVERS

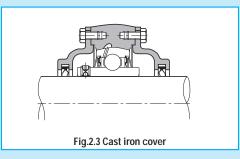
The NSK bearing unit with a cover consists of a standard bearing unit and an outside covering for extra protection against dust. Special consideration has been given to its design with respect to dust-proofing.

Sealing devices are provided in both the bearing and the housing, so that units of this type operate satisfactorily even in such adverse environments as flour mills, steel mills, foundries, galvanizing plants and chemical plants, where excessive dust is produced and/or liquids are used. They are also eminently suitable for outdoor environments where dust and rain are inevitable, and in heavy industrial machinery such as construction and transportation equipment.

The rubber seal of the cover contacts with the shaft by its two lips, as shown in Fig. 2.2 and 2.3. By filling the groove between the two lips with grease, an excellent sealing effect is obtained and, at the same time, the contacting portions of the lips are lubricated. Furthermore, the groove is so designed that when the shaft is inclined the rubber seal can move in the radial direction.

When bearing units are exposed to splashes of water rather than to dust, a drain hole (5 to 8 mm, 0.2 to 0.3 inches in diameter)is provided at the bottom of the cover, and grease should be applied to the side of the bearing itself instead of into the cover.





2.4 SECURE FITTING

Fastening the bearing to the shaft is effected by tightening the ball-end set screw, situated on the inner ring. This is a unique feature which prevents loosening, even if the bearing is subject to intense vibrations and shocks.

2.5 SELF-ALIGNING

With the NSK bearing unit, the outer surface of the ball bearing and the inner surface of the housing are spherical, thus this bearing unit has self-aligning characteristic. Any misalignment of axis that arise from poor workmanship on the shaft or errors in fitting will be properly adjusted.

2.6 HIGHER RATED LOAD CAPACITY

The bearing used in the unit is of the same internal construction as those in bearing series 62 and 63, and is capable of accommodating axial load as well as radial load, or composite load. The rated load capacity or this bearing is considerably higher than that of the corresponding self-aligning ball bearings used for standard plummer blocks

2.7 LIGHT WEIGHT YET STRONG HOUSING

Housings for NSK bearing units come in various shapes. They consist of either high-grade cast iron, one-piece casting, or of precision finished pressed steel, the latter being lighter in weight. In either case, they are practically designed to combine lightness with maximum strength.

2.8 EASY MOUNTING

The NSK bearing unit is an integrated unit consisting of a bearing and a housing.

As the bearing is prelubricated at manufacture with the correct amount of high-grade lithium base, it can be mounted on the shaft just as it is. It is sufficient to carry out a short test run after mounting.

2.9 ACCURATE FITTING OF THE HOUSING

In order to simplify the fitting of the pillow block and flange type bearing units, the housings are provided with a seat for a dowel pin, which may be utilized as needed.

2.10 BEARING REPLACEABILITY

The bearing used in the NSK bearing unit is replaceable. In the event of bearing failure, a new bearing can be fitted to the existing housing.

3. RECOMMENDED TORQUES FOR TIGTENING SET SCREWS

Table 3.1 Recommended torques for tightening set screws

A) Metric series, applied to metric bore size.

	ion of the pplicable υ		Designation of set screws	Tightening torques N·m (max.)
UC201 to UC205	_	_	M 5×0.8 × 7	3.9
UC206	_	UC305 to UC306	M 6×0.75× 8	4.9
UC207	UCX05	_	M 6×0.75× 8	5.8
UC208 to UC210	_	_	M 8×1 ×10	7.8
UC211	UCX06 to UCX08	UC307	M 8×1 ×10	9.8
UC212	UCX09	_	M10×1.25×12	16.6
UC213 to UC215	_	UC308 to UC309	M10×1.25×12	19.6
UC216	UCX10	_	M10×1.25×12	22.5
_	UCX11 to UCX12	_	M10×1.25×12	24.5
UC217 to UC218	UCX13 to UCX15	UC310 to UC314	M12×1.5 ×13	29.4
_	UCX16 to UCX17	_	M12×1.5 ×13	34.3
	UCX18	UC315 to UC316	M14×1.5 ×15	34.3
	UCX20	UC317 to UC319	M16×1.5 ×18	53.9
_	_	UC320 to UC324	M18×1.5 ×20	58.8
_	_	UC326 to UC328	M20×1.5 ×25	78.4

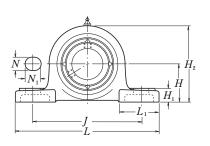
D)	L. L. L. L.		40.00	4.15	10000	1	
В,) inch	series,	applie	a to	incn	pore	SIZe.

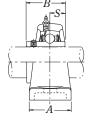
for th	ion of the ne unit to v given are a	vhich	Designation of set screws	Tightening torques Ibf-inch (max
UC201 to UC205	_	_	No.10 -32UNF	34
UC206	_	UC305 to UC306	¹ /4 -28UNF	43
UC207	UCX05	_	¹ / ₄ -28UNF	52
UC208 to UC210	_	_	⁵ /16 -24UNF	69
UC211	UCX06 to UCX08	UC307	⁵ /16 -24UNF	86
UC212	UCX09	_	³ /8 -24UNF	147
UC213 to UC215	_	UC308 to UC309	³ /8 -24UNF	173
UC216	UCX10	_	³ /8 -24UNF	199
_	UCX11 to UCX12	_	³ /8 -24UNF	216
UC217 to UC218	UCX13 to UCX15	UC310 to UC314	¹ /2 -20UNF	260
_	UCX16 to UCX17	_	¹ /2 -20UNF	303
_	UCX18	UC315 to UC316	⁹ /16 -18UNF	303
-	UCX20	UC317 to UC318	⁵ /8 -18UNF	477
-	_	UC320	⁵ /8 -18UNF	520

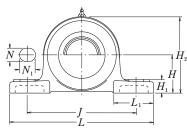
Designation of the bearings of applicable units	Designation of set screws	Tightening torques N·m (max.)
AS201 to 205	M5×0.8 × 7	3.4
AS206	M6×0.75× 8	4.4
AS207	M6×0.75× 8	4.9
AS208	M8×1 ×10	6.8

Designation of the bearings for the unit to which torques given are applicable	Designation of set screws	Tightening torques lbf·inch (max.)
AS201 to 205	No 10-32UNF	30
AS206	¹ /4 -28UNF	39
AS207	1/4 -28UNF	43
AS208	5/16-24UNF	60

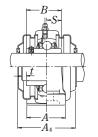
Pillow blocks units cast housing Set screw type

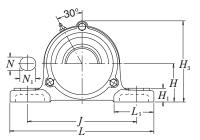


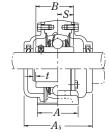




Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1







Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

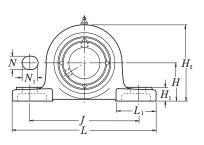
Shaft dia.	Unit number(1)					Nomin	al dime	ensions					Bolt size	Bearing number
						n	nm inc	:h						
mm inch		Н	L	J	A	N	N_1	H_1	H_2	L_1	В	S	mm inch	
12 1/2	UCP201D1 UCP201-008D1	30.2 1 ³ /16	127 5	95 3 ³ / ₄	38 1 ¹ / ₂	13 1/2	16 5/8	14 9/16	62 2 ⁷ / ₁₆	42 1 ²¹ / ₃₂	31 1.2205	12.7 0.500	M10 3/8	UC201D1 UC201-008D1
15	UCP202D1	30.2	127	95	38	13	16	14	62	42	31	12.7	M10	UC202D1
9/16 5/8	UCP202-009D1 UCP202-010D1	1 3/16	5	33/4	11/2	1/2	5/8	9/16	27/16	1 21/32	1.2205	0.500	3/8	UC202-009D1 UC202-010D1
17	UCP203D1 UCP203-011D1	30.2 1 ³ / ₁₆	127 5	95 3 ³ / ₄	38 1 ¹ / ₂	13 1/2	16 5/8	14 9/16	62	42 1 ²¹ / ₃₂	31 1.2205	12.7 0.500	M10 3/8	UC203D1
														UC203-011D1
20 3/ ₄	UCP204D1 UCP204-012D1	33.3 1 ⁵ /16	127 5	95 3 ³ / ₄	38 1 ¹ / ₂	13 1/2	16 5/8	14 9/16	65 2 9/16	42 1 ²¹ / ₃₂	31 1.2205	12.7 0.500	M10 3/8	UC204D1 UC204-012D1
25	UCP205D1	36.5	140	105	38	13	16	15	71	42	34.1	14.3	M10	UC205D1
7/8	UCP205-013D1 UCP205-014D1 UCP205-015D1 UCP205-100D1	1 ⁷ /16	51/2	4 ¹ /8	1 ¹ / ₂	1/2	5/8	19/32	2 ²⁵ / ₃₂	1 21/32	1.3425	0.563	3/8	UC205-013D1 UC205-014D1 UC205-015D1 UC205-100D1
30	UCP206D1	42.9	165	121	48	17	20	17	83	54	38.1	15.9	M14	UC206D1
11/8	UCP206-101D1 UCP206-102D1 UCP206-103D1 UCP206-104D1	1 ¹¹ /16	61/2	4 3/4	1 ⁷ /8	21/32	25/32	21/32	3 9/32	21/8	1.5000	0.626	1/2	UC206-101D1 UC206-102D1 UC206-103D1 UC206-104D1
35	UCP207D1	47.6	167	127	48	17	20	18	93	54	42.9	17.5	M14	UC207D1
13/8	UCP207-104D1 UCP207-105D1 UCP207-106D1 UCP207-107D1	1 ⁷ /8	6 9/16	5	1 ⁷ /8	21/32	25/32	23/32	3 21/32	21/8	1.6890	0.689	1/2	UC207-104D1 UC207-105D1 UC207-106D1 UC207-107D1
40	UCP208D1	49.2	184	137	54	17	20	18	98	52	49.2	19	M14	UC208D1
1 ¹ / ₂ 1 ⁹ / ₁₆	UCP208-108D1 UCP208-109D1	1 15/16	71/4	513/32	21/8	21/32	25/32	23/32	3 27/32	21/16	1.9370	0.748	1/2	UC208-108D1 UC208-109D1

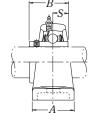
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

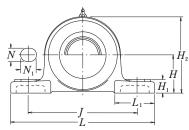
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nominal di	mensions	i	N	lass of uni	it
	cover type		t	$egin{array}{c} mm \ A_{\scriptscriptstyle 4} \end{array}$	inch H_3	A_5		kg lb	
			max.	•	3	J	UCP	Z(ZM)	C(CM)
P203D1 P203D1	Z(ZM)-UCP201D1 Z(ZM)-UCP201-008D1	C(CM)-UCP201D1 C(CM)-UCP201-008D1	2 5/64	45 1 ²⁵ / ₃₂	67 2 ⁵ /8	62 2 ⁷ /16	0.7 1.5	0.7 1.5	1.0 2.2
P203D1	Z(ZM)-UCP202D1	C(CM)-UCP202D1	2	45	67	62	0.7	0.7	1.0
P203D1 P203D1	Z(ZM)-UCP202-009D1 Z(ZM)-UCP202-010D1	C(CM)-UCP202-009D1 C(CM)-UCP202-010D1	5/64	125/32	2 5/8	27/16	1.5	1.5	2.2
P203D1 P203D1	Z(ZM)-UCP203D1 Z(ZM)-UCP203-011D1	C(CM)-UCP203D1 C(CM)-UCP203-011D1	2 5/64	45 1 ²⁵ /32	67 2 5/8	62 2 ⁷ / ₁₆	0.7 1.5	0.7 1.5	1.0
P204D1	Z(ZM)-UCP204D1	C(CM)-UCP204D1	2	45	70	62	0.7	0.7	0.9
P204D1	Z(ZM)-UCP204-012D1	C(CM)-UCP204-012D1	5/64	1 ²⁵ /32	2 ³ / ₄	2 ⁷ /16	1.5	1.5	2.0
P205D1	Z(ZM)-UCP205D1	C(CM)-UCP205D1	2	48	76	70	0.8	0.9	1.1
P205D1 P205D1	Z(ZM)-UCP205-013D1 Z(ZM)-UCP205-014D1	C(CM)-UCP205-013D1 C(CM)-UCP205-014D1	E.			-0.1			
P205D1	Z(ZM)-UCP205-015D1	C(CM)-UCP205-015D1	5/64	1 ²⁹ /32	3	2 ³ /4	1.8	2.0	2.4
P205D1	Z(ZM)-UCP205-100D1	C(CM)-UCP205-100D1							
P206D1 P206D1	Z(ZM)-UCP206D1	C(CM)-UCP206D1	2	53	88	75	1.4	1.4	1.7
P206D1 P206D1	Z(ZM)-UCP206-101D1 Z(ZM)-UCP206-102D1	C(CM)-UCP206-101D1 C(CM)-UCP206-102D1	5/64	2 3/32	3 15/32	2 ¹⁵ / ₁₆	3.1	3.1	3.7
P206D1	Z(ZM)-UCP206-103D1	C(CM)-UCP206-103D1							
P206D1	_	_							
P207D1 P207D1	Z(ZM)-UCP207D1 Z(ZM)-UCP207-104D1	C(CM)-UCP207D1 C(CM)-UCP207-104D1	3	60	99	80	1.6	1.7	2.0
P207D1	Z(ZM)-UCP207-105D1	C(CM)-UCP207-105D1	1/8	2 3/8	3 29/32	3 5/32	3.5	3.7	4.4
P207D1	Z(ZM)-UCP207-106D1	C(CM)-UCP207-106D1							
P207D1	_	_							
P208D1 P208D1	Z(ZM)-UCP208D1 Z(ZM)-UCP208-108D1	C(CM)-UCP208D1 C(CM)-UCP208-108D1	3	69	105	90	1.9	2.1	2.7
P208D1	Z(ZM)-UCP208-109D1	C(CM)-UCP208-109D1	1/8	2 23/32	41/8	3 17/32	4.2	4.6	6.0

B 286 B 287

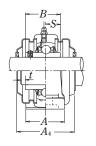
Pillow blocks units cast housing Set screw type

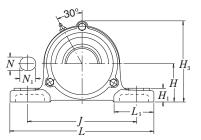


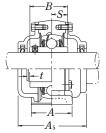




Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1







Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

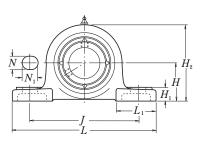
Shaft dia.	Unit number(1)					Nomin	al dime	ensions					Bolt size	Bearing number
						n	nm inc	h						
mm inch		Н	L	J	A	N	N_{1}	H_1	H_2	L_1	В	S	mm inch	
45	UCP209D1	54	190	146	54	17	20	20	106	60	49.2	19	M14	UC209D1
1 ⁵ /8 1 ¹¹ / ₁₆ 1 ³ / ₄	UCP209-110D1 UCP209-111D1 UCP209-112D1	21/8	7 15/32	53/4	21/8	21/32	25/32	25/32	43/16	2 3/8	1.9370	0.748	1/2	UC209-110D1 UC209-111D1 UC209-112D1
50	UCP210D1	57.2	206	159	60	20	23	21	114	65	51.6	19	M16	UC210D1
17/8	UCP210-113D1 UCP210-114D1 UCP210-115D1 UCP210-200D1	21/4	81/8	61/4	2 ³ /8	25/32	29/32	13/16	41/2	2 ⁹ /16	2.0315	0.748	5/8	UC210-113D1 UC210-114D1 UC210-115D1 UC210-200D1
55	UCP211D1	63.5	219	171	60	20	23	23	126	65	55.6	22.2	M16	UC211D1
2 21/16 21/8 23/16	UCP211-200D1 UCP211-201D1 UCP211-202D1 UCP211-203D1	2 ¹ /2	8 5/8	6 ²³ /32	2 ³ /8	25/32	29/32	29/32	4 ³¹ / ₃₂	2 9/16	2.1890	0.874	5/8	UC211-200D1 UC211-201D1 UC211-202D1 UC211-203D1
60	UCP212D1	69.8	241	184	70	20	23	25	138	70	65.1	25.4	M16	UC212D1
21/4 25/16 23/8 27/16	UCP212-204D1 UCP212-205D1 UCP212-206D1 UCP212-207D1	23/4	9 1/2	7 1/4	23/4	25/32	29/32	31/32	5 ⁷ /16	23/4	2.5630	1.000	5/8	UC212-204D1 UC212-205D1 UC212-206D1 UC212-207D1
65	UCP213D1	76.2	265	203	70	25	28	27	151	77	65.1	25.4	M20	UC213D1
2 ¹ / ₂ 2 ⁹ / ₁₆	UCP213-208D1 UCP213-209D1	3	10 ⁷ /16	8	2 ³ /4	31/32	13/32	1 ¹ /16	5 ¹⁵ / ₁₆	31/32	2.5630	1.000	3/4	UC213-208D1 UC213-209D1
70	UCP214D1	79.4	266	210	72	25	28	27	157	77	74.6	30.2	M20	UC214D1
2 ⁵ /8 2 ¹¹ / ₁₆ 2 ³ / ₄	UCP214-210D1 UCP214-211D1 UCP214-212D1	31/8	1015/32	89/32	2 27/32	31/32	13/32	11/16	6 3/16	31/32	2.9370	1.189	3/4	UC214-210D1 UC214-211D1 UC214-212D1

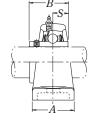
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

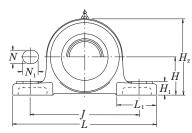
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nominal di	imensions	5	N	lass of un	it
			,	mm 4		4		kg lb	
			t max.	A_4	H_3	A_5	UCP	Z(ZM)	C(CM)
P209D1 P209D1	Z(ZM)-UCP209D1 Z(ZM)-UCP209-110D1	C(CM)-UCP209D1 C(CM)-UCP209-110D1	3	69	113	95	2.2	2.4	3.1
P209D1 P209D1	Z(ZM)-UCP209-110D1 Z(ZM)-UCP209-111D1	C(CM)-UCP209-111D1	1/8	2 23/32	4 7/16	33/4	4.9	5.3	6.8
P209D1	Z(ZM)-UCP209-112D1	C(CM)-UCP209-112D1							
P210D1	Z(ZM)-UCP210D1	C(CM)-UCP210D1	3	76	119	100	2.7	2.8	3.6
P210D1 P210D1	Z(ZM)-UCP210-113D1 Z(ZM)-UCP210-114D1	C(CM)-UCP210-113D1 C(CM)-UCP210-114D1	1/8	3	411/16	315/16	6.0	6.2	7.9
P210D1	Z(ZM)-UCP210-115D1	C(CM)-UCP210-115D1							
P210D1	_	C(CM)-UCP210-200D1							
P211D1	Z(ZM)-UCP211D1	C(CM)-UCP211D1	4	77	130	100	3.5	3.5	4.4
P211D1 P211D1	Z(ZM)-UCP211-200D1 Z(ZM)-UCP211-201D1	C(CM)-UCP211-200D1 C(CM)-UCP211-201D1	E /	01/	E1/-	315/16		7.7	0.7
P211D1	Z(ZM)-UCP211-202D1	C(CM)-UCP211-202D1	5/32	3 1/32	5 ¹ / ₈	315/16	7.7	7.7	9.7
P211D1	Z(ZM)-UCP211-203D1	C(CM)-UCP211-203D1							
P212D1	Z(ZM)-UCP212D1	C(CM)-UCP212D1	4	89	143	115	4.7	5.0	6.0
P212D1 P212D1	Z(ZM)-UCP212-204D1 Z(ZM)-UCP212-205D1	C(CM)-UCP212-204D1 C(CM)-UCP212-205D1	5/32	31/2	5 5/8	4 17/32	10	11	13
P212D1	Z(ZM)-UCP212-206D1	C(CM)-UCP212-206D1	3/32	31/2	29/8	417/32	10		13
P212D1	_	C(CM)-UCP212-207D1							
P213D1	Z(ZM)-UCP213D1	C(CM)-UCP213D1	4	91	155	120	5.6	5.8	7.2
P213D1 P213D1	Z(ZM)-UCP213-208D1 Z(ZM)-UCP213-209D1	C(CM)-UCP213-208D1 C(CM)-UCP213-209D1	5/32	319/32	6 ³ / ₃₂	423/32	12	13	16
P214D1		C(CM)-UCP214D1	4		162	135	6.5		8.3
P214D1 P214D1	_	C(CM)-UCP214-210D1	4	_	102	133	0.5	_	0.3
P214D1	_	C(CM)-UCP214-211D1	5/32	_	63/8	5 5/16	14	_	18
P214D1		C(CM)-UCP214-212D1							



Pillow blocks units cast housing Set screw type



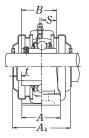


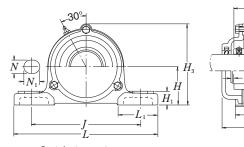


Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1

Shaft dia.	Unit number(1)		Nominal dimensions											Bearing number
mm						n	nm inc	h					mm	
inch		Н	L	J	A	N	N_1	H_1	H_2	L_1	В	S	inch	
75 2 ¹³ / ₁₆	UCP215D1 UCP215-213D1	82.6	275	217	74	25	28	28	163	80	77.8	33.3	M20	UC215D1 UC215-213D1
27/8	UCP215-214D1 UCP215-215D1 UCP215-300D1	31/4	10 ¹³ /16	817/32	2 29/32	31/32	13/32	13/32	613/32	3 5/32	3.0630	1.311	3/4	UC215-214D1 UC215-215D1 UC215-300D1
80	UCP216D1	88.9	292	232	78	25	28	30	175	85	82.6	33.3	M20	UC216D1
3 ¹ / ₁₆ 3 ¹ / ₈ 3 ³ / ₁₆	UCP216-301D1 UCP216-302D1 UCP216-303D1	31/2	11 ¹ /2	9 1/8	3 ¹ /16	31/32	1 ³ /32	1 ³ /16	6 ⁷ /8	3 ¹¹ / ₃₂	3.2520	1.311	3/4	UC216-301D1 UC216-302D1 UC216-303D1
85	UCP217D1	95.2	310	247	83	25	28	32	187	85	85.7	34.1	M20	UC217D1
	UCP217-304D1 UCP217-305D1 UCP217-307D1	33/4	12 ⁷ /32	923/32	3 9/32	31/32	1 ³ /32	11/4	7 3/8	311/32	3.3740	1.343	3/4	UC217-304D1 UC217-305D1 UC217-307D1
90 3 ¹ / ₂	UCP218D1 UCP218-308D1	101.6 4	327 12 ⁷ /8	262 10 ⁵ /16	88 3 ¹⁵ / ₃₂	27 1 ¹ /16	30 1 ³ / ₁₆	33 1 ⁵ / ₁₆	200 7 ⁷ /8	90 3 ¹⁷ / ₃₂	96 3.7795	39.7 1.563	M22 7/8	UC218D1 UC218-308D1

Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".



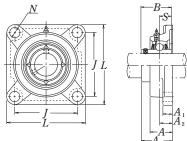


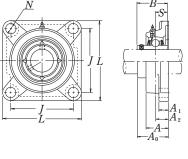
Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

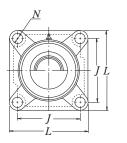
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	١	Nominal d	limensions	i	Ν	lass of un	it
	cover type		t		inch	4		kg lb	
			max.	A_4	H_3	A_5	UCP	Z(ZM)	C(CM)
P215D1	_	C(CM)-UCP215D1	4	_	168	135	7.2	_	9.3
P215D1 P215D1 P215D1 P215D1	_	C(CM)-UCP215-213D1 C(CM)-UCP215-214D1 C(CM)-UCP215-215D1 C(CM)-UCP215-300D1	5/32	_	6 5/8	5 5/16	16	_	21
P216D1	_	C(CM)-UCP216D1	4	_	181	145	8.7	_	11
P216D1 P216D1 P216D1	_	C(CM)-UCP216-301D1 C(CM)-UCP216-302D1 C(CM)-UCP216-303D1	5/32	_	7 ¹ /8	5 ²³ / ₃₂	19	_	24
P217D1	_	C(CM)-UCP217D1	5	_	191	155	11	_	13
P217D1 P217D1 P217D1	_	C(CM)-UCP217-304D1 C(CM)-UCP217-305D1 C(CM)-UCP217-307D1	13/64	_	7 17/32	6 ³ /32	24	_	29
P218D1 P218D1		C(CM)-UCP218D1 C(CM)-UCP218-308D1	5 13/64	_	204 8 ¹ / ₃₂	165 6 ¹ / ₂	13 29		16 35

B 290 B 291

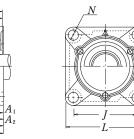
Square flanged units cast housing Set screw type

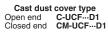












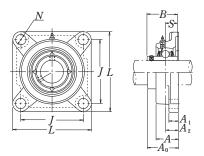
B-S-
A_1 A_2

Shaft dia.	Unit number(1)				No	minal dim	ensions				Bolt size	Bearing number	Housing number	Unit number (1) pressed steel dust cover type	Unit number (¹) cast dust cover type	Nomi	nal dimen	sions	N	lass of uni	it
mm inch		L	J	A_2	A_1	mm in A	ch N	A_0	В	S	mm inch			cover type		t max.	mm inch A_4	A_5	UCP	kg lb	C(CM)
12 1/2	UCF201D1 UCF201-008D1	86 3 ³ /8	64 2 ³³ / ₆₄	15 19/ ₃₂	11 ⁷ /16	25.5 1	12 15/32	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC201D1 UC201-008D1	F204D1 F204D1	Z(ZM)-UCF201D1 Z(ZM)-UCF201-008D1	C(CM)-UCF201D1 C(CM)-UCF201-008D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.8 1.8
9/16	UCF202D1 UCF202-009D1 UCF202-010D1	86 3 ³ /8	64 2 ³³ / ₆₄	15 19/32	11 7/16	25.5 1	12 15/ ₃₂	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC202D1 UC202-009D1 UC202-010D1	F204D1 F204D1 F204D1	Z(ZM)-UCF202D1 Z(ZM)-UCF202-009D1 Z(ZM)-UCF202-010D1	C(CM)-UCF202D1 C(CM)-UCF202-009D1 C(CM)-UCF202-010D1	2 5/64	38 11/2	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.8
	UCF203D1 UCF203-011D1	86 3 ³ /8	64 2 ³³ /64	15 19/32	11 ⁷ /16	25.5 1	12 15/32	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC203D1 UC203-011D1	F204D1 F204D1	Z(ZM)-UCF203D1 Z(ZM)-UCF203-011D1	C(CM)-UCF203D1 C(CM)-UCF203-011D1	2 ⁵ /64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.8 1.8
20 3/4	UCF204D1 UCF204-012D1	86 3 ³ /8	64 2 ³³ / ₆₄	15 19/32	11 7/16	25.5 1	12 15/32	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC204D1 UC204-012D1	F204D1 F204D1	Z(ZM)-UCF204D1 Z(ZM)-UCF204-012D1	C(CM)-UCF204D1 C(CM)-UCF204-012D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.7 1.5
13/ ₁₆ 7/ ₈ 15/ ₁₆	UCF205D1 UCF205-013D1 UCF205-014D1 UCF205-015D1 UCF205-100D1	95 3 ³ / ₄	70 2 ³ / ₄	16 5/8	13	27 1 ¹ / ₁₆	12 15/ ₃₂	35.8 1 ¹³ / ₃₂	34.1 1.3425	14.3 0.563	M10	UC205D1 UC205-013D1 UC205-014D1 UC205-015D1 UC205-100D1	F205D1 F205D1 F205D1 F205D1 F205D1	Z(ZM)-UCF205D1 Z(ZM)-UCF205-013D1 Z(ZM)-UCF205-014D1 Z(ZM)-UCF205-015D1 Z(ZM)-UCF205-100D1	C(CM)-UCF205D1 C(CM)-UCF205-013D1 C(CM)-UCF205-014D1 C(CM)-UCF205-015D1 C(CM)-UCF205-100D1	2 5/64	40 1 ¹⁹ / ₃₂	51	0.8	0.8 1.8	0.9
1 ¹ / ₈ 1 ³ / ₁₆	UCF206D1 UCF206-101D1 UCF206-102D1 UCF206-103D1 UCF206-104D1	108 4 ¹ / ₄	83 3 ¹⁷ / ₆₄	18 45/64	13	31 1 ⁷ / ₃₂	12 15/ ₃₂	40.2 1 ³⁷ / ₆₄	38.1 1.5000	15.9 0.626	M10	UC206D1 UC206-101D1 UC206-102D1 UC206-103D1 UC206-104D1	F206D1 F206D1 F206D1 F206D1 F206D1	Z(ZM)-UCF206D1 Z(ZM)-UCF206-101D1 Z(ZM)-UCF206-102D1 Z(ZM)-UCF206-103D1	C(CM)-UCF206D1 C(CM)-UCF206-101D1 C(CM)-UCF206-102D1 C(CM)-UCF206-103D1 C(CM)-UCF206-104D1	2 5/64	45 1 ³ / ₄	56 2 ⁷ / ₃₂	1.1	1.1 2.4	1.3
1 ⁵ /16 1 ³ /8	UCF207D1 UCF207-104D1 UCF207-105D1 UCF207-106D1 UCF207-107D1	117 4 ¹⁹ / ₃₂	92 3 ⁵ /8	19 3/4	15 19/32	34 1 ¹¹ / ₃₂	14 35/64	44.4 1 ³ / ₄	42.9 1.6890	17.5 0.689	M12	UC207D1 UC207-104D1 UC207-105D1 UC207-106D1 UC207-107D1	F207D1 F207D1 F207D1 F207D1 F207D1	Z(ZM)-UCF207D1 Z(ZM)-UCF207-104D1 Z(ZM)-UCF207-105D1 Z(ZM)-UCF207-106D1	C(CM)-UCF207D1 C(CM)-UCF207-104D1 C(CM)-UCF207-105D1 C(CM)-UCF207-106D1 C(CM)-UCF207-107D1	3 1/8	49 1 ¹⁵ / ₁₆	59 2 ⁵ /16	1.5 3.3	1.5 3.3	1.8
11/2	UCF208D1 UCF208-108D1 UCF208-109D1	130 5 ¹ /8	102 4 ¹ / ₆₄	21 53/64	15 19/32	36 1 ¹³ / ₃₂	16 5/8	51.2 2 ¹ / ₆₄	49.2 1.9370	19 0.748	M14	UC208D1 UC208-108D1 UC208-109D1	F208D1 F208D1 F208D1	Z(ZM)-UCF208D1 Z(ZM)-UCF208-108D1 Z(ZM)-UCF208-109D1	C(CM)-UCF208D1 C(CM)-UCF208-108D1 C(CM)-UCF208-109D1	3 1/8	56 2 ³ /16	66 2 ¹⁹ / ₃₂	1.7 3.7	1.8 4.0	2.2

Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

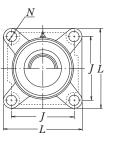
B 292 B 293

Square flanged units cast housing Set screw type



Shaft dia.	Unit number(1)				Noi	minal dime	ensions				Bolt size	Bearing number
						mm inc	ch					
mm inch		L	J	A_2	A_1	A	N	A_0	В	S	mm inch	
45 1 ⁵ /8	UCF209D1 UCF209-110D1	137	105	22	16	38	16	52.2	49.2	19	M14	UC209D1 UC209-110D1
	UCF209-110D1 UCF209-111D1 UCF209-112D1	513/32	4 9/64	55/64	5/8	11/2	5/8	21/16	1.9370	0.748	1/2	UC209-110D1 UC209-111D1 UC209-112D1
50 113/16	UCF210D1 UCF210-113D1	143	111	22	16	40	16	54.6	51.6	19	M14	UC210D1 UC210-113D1
17/8	UCF210-114D1 UCF210-115D1 UCF210-200D1	55/8	4 3/8	55/64	5/8	1 9/16	5/8	2 5/32	2.0315	0.748	1/2	UC210-114D1 UC210-115D1 UC210-200D1
55 2	UCF211D1 UCF211-200D1	162	130	25	18	43	19	58.4	55.6	22.2	M16	UC211D1 UC211-200D1
_	UCF211-200D1 UCF211-201D1 UCF211-202D1 UCF211-203D1	6 3/8	51/8	63/64	23/32	1 11/16	3/4	219/64	2.1890	0.874	5/8	UC211-200D1 UC211-201D1 UC211-202D1 UC211-203D1
60	UCF212D1	175	143	29	18	48	19	68.7	65.1	25.4	M16	UC212D1
2 ¹ / ₄ 2 ⁵ / ₁₆ 2 ³ / ₈ 2 ⁷ / ₁₆	UCF212-204D1 UCF212-205D1 UCF212-206D1 UCF212-207D1	6 ⁷ /8	5 5/8	19/64	23/32	17/8	3/4	2 ⁴⁵ /64	2.5630	1.000	5/8	UC212-204D1 UC212-205D1 UC212-206D1 UC212-207D1
65	UCF213D1	187	149	30	22	50	19	69.7	65.1	25.4	M16	UC213D1
2 ¹ / ₂ 2 ⁹ / ₁₆	UCF213-208D1 UCF213-209D1	7 3/8	5 ⁵⁵ /64	1 ³ /16	7/8	1 31/32	3/4	23/4	2.5630	1.000	5/8	UC213-208D1 UC213-209D1
70 2 ⁵ /8	UCF214D1	193	152	31	22	54	19	75.4	74.6	30.2	M16	UC214D1
	UCF214-210D1 UCF214-211D1 UCF214-212D1	7 19/32	563/64	17/32	7/8	21/8	3/4	2 ³¹ / ₃₂	2.9370	1.189	5/8	UC214-210D1 UC214-211D1 UC214-212D1

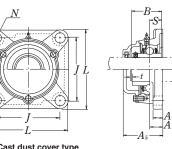
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".







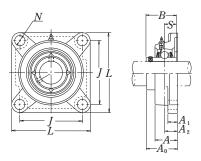
Cast dust cover type
Open end C-UCF...D1
Closed end CM-UCF...D1



Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	Nomi	nal dimen	sions	N	lass of uni	t
				mm inch			kg lb	
			t max.	A_4	A_5	UCF	Z(ZM)	C(CM)
F209D1	Z(ZM)-UCF209D1	C(CM)-UCF209D1	3	57	70	2.1	2.2	2.6
F209D1 F209D1 F209D1	Z(ZM)-UCF209-110D1 Z(ZM)-UCF209-111D1 Z(ZM)-UCF209-112D1	C(CM)-UCF209-110D1 C(CM)-UCF209-111D1 C(CM)-UCF209-112D1	1/8	21/4	23/4	4.6	4.9	5.7
F210D1	Z(ZM)-UCF210D1	C(CM)-UCF210D1	3	60	72	2.5	2.5	3.0
F210D1 F210D1 F210D1 F210D1	Z(ZM)-UCF210-113D1 Z(ZM)-UCF210-114D1 Z(ZM)-UCF210-115D1 —	C(CM)-UCF210-113D1 C(CM)-UCF210-114D1 C(CM)-UCF210-115D1 C(CM)-UCF210-200D1	1/8	2 ³ /8	2 ²⁷ / ₃₂	5.5	5.5	6.6
F211D1	Z(ZM)-UCF211D1	C(CM)-UCF211D1	4	64	75	3.3	3.4	4.0
F211D1 F211D1 F211D1 F211D1	Z(ZM)-UCF211-200D1 Z(ZM)-UCF211-201D1 Z(ZM)-UCF211-202D1 Z(ZM)-UCF211-203D1	C(CM)-UCF211-200D1 C(CM)-UCF211-201D1 C(CM)-UCF211-202D1 C(CM)-UCF211-203D1	5/32	2 1/2	2 ¹⁵ /16	7.3	7.5	8.8
F212D1	Z(ZM)-UCF212D1	C(CM)-UCF212D1	4	74	86	3.9	4.1	4.8
F212D1 F212D1 F212D1 F212D1	Z(ZM)-UCF212-204D1 Z(ZM)-UCF212-205D1 Z(ZM)-UCF212-206D1 —	C(CM)-UCF212-204D1 C(CM)-UCF212-205D1 C(CM)-UCF212-206D1 C(CM)-UCF212-207D1	5/32	2 ²⁹ /32	3 ³ /8	8.6	9.0	11
F213D1	Z(ZM)-UCF213D1	C(CM)-UCF213D1	4	76	90	5.5	5.6	6.4
F213D1 F213D1	Z(ZM)-UCF213-208D1 Z(ZM)-UCF213-209D1	C(CM)-UCF213-208D1 C(CM)-UCF213-209D1	5/32	3	317/32	12	12	14
F214D1	_	C(CM)-UCF214D1	4	_	98	6.3	_	7.4
F214D1 F214D1 F214D1	_	C(CM)-UCF214-210D1 C(CM)-UCF214-211D1 C(CM)-UCF214-212D1	5/32	_	3 27/32	14	_	16

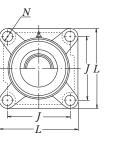
B 294 B 295

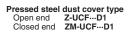
Square flanged units cast housing Set screw type

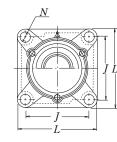


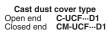
Shaft dia.	Unit number(1)				Noi	minal dime	ensions				Bolt size	Bearing number
						mm inc	ch					
inch		L	J	A_2	A_1	A	N	A_0	B	S	mm inch	
75 2 ¹³ / ₁₆	UCF215D1 UCF215-213D1	200	159	34	22	56	19	78.5	77.8	33.3	M16	UC215D1 UC215-213D1
27/8	UCF215-213D1 UCF215-214D1 UCF215-215D1 UCF215-300D1	7 ⁷ /8	6 ¹⁷ /64	1 ¹¹ /32	7/8	2 ⁷ /32	3/4	3 3/32	3.0630	1.311	5/8	UC215-213D1 UC215-214D1 UC215-215D1 UC215-300D1
80 31/16	UCF216D1 UCF216-301D1	208	165	34	22	58	23	83.3	82.6	33.3	M20	UC216D1 UC216-301D1
3 ¹ / ₈ 3 ³ / ₁₆	UCF216-302D1 UCF216-303D1	8 ³ /16	6 ¹ / ₂	1 ¹¹ /32	7/8	2 9/32	29/32	3 9/32	3.2520	1.311	3/4	UC216-303D1 UC216-303D1
85	UCF217D1	220	175	36	24	63	23	87.6	85.7	34.1	M20	UC217D1
3 ¹ / ₄ 3 ⁵ / ₁₆ 3 ⁷ / ₁₆	UCF217-304D1 UCF217-305D1 UCF217-307D1	821/32	6 ⁵⁷ /64	127/64	15/16	2 15/32	29/32	3 ²⁹ /64	3.3740	1.343	3/4	UC217-304D1 UC217-305D1 UC217-307D1
90 3 ¹ / ₂	UCF218D1 UCF218-308D1	235 9 ¹ / ₄	187 7 ²³ / ₆₄	40 1 ³⁷ / ₆₄	24 15/16	68 2 ¹¹ / ₁₆	23 29/32	96.3 3 ⁵¹ / ₆₄	96 3.7795	39.7 1.563	M20 3/4	UC218D1 UC218-308D1

Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".







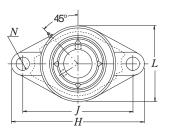


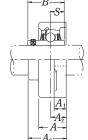
	S S A_1 A_2 A_3
ast dust cover type	

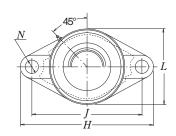
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	Nomi	nal dimer	nsions	N	lass of uni	it
	31		1	mm inch			kg lb	
			t max.	A_4	A_5	UCF	Z(ZM)	C(CM)
F215D1	_	C(CM)-UCF215D1	4	_	102	6.6	_	7.9
F215D1 F215D1 F215D1 F215D1	_	C(CM)-UCF215-213D1 C(CM)-UCF215-214D1 C(CM)-UCF215-215D1 C(CM)-UCF215-300D1	5/32	_	4 ¹ /32	15	_	17
F216D1 F216D1	_	C(CM)-UCF216D1	4	_	106	7.9	_	9.3
F216D1 F216D1 F216D1	_	C(CM)-UCF216-301D1 C(CM)-UCF216-302D1 C(CM)-UCF216-303D1	5/32	_	4 ³ /16	17	_	21
F217D1	_	C(CM)-UCF217D1	5	_	114	9.8	_	12
F217D1 F217D1 F217D1	_	C(CM)-UCF217-304D1 C(CM)-UCF217-305D1 C(CM)-UCF217-307D1	13/64	_	4 1/2	22	_	26
F218D1 F218D1	_ _ _	C(CM)-UCF218D1 C(CM)-UCF218-308D1	5 13/64	<u> </u>	122 4 ¹³ / ₁₆	12 26	_ _	13 29

B 296 B 297

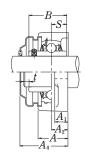
Rhombus flanged units cast housing Set screw type

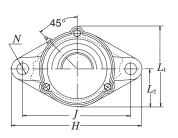


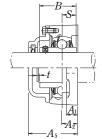




Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1







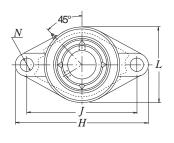
Cast dust cover type
Open end C-UCFL...D1
Closed end CM-UCFL...D1

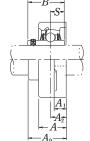
Shaft dia.	Unit number(1)				Ν	lominal	dimensi	ons				Bolt size	Bearing number
mm						mm	inch					mm	
inch		Н	J	A_2	A_1	A	N	L	A_0	B	S	inch	
12 1/2	UCFL201D1 UCFL201-008D1	113 4 ⁷ / ₁₆	90 3 ³⁵ / ₆₄	15 19/32	11 7/16	25.5 1	12 15/32	60 2 ³ /8	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC201D1 UC201-008D1
15	UCFL202D1	113	90	15	11	25.5	12	60	33.3	31	12.7	M10	UC202D1
9/16 5/8	UCFL202-009D1 UCFL202-010D1	4 7/16	335/64	19/32	7/16	1	15/32	2 3/8	1 5/16	1.2205	0.500	3/8	UC202-009D1 UC202-010D1
17 11/ ₁₆	UCFL203D1 UCFL203-011D1	113 4 ⁷ / ₁₆	90 3 ³⁵ / ₆₄	15 19/32	11 7/ ₁₆	25.5 1	12 15/ ₃₂	60 2 ³ /8	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC203D1 UC203-011D1
20 3/4	UCFL204D1 UCFL204-012D1	113 4 ⁷ / ₁₆	90 3 ³⁵ / ₆₄	15 19/32	11 7/ ₁₆	25.5 1	12 15/32	60 2 ³ /8	33.3 15/16	31 1.2205	12.7 0.500	M10 3/8	UC204D1 UC204-012D1
25	UCFL205D1	130	99	16	13	27	16	68	35.8	34.1	14.3	M14	UC205D1
7/8	UCFL205-013D1 UCFL205-014D1 UCFL205-015D1 UCFL205-100D1	51/8	357/64	5/8	1/2	1 ¹ /16	5/8	2 ¹¹ / ₁₆	1 ¹³ / ₃₂	1.3425	0.563	1/2	UC205-013D1 UC205-014D1 UC205-015D1 UC205-100D1
30 1 ¹ / ₁₆	UCFL206D1 UCFL206-101D1	148	117	18	13	31	16	80	40.2	38.1	15.9	M14	UC206D1 UC206-101D1
1 ¹ / ₈ 1 ³ / ₁₆ 1 ¹ / ₄	UCFL206-102D1 UCFL206-103D1 UCFL206-104D1	5 ¹³ / ₁₆	4 ³⁹ /64	45/64	1/2	17/32	5/8	3 5/32	137/64	1.5000	0.626	1/2	UC206-102D1 UC206-103D1 UC206-104D1
35	UCFL207D1	161	130	19	15	34	16	90	44.4	42.9	17.5	M14	UC207D1
1 ¹ / ₄ 1 ⁵ / ₁₆ 1 ³ / ₈ 1 ⁷ / ₁₆	UCFL207-104D1 UCFL207-105D1 UCFL207-106D1 UCFL207-107D1	6 ¹¹ / ₃₂	51/8	3/4	19/32	111/32	5/8	317/32	13/4	1.6890	0.689	1/2	UC207-104D1 UC207-105D1 UC207-106D1 UC207-107D1
40 1 ¹ / ₂ 1 ⁹ / ₁₆	UCFL208D1 UCFL208-108D1 UCFL208-109D1	175 6 ⁷ /8	144 5 ⁴³ / ₆₄	21 53/64	15 19/ ₃₂	36 1 ¹³ / ₃₂	16 5/8	100 3 ¹⁵ / ₁₆	51.2 2 ¹ / ₆₄	49.2 1.9370	19 0.748	M14	UC208D1 UC208-108D1 UC208-109D1

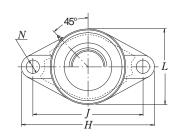
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nomin	ıal dimer	nsions		N	lass of uni	it
	cover type		,		nm inch		7		kg lb	
			t max.	A_4	A_5	L_1	L_2	UCFL	Z(ZM)	C(CM)
FL204D1 FL204D1	Z(ZM)-UCFL201D1 Z(ZM)-UCFL201-008D1	C(CM)-UCFL201D1 C(CM)-UCFL201-008D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	67 2 ⁵ /8	30 1 ³ / ₁₆	0.5 1.1	0.5 1.1	0.6 1.3
FL204D1 FL204D1 FL204D1	Z(ZM)-UCFL202D1 Z(ZM)-UCFL202-009D1 Z(ZM)-UCFL202-010D1	C(CM)-UCFL202D1 C(CM)-UCFL202-009D1 C(CM)-UCFL202-010D1	2 5/64	38 11/2	46 1 ¹³ / ₁₆	67 2 ⁵ /8	30 1 ³ / ₁₆	0.5 1.1	0.5 1.1	0.6 1.3
FL204D1 FL204D1	Z(ZM)-UCFL203D1 Z(ZM)-UCFL203-011D1	C(CM)-UCFL203D1 C(CM)-UCFL203-011D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	67 2 ⁵ /8	30 1 ³ / ₁₆	0.5 1.1	0.5 1.1	0.6 1.3
FL204D1 FL204D1	Z(ZM)-UCFL204D1 Z(ZM)-UCFL204-012D1	C(CM)-UCFL204D1 C(CM)-UCFL204-012D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	67 2 ⁵ /8	30 1 ³ / ₁₆	0.4	0.4	0.6 1.3
FL205D1 FL205D1 FL205D1 FL205D1 FL205D1	Z(ZM)-UCFL205D1 Z(ZM)-UCFL205-013D1 Z(ZM)-UCFL205-014D1 Z(ZM)-UCFL205-015D1 Z(ZM)-UCFL205-100D1	C(CM)-UCFL205D1 C(CM)-UCFL205-013D1 C(CM)-UCFL205-014D1 C(CM)-UCFL205-015D1 C(CM)-UCFL205-100D1	2 5/64	40 1 ¹⁹ / ₃₂	51 2	74 2 ²⁹ /32	34 1 ¹¹ / ₃₂	0.6	0.6	0.8
FL206D1	Z(ZM)-UCFL206D1	C(CM)-UCFL206D1	2	45	56	85	40	0.9	0.9	1.2
FL206D1 FL206D1 FL206D1 FL206D1	Z(ZM)-UCFL206-101D1 Z(ZM)-UCFL206-102D1 Z(ZM)-UCFL206-103D1	C(CM)-UCFL206-101D1 C(CM)-UCFL206-102D1 C(CM)-UCFL206-103D1	5/64	13/4	2 ⁷ / ₃₂	311/32	1 9/16	2.0	2.0	2.6
FL207D1	Z(ZM)-UCFL207D1	C(CM)-UCFL207D1	3	49	59	97	45	1.2	1.2	1.4
FL207D1 FL207D1 FL207D1 FL207D1	Z(ZM)-UCFL207-104D1 Z(ZM)-UCFL207-105D1 Z(ZM)-UCFL207-106D1	C(CM)-UCFL207-104D1 C(CM)-UCFL207-105D1 C(CM)-UCFL207-106D1	1/8	1 ¹⁵ /16	2 ⁵ /16	3 ¹³ /16	1 ²⁵ / ₃₂	2.6	2.6	3.1
FL208D1 FL208D1 FL208D1	Z(ZM)-UCFL208D1 Z(ZM)-UCFL208-108D1 Z(ZM)-UCFL208-109D1	C(CM)-UCFL208D1 C(CM)-UCFL208-108D1 C(CM)-UCFL208-109D1	3 1/8	56 2 ³ /16	66 2 ¹⁹ / ₃₂	106 4 ³ / ₁₆	50 1 ³¹ / ₃₂	1.5 3.3	1.5	1.9 4.2

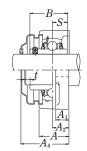
Rhombus flanged units cast housing Set screw type

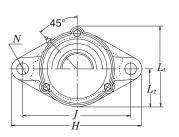


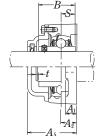




Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1







Cast dust cover type
Open end C-UCFL...D1
Closed end CM-UCFL...D1

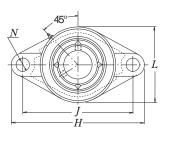
												1	
Shaft dia.	Unit number(1)				N	ominal c	limensi	ons				Bolt size	Bearing number
uia.												SIZE	Humber
						mm	inch						
mm inch		Н	J	A_2	A_1	A	N	L	A_0	В	S	mm	
45	UCFL209D1	188	148	22	16	38	19	108	52.2	49.2	19	M16	UC209D1
1 ⁵ /8 1 ¹¹ / ₁₆	UCFL209-110D1	712/00	553/64	55/64	5/8	11/0	21.	41/4	21/	1 0070	0.740	5/8	UC209-110D1
1 ³ / ₄	UCFL209-111D1 UCFL209-112D1	7 13/32	555/64	55/64	5/8	1 ¹ / ₂	3/4	4 1/4	2 ¹ /16	1.9370	0.748	5/8	UC209-111D1 UC209-112D1
50	UCFL210D1	197	157	22	16	40	19	115	54.6	51.6	19	M16	UC210D1
113/16	UCFL210-113D1					10			0 1.0	00	.,		UC210-113D1
17/8 115/16	UCFL210-114D1 UCFL210-115D1	73/4	6 ³ /16	55/64	5/8	1 9/16	3/4	417/32	2 5/32	2.0315	0.748	5/8	UC210-114D1 UC210-115D1
2	UCFL210-200D1												UC210-200D1
55	UCFL211D1	224	184	25	18	43	19	130	58.4	55.6	22.2	M16	UC211D1
2 2 ¹ / ₁₆	UCFL211-200D1												UC211-200D1
21/8	UCFL211-201D1 UCFL211-202D1	813/16	71/4	63/64	23/32	1 11/16	3/4	51/8	219/64	2.1890	0.874	5/8	UC211-201D1 UC211-202D1
2 ³ /16	UCFL211-203D1												UC211-203D1
60	UCFL212D1	250	202	29	18	48	23	140	68.7	65.1	25.4	M20	UC212D1
2 ¹ / ₄ 2 ⁵ / ₁₆	UCFL212-204D1 UCFL212-205D1												UC212-204D1 UC212-205D1
23/8	UCFL212-206D1	9 27/32	7 61/64	19/64	23/32	17/8	29/32	51/2	245/64	2.5630	1.000	3/4	UC212-206D1
27/16	UCFL212-207D1												UC212-207D1
65	UCFL213D1	258	210	30	22	50	23	155	69.7	65.1	25.4	M20	UC213D1
2 ¹ / ₂ 2 ⁹ / ₁₆	UCFL213-208D1 UCFL213-209D1	10 ⁵ /32	817/64	1 3/16	7/8	1 31/32	29/32	6 ³ /32	23/4	2.5630	1.000	3/4	UC213-208D1 UC213-209D1
70		245	217	31	22	54	22	140	75.4	71.4	20.2	1420	UC214D1
70 2 ⁵ /8	UCFL214D1 UCFL214-210D1	265	216	31	22	54	23	160	75.4	74.6	30.2	M20	UC214D1 UC214-210D1
211/16	UCFL214-211D1	10 ⁷ /16	81/2	17/32	7/8	21/8	29/32	6 5/16	2 31/32	2.9370	1.189	3/4	UC214-211D1
23/4	UCFL214-212D1												UC214-212D1

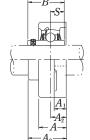
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

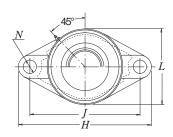
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nomin	ıal dimer	nsions		N	lass of uni	it
	22.2.3/62				nm inch				kg lb	
			t max.	A_4	A_5	L_1	L_2	UCFL	Z(ZM)	C(CM)
FL209D1	Z(ZM)-UCFL209D1	C(CM)-UCFL209D1	3	57	70	113	54	1.8	1.9	2.3
FL209D1 FL209D1 FL209D1	Z(ZM)-UCFL209-110D1 Z(ZM)-UCFL209-111D1 Z(ZM)-UCFL209-112D1	C(CM)-UCFL209-110D1 C(CM)-UCFL209-111D1 C(CM)-UCFL209-112D1	1/8	21/4	23/4	47/16	21/8	4.0	4.2	5.1
FL210D1	Z(ZM)-UCFL210D1	C(CM)-UCFL210D1	3	60	72	120	58	2.0	2.1	2.7
FL210D1 FL210D1 FL210D1 FL210D1	Z(ZM)-UCFL210-113D1 Z(ZM)-UCFL210-114D1 Z(ZM)-UCFL210-115D1	C(CM)-UCFL210-113D1 C(CM)-UCFL210-114D1 C(CM)-UCFL210-115D1 C(CM)-UCFL210-200D1	1/8	2 ³ /8	2 ²⁷ / ₃₂	4 ²³ /32	2 9/32	4.4	4.6	6.0
FL211D1	Z(ZM)-UCFL211D1	C(CM)-UCFL211D1	4	64	75	133	65	2.9	3.0	3.4
FL211D1 FL211D1 FL211D1 FL211D1	Z(ZM)-UCFL211-200D1 Z(ZM)-UCFL211-201D1 Z(ZM)-UCFL211-202D1 Z(ZM)-UCFL211-203D1	C(CM)-UCFL211-200D1 C(CM)-UCFL211-201D1 C(CM)-UCFL211-202D1 C(CM)-UCFL211-203D1	5/32	2 1/2	215/16	51/4	2 9/16	6.4	6.6	7.5
FL212D1	Z(ZM)-UCFL212D1	C(CM)-UCFL212D1	4	74	86	144	70	3.8	4.0	4.6
FL212D1 FL212D1 FL212D1 FL212D1	Z(ZM)-UCFL212-204D1 Z(ZM)-UCFL212-205D1 Z(ZM)-UCFL212-206D1	C(CM)-UCFL212-204D1 C(CM)-UCFL212-205D1 C(CM)-UCFL212-206D1 C(CM)-UCFL212-207D1	5/32	2 ²⁹ /32	33/8	5 ²¹ / ₃₂	2 ³ /4	8.4	8.9	10
FL213D1	Z(ZM)-UCFL213D1	C(CM)-UCFL213D1	4	76	90	157	78	4.8	4.9	5.8
FL213D1 FL213D1	Z(ZM)-UCFL213-208D1 Z(ZM)-UCFL213-209D1	C(CM)-UCFL213-208D1 C(CM)-UCFL213-209D1	5/32	3	317/32	6 ³ /16	31/16	11	11	15
FL214D1	_	C(CM)-UCFL214D1	4	_	98	164	80	5.4	_	7.7
FL214D1 FL214D1 FL214D1	_	C(CM)-UCFL214-210D1 C(CM)-UCFL214-211D1 C(CM)-UCFL214-212D1	5/32	_	327/32	615/32	3 5/32	12	_	17



Rhombus flanged units cast housing Set screw type



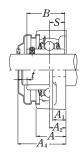


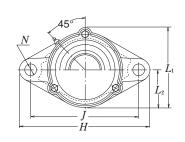


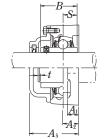
Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1

Shaft dia.	Unit number(1)				N	ominal d	imensi	ons				Bolt size	Bearing number
mm						mm	inch					mm	
inch		Н	J	A_2	A_1	A	N	L	A_0	В	S	inch	
75 213/16	UCFL215D1 UCFL215-213D1	275	225	34	22	56	23	165	78.5	77.8	33.3	M20	UC215D1 UC215-213D1
2 ⁷ / ₈ 2 ¹⁵ / ₁₆ 3	UCFL215-214D1	10 ¹³ /16	8 ⁵⁵ /64	1 ¹¹ / ₃₂	7/8	2 ⁷ /32	29/32	61/2	3 3/32	3.0630	1.311	3/4	UC215-214D1 UC215-215D1 UC215-300D1
80	UCFL216D1	290	233	34	22	58	25	180	83.3	82.6	33.3	M22	UC216D1
3 ¹ / ₁₆ 3 ¹ / ₈ 3 ³ / ₁₆	UCFL216-301D1 UCFL216-302D1 UCFL216-303D1	11 ¹³ /32	911/64	1 ¹¹ / ₃₂	7/8	2 9/32	63/64	7 3/32	3 9/32	3.2520	1.311	7/8	UC216-301D1 UC216-302D1 UC216-303D1
85	UCFL217D1	305	248	36	24	63	25	190	87.6	85.7	34.1	M22	UC217D1
3 ¹ / ₄ 3 ⁵ / ₁₆ 3 ⁷ / ₁₆	UCFL217-304D1 UCFL217-305D1 UCFL217-307D1	12	949/64	127/64	15/16	2 15/32	63/64	7 15/32	3 ²⁹ /64	3.3740	1.343	7/8	UC217-304D1 UC217-305D1 UC217-307D1
90 3 ¹ / ₂	UCFL218D1 UCFL218-308D1	320 12 ¹⁹ /32	265 10 ⁷ /16	40 1 ³⁷ /64	24 15/16	68 2 ¹¹ / ₁₆	25 ⁶³ / ₆₄	205 8 ¹ / ₁₆	96.3 3 ⁵¹ /64	96 3.7795	39.7 1.563	M22 7/8	UC218D1 UC218-308D1

Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".







Cast dust cover type
Open end C-UCFL...D1
Closed end CM-UCFL...D1

Housing number	Unit number (1) pressed steel dust	Unit number (1) cast dust cover type		Nomi	nal dimer	nsions		M	lass of uni	t
	cover type		t	$A_{\scriptscriptstyle 4}$	mm inch A_5	L_1	L_2		kg lb	
			max.	A_4	Λ ₅	L_1	L_2	UCFL	Z(ZM)	C(CM)
FL215D1	_	C(CM)-UCFL215D1	4	_	102	169	82	6.0	_	7.1
FL215D1 FL215D1 FL215D1 FL215D1	_	C(CM)-UCFL215-213D1 C(CM)-UCFL215-214D1 C(CM)-UCFL215-215D1 C(CM)-UCFL215-300D1	5/32	_	4 1/32	6 ²¹ / ₃₂	3 7/32	13	_	16
FL216D1	_	C(CM)-UCFL216D1	4	_	106	183	90	7.4	_	8.6
FL216D1 FL216D1 FL216D1	_	C(CM)-UCFL216-301D1 C(CM)-UCFL216-302D1 C(CM)-UCFL216-303D1	5/32	_	4 ³ /16	7 7/32	317/32	16	_	19
FL217D1	_	C(CM)-UCFL217D1	5	_	114	192	95	8.8	_	10
FL217D1 FL217D1 FL217D1	_	C(CM)-UCFL217-304D1 C(CM)-UCFL217-305D1 C(CM)-UCFL217-307D1	13/64	_	41/2	7 9/16	33/4	19	_	22
FL218D1 FL218D1		C(CM)-UCFL218D1 C(CM)-UCFL218-308D1	5 13/64	_	122 4 ¹³ / ₁₆	205 8 ¹ / ₁₆	102 4 ¹ / ₃₂	11 24	<u> </u>	13 29

PLUMMER BLOCKS

STANDARD TYPE PLUMMER BLOCKS	B306
LARGE PLUMMER BLOCKS	B312
DUSTPROOF PLUMMER BLOCKS	B316
STEPPED-SHAFT TYPE PLUMMER	
BLOCKS	B318

DESIGN, TYPES AND FEATURES

There are numerous types and sizes of plummer blocks. In this catalog, only the types marked by are shown.

SN 5B

SN 6B SN 30B

SN 31B

SN 2B

SN 3B SN 2BC

SN 3BC

SD 30S SD 31S SD 5

SD 6

SD 2

SD 3

SD 2C

SD 3C

 $V \cdot C$



These are the most common type. Models SN30 and SN31 are for medium

For types SN2C and SN3C, the bore diameters on the two sides are different.



Dustproof plummer blocks have a combination of oil seals, labyrinth seals, and oil groove seals, therefore, they are suitable

for environments with much dust and other foreign matter.



SD32TS

SN 5

SN 6

SN 30

SN 31

SN 2

SN 3

SN₂C

SG 5

SD31TS

These are provided with labyrinth seals, so they are suitable for high speed applications.



These have the same dimensions as those of types SN5 and SN6. To increase the bearing box strength, no material is removed from the top or bottom of the base, so mounting holes can be drilled anywhere.



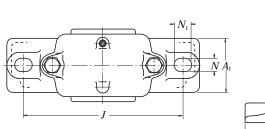
These are large and made for heavy loads. The standard ones have double seals and four mounting bolt holes. For types SD2C and SD3C, the bore diameters on the two sides are different.

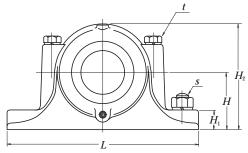


Single-piece plummer blocks (integrated type roller bearing unit)have higher rigidity and precision than split type plummer blocks.

B 304 B 305

SN 5, SN 6 Types Shaft Diameter 20 – 55 mm



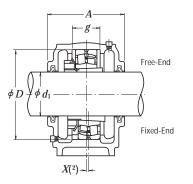


Shaft Diameter (mm)	Plummer Block							Dimens (mr							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	\boldsymbol{A}	L	A_1	H_1	H_2	g H13	t nominal	S nominal	approx.
20	SN 505	52	40	130	15	20	67	165	46	22	75	25	M 8	M 12	1.1
	SN 605	62	50	150	15	20	80	185	52	22	90	34	M 8	M 12	1.6
25	SN 506	62	50	150	15	20	77	185	52	22	90	30	M 8	M 12	1.7
	SN 606	72	50	150	15	20	82	185	52	22	95	37	M 10	M 12	1.8
30	SN 507	72	50	150	15	20	82	185	52	22	95	33	M 10	M 12	1.9
	SN 607	80	60	170	15	20	90	205	60	25	110	41	M 10	M 12	2.6
35	SN 508	80	60	170	15	20	85	205	60	25	110	33	M 10	M 12	2.6
	SN 608	90	60	170	15	20	95	205	60	25	115	43	M 10	M 12	2.9
40	SN 509	85	60	170	15	20	85	205	60	25	112	31	M 10	M 12	2.8
	SN 609	100	70	210	18	23	105	255	70	28	130	46	M 12	M 16	4.1
45	SN 510	90	60	170	15	20	90	205	60	25	115	33	M 10	M 12	3.0
	SN 610	110	70	210	18	23	115	255	70	30	135	50	M 12	M 16	4.7
50	SN 511	100	70	210	18	23	95	255	70	28	130	33	M 12	M 16	4.5
	SN 611	120	80	230	18	23	120	275	80	30	150	53	M 12	M 16	5.8
55	SN 512	110	70	210	18	23	105	255	70	30	135	38	M 12	M 16	5.0
	SN 612	130	80	230	18	23	125	280	80	30	155	56	M 12	M 16	6.5



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter+locating ring".

Remarks Threads for plugs are R 1/8.



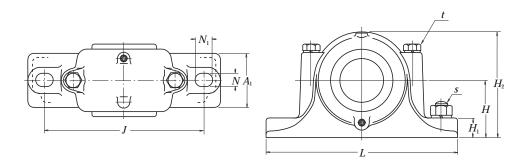


		Ар	plicable Parts				Oil Seals (3)
Self-Aligni Numbers	ng Ball Bearing Basic Dynamic Load Ratings $C_{ m r}$ (N)		r Bearing sic Dynamic Load Ratings $C_{ m r}$ (N)	Adapter Numbers	Locating Rings Nominal (Outside XWidth)	Q'ty	Scuis ()
1205 K 2205 K 1305 K 2305 K	12 200 12 400 18 200 24 900	 22205 CKE4 21305 CDKE4 	37 500 43 000 —	H 205X H 305X H 305X H 2305X	SR 52× 5 SR 52× 7 SR 62× 8.5 SR 62×10	2 1 2 1	GS 5 GS 5
1206 K 2206 K 1306 K 2306 K	15 800 15 300 21 400 32 000	 22206 CKE4 21306 CDKE4 	 50 000 55 000 	H 206X H 306X H 306X H 2306X	SR 62× 7 SR 62×10 SR 72× 9 SR 72×10	2 1 2 1	GS 6 GS 6
1207 K 2207 K 1307 K 2307 K	15 900 21 700 25 300 40 000	22207 CKE4 21307 CDKE4 	 69 000 71 500 	H 207X H 307X H 307X H 2307X	SR 72× 8 SR 72×10 SR 80×10 SR 80×10	2 1 2 1	GS 7 GS 7
1208 K 2208 K 1308 K 2308 K	19 300 22 400 29 800 45 500	22208 EAKE4 21308 EAKE4 22308 EAKE4	90 500 94 500 136 000	H 208X H 308X H 308X H 2308X	SR 80× 7.5 SR 80×10 SR 90×10 SR 90×10	2 1 2 1	GS 8 GS 8
1209 K 2209 K 1309 K 2309 K	22 000 23 300 38 500 55 000	22209 EAKE4 21309 EAKE4 22309 EAKE4	94 500 119 000 166 000	H 209X H 309X H 309X H 2309X	SR 85× 6 SR 85× 8 SR 100×10.5 SR 100×10	2 1 2 1	GS 9 GS 9
1210 K 2210 K 1310 K 2310 K	22 800 23 400 43 500 65 000	22210 EAKE4 21310 EAKE4 22310 EAKE4	99 000 142 000 197 000	H 210X H 310X H 310X H 2310X	SR 90× 6.5 SR 90×10 SR 110×11.5 SR 110×10	2 1 2 1	GS10 GS10
1211 K 2211 K 1311 K 2311 K	26 900 26 700 51 500 76 500	 22211 EAKE4 21311 EAKE4 22311 EAKE4		H 211X H 311X H 311X H 2311X	SR 100× 6 SR 100× 8 SR 120×12 SR 120×10	2 1 2 1	GS11 GS11
1212 K 2212 K 1312 K 2312 K	30 500 34 000 57 500 88 500	 22212 EAKE4 21312 EAKE4 22312 EAKE4	 142 000 190 000 271 000	H 212X H 312X H 312X H 2312X	SR 110× 8 SR 110×10 SR 130×12.5 SR 130×10	2 1 2 1	GS12 GS12

Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

(3) Applicable to the ZF Type with the same number.

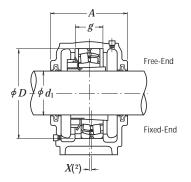
SN 31, SN 5, SN 6 Types Shaft Diameter 60 – 100 mm



Shaft Diameter (mm)	Plummer Block							Dimens (mr							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal	approx.
60	SN 513	120	80	230	18	23	110	275	80	30	150	43	M 12	M 16	5.6
	SN 613	140	95	260	22	27	130	315	90	32	175	58	M 16	M 20	8.7
65	SN 515	130	80	230	18	23	115	280	80	30	155	41	M 12	M 16	7.0
	SN 615	160	100	290	22	27	140	345	100	35	195	65	M 16	M 20	11.3
70	SN 516	140	95	260	22	27	120	315	90	32	175	43	M 16	M 20	9.0
	SN 616	170	112	290	22	27	145	345	100	35	212	68	M 16	M 20	12.6
75	SN 517	150	95	260	22	27	125	320	90	32	185	46	M 16	M 20	10
	SN 617	180	112	320	26	32	155	380	110	40	218	70	M 20	M 24	15
80	SN 518	160	100	290	22	27	145	345	100	35	195	62.4	M 16	M 20	13
	SN 618	190	112	320	26	32	160	380	110	40	225	74	M 20	M 24	19
85	SN 519	170	112	290	22	27	140	345	100	35	210	53	M 16	M 20	15
	SN 619	200	125	350	26	32	170	410	120	45	245	77	M 20	M 24	22
90	SN 520	180	112	320	26	32	160	380	110	40	218	70.3	M 20	M 24	18.5
	SN 620	215	140	350	26	32	175	410	120	45	270	83	M 20	M 24	25
100	SN 3122 SN 522	180 200	112 125	320 350	26 26	32 32	155 175	380 410	110 120	40 45	218 240	66 80	M 20 M 20	M 24 M 24	18 20
	SN 622	240	150	390	28	36	190	450	130	50	300	90	M 24	M 24	32



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter+locating ring".





	Арр	olicable Parts				Oil Seals (3)
Self-Aligning Ball Bearing Numbers Basic Dynamic Loa Ratings C_{r} (N)		Bearing ic Dynamic Load latings $C_{ m r}$ (N)	Adapter Numbers	$\begin{array}{c} \text{Locating Rings} \\ \text{Nominal } \begin{pmatrix} \text{Outside} \\ \text{Dia.} \end{pmatrix} \times \text{Width} \end{pmatrix}$	Q'ty	Seals (*)
1213 K 31 000 2213 K 43 500 1313 K 62 500 2313 K 97 000	 22213 EAKE4 21313 EAKE4 22313 EAKE4	 177 000 212 000 300 000	H 213X H 313X H 313X H 2313X	SR 120×10 SR 120×12 SR 140×12.5 SR 140×10	2 1 2 1	GS13 GS13
1215 K 39 000 2215 K 44 500 1315 K 80 000 2315 K 125 000	 22215 EAKE4 21315 EAKE4 22315 EAKE4		H 215X H 315X H 315X H 2315X	SR 130× 8 SR 130×10 SR 160×14 SR 160×10	2 1 2 1	GS15 GS15
1216 K 40 000 2216 K 49 000 1316 K 89 000 2316 K 130 000	 22216 EAKE4 21316 EAKE4 22316 EAKE4	212 000 284 000 435 000	H 216X H 316X H 316X H 2316X	SR 140× 8.5 SR 140×10 SR 170×14.5 SR 170×10	2 1 2 1	GS16 GS16
1217 K 49 500 2217 K 58 500 1317 K 98 500 2317 K 142 000	 22217 EAKE4 21317 EAKE4 22317 EAKE4	250 000 289 000 480 000	H 217X H 317X H 317X H 2317X	SR 150× 9 SR 150×10 SR 180×14.5 SR 180×10	2 1 2 1	GS17 GS17
1218 K 57 500 2218 K 70 500 — — — — — — — — — — — — — — — — — — —	22218 EAKE4 23218 CKE4 21318 EAKE4 22318 EAKE4	289 000 340 000 330 000 535 000	H 218X H 318X H 2318X H 318X H 2318X	SR 160×16.2 SR 160×11.2 SR 160×10 SR 190×15.5 SR 190×10	2 2 1 2 1	GS18 GS18
1219 K 64 000 2219 K 84 000 1319 K 129 000 2319 K 161 000	 22219 EAKE4 21319 CKE4 22319 EAKE4	330 000 345 000 590 000	H 219X H 319X H 319X H 2319X	SR 170×10.5 SR 170×10 SR 200×16 SR 200×10	2 1 2 1	GS19 GS19
1220 K 69 500 2220 K 94 500 — — — — — — — — — — — — — — — — — — —	 22220 EAKE4 23220 CKE4 21320 CKE4 22320 EAKE4	365 000 420 000 395 000 690 000	H 220X H 320X H 2320X H 320X H 2320X	SR 180×18.1 SR 180×12.1 SR 180×10 SR 215×18 SR 215×10	2 2 1 2	GS 20 GS 20
1222 K 87 000 2222 K 122 000	23122 CKE4 22222 EAKE4 23222 CKE4	385 000 	H 3122X H 222X H 322X H 2322X	SR 219×10 SR 180×10 SR 200×21 SR 200×13.5 SR 200×10	1 2 2 1 2	GS22 GS22
1322 K 161 000 2322 K 211 000	21322 CAKE4 22322 EAKE4	450 000 825 000	H 322X H 2322X	SR 240×20 SR 240×10	2 1	GS22

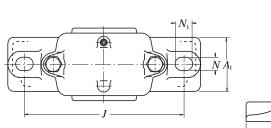
Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

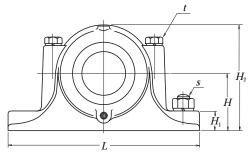
Remarks 1. The threads for plugs are R 1/8 for SN 616 and SN 519 or under and R 1/4 for SN 617, SN 520, SN 3122, and over.

^{2.} SN 620 and SN 622 are provided with eye bolts.

⁽³⁾ Applicable to the ZF Type with the same number.

SN 30, SN 31, SN 5, SN 6 Types Shaft Diameter 110 – 140 mm





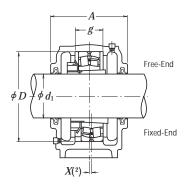
Shaft Diameter (mm)	Plummer Block							Dimens (mr							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{ m H8}^{D}$	H h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal	approx.
110	SN 3024	180	112	320	26	32	150	380	110	40	218	56	M 20	M 24	16
	SN 3124	200	125	350	26	32	165	410	120	45	245	72	M 20	M 24	20
	SN 524	215	140	350	26	32	185	410	120	45	270	86	M 20	M 24	24.5
	SN 624	260	160	450	33	42	200	530	160	60	320	96	M 24	M 30	48
115	SN 3026	200	125	350	26	32	160	410	120	45	240	62	M 20	M 24	19
	SN 3126	210	140	350	26	32	170	410	120	45	270	74	M 20	M 24	26
	SN 526	230	150	380	28	36	190	445	130	50	290	90	M 24	M 24	30
	SN 626	280	170	470	33	42	210	550	160	60	340	103	M 24	M 30	56
125	SN 3028	210	140	350	26	32	170	410	120	45	270	63	M 20	M 24	25
	SN 3128	225	150	380	28	36	180	445	130	50	290	78	M 24	M 24	32
	SN 528	250	150	420	33	42	205	500	150	50	305	98	M 24	M 30	38
	SN 628	300	180	520	35	45	235	610	170	65	365	112	M 30	M 30	72
135	SN 3030	225	150	380	28	36	175	445	130	50	290	66	M 24	M 24	29
	SN 3130	250	150	420	33	42	200	500	150	50	305	90	M 24	M 30	38
	SN 530	270	160	450	33	42	220	530	160	60	325	106	M 24	M 30	46
	SN 630	320	190	560	35	45	245	650	180	65	385	118	M 30	M 30	98
140	SN 3032	240	150	390	28	36	190	450	130	50	300	70	M 24	M 24	32
	SN 3132	270	160	450	33	42	215	530	160	60	325	96	M 24	M 30	48
	SN 532	290	170	470	33	42	235	550	160	60	345	114	M 24	M 30	50
	SN 632	340	200	580	42	50	255	680	190	70	405	124	M 30	M 36	115



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter+locating ring".

Remarks 1. The threads for plugs are R 1/4.

2. The bearing boxes for SN 524, SN 624, SN 3126, SN 3028, and over are provided with eye bolts.



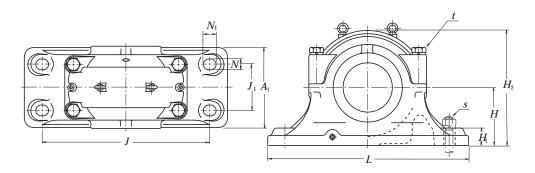


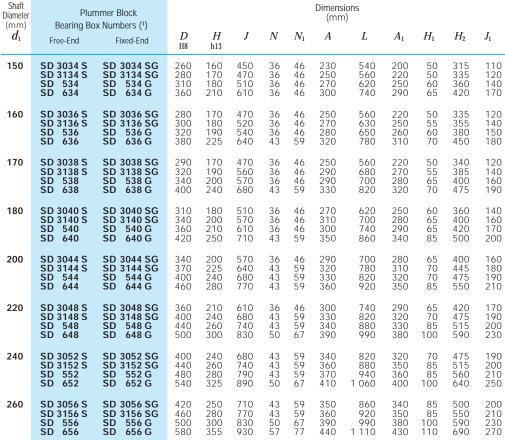
		ı	Appl	icable Parts				Oil Seals (3)
	ng Ball Bearing Basic Dynamic Load	Spherical Ro		Bearing Dynamic Load	Adapter	Locating Rings	0.11	Jeuis ()
Numbers	Ratings $C_{\rm r}$ (N)	Numbers		tings $C_{\rm r}$ (N)	Numbers	Nominal (Outside ×Width)	Q'ty	
_	_	23024 CDKE	4	315 000	H 3024	SR 180×10	1	GS 24
_	_	23124 CKE4		465 000	H 3124	SR 200×10	1	GS 24
_	_	22224 EAKE 23224 CKE4	1	550 000 630 000	H 3124 H 2324	SR 215×14 SR 215×10	2 1	GS 24
_	_	22324 EAKE	1	955 000	H 2324	SR 260×10	1	GS 24
_	_	23026 CDKE	4	400 000	H 3026	SR 200×10	1	GS 26
_	_	23126 CKE4		505 000	H 3126	SR 210×10	1	GS 26
_	_	22226 EAKE 23226 CKE4	1	655 000 700 000	H 3126 H 2326	SR 230×13 SR 230×10	2 1	GS26
_	_	22326 CKE4		995 000	H 2326	SR 280×10	1	GS26
_	_	23028 CDKE	4	420 000	H 3028	SR 210×10	1	GS 28
_	_	23128 CKE4		580 000	H 3128	SR 225×10	1	GS 28
_	_	22228 CDKE 23228 CKE4	4	645 000 835 000	H 3128 H 2328	SR 250×15 SR 250×10	2 1	GS 28
_	_	22328 CKE4	1	160 000	H 2328	SR 300×10	1	GS 28
_	_	23030 CDKE	4	470 000	H 3030	SR 225×10	1	GS 30
_	_	23130 CKE4		725 000	H 3130	SR 250×10	1	GS 30
_	_	22230 CDKE 23230 CKE4	4	765 000 975 000	H 3130 H 2330	SR 270×16.5 SR 270×10	2 1	GS 30
_	_	22330 CAKE	1 1	220 000	H 2330	SR 320×10	1	GS 30
_		23032 CDKE	1	540 000	H 3032	SR 240×10	1	GS 32
_	_	23132 CKE4	т	855 000	H 3132	SR 270×10	1	GS 32
_	_	22232 CDKE	4	910 000	H 3132	SR 290×17	2	GS 32
_	_	23232 CKE4		100 000	H 2332	SR 290×10	1	
_	— -	22332 CAKE	1 1	360 000	H 2332	SR 340×10	1	GS 32

Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

(3) Applicable to the ZF Type with the same number.

SD 30 S, SD 31 S, SD 5, SD 6 Types Shaft Diameter 150 – 260 mm

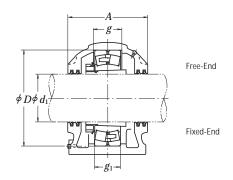






To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter".

Remarks 1. The threads for oil replenishing hole plugs are R 1/4 and those for drain plugs are R 3/8.

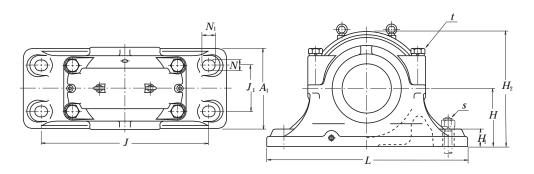


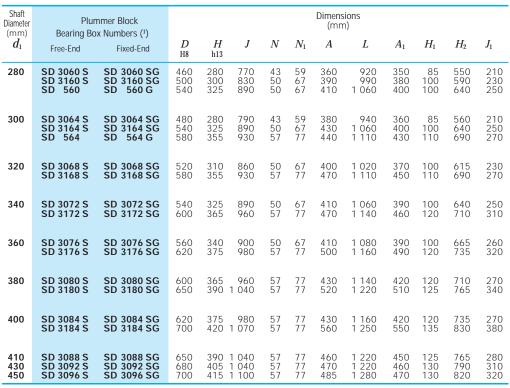
				Mass (kg)	Applicable Parts	Oil Seals (2)
g H13	g 1 H13	t nominal	S nominal	approx.	Spherical Roller Bearing Adapter Numbers Basic Dynamic Load Ratings $C_{ m r}$ (N)	(,
77	67	M 24	M 30	70	23034 CDKE4 640 000 H 3034	GS 34
98	88	M 24	M 30	75	23134 CKE4 940 000 H 3134	GS 34
96	86	M 24	M 30	100	22234 CDKE4 990 000 H 3134	GS 34
130	120	M 30	M 30	160	22334 CAKE4 1 580 000 H 2334	GS 34
84	74	M 24	M 30	79	23036 CDKE4 750 000 H 3036	GS 36
106	96	M 24	M 30	94	23136 CKE4 1 050 000 H 3136	GS 36
96	86	M 24	M 30	110	22236 CDKE4 1 020 000 H 3136	GS 36
136	126	M 30	M 36	195	22336 CAKE4 1 740 000 H 2336	GS 36
85	75	M 24	M 30	87	23038 CAKE4 775 000 H 3038	GS 38
114	104	M 24	M 30	110	23138 CKE4 1 190 000 H 3138	GS 38
102	92	M 30	M 30	130	22238 CAKE4 1 140 000 H 3138	GS 38
142	132	M 30	M 36	210	22338 CAKE4 1 890 000 H 2338	GS 38
92	82	M 24	M 30	100	23040 CAKE4 940 000 H 3040	GS 40
122	112	M 30	M 30	130	23140 CKE4 1 360 000 H 3140	GS 40
108	98	M 30	M 30	155	22240 CAKE4 1 300 000 H 3140	GS 40
148	138	M 36	M 36	240	22340 CAKE4 2 000 000 H 2340	GS 40
100	90	M 30	M 30	130	23044 CAKE4 1 090 000 H 3044	GS 44
130	120	M 30	M 36	180	23144 CKE4 1 570 000 H 3144	GS 44
118	108	M 30	M 36	205	22244 CAKE4 1 570 000 H 3144	GS 44
155	145	M 36	M 36	315	22344 CAKE4 2 350 000 H 2344	GS 44
102	92	M 30	M 30	160	23048 CAKE4 1 160 000 H 3048	GS 48
138	128	M 30	M 36	210	23148 CKE4 1 790 000 H 3148	GS 48
130	120	M 36	M 36	240	22248 CAKE4 1 870 000 H 3148	GS 48
165	155	M 36	M 42	405	22348 CAKE4 2 600 000 H 2348	GS 48
114	104	M 30	M 36	210	23052 CAKE4 1 430 000 H 3052	GS 52
154	144	M 36	M 36	240	23152 CAKE4 2 160 000 H 3152	GS 52
140	130	M 36	M 36	315	22252 CAKE4 2 180 000 H 3152	GS 52
175	165	M 36	M 42	480	22352 CAKE4 3 100 000 H 2352	GS 52
116	106	M 36	M 36	240	23056 CAKE4 1 540 000 H 3056	GS 56
156	146	M 36	M 36	315	23156 CAKE4 2 230 000 H 3156	GS 56
140	130	M 36	M 42	390	22256 CAKE4 2 280 000 H 3156	GS 56
185	175	M 42	M 48	610	22356 CAKE4 3 500 000 H 2356	GS 56

Note (2) Applicable to the ZF Type with the same number.

^{2.} The plummer block bearing boxes listed above are provided with eye bolts.

SD 30 S, SD 31 S, SD 5 Types Shaft Diameter 280 – 450 mm

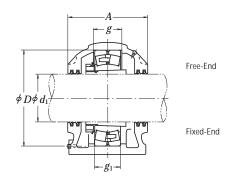






To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter".

Remarks 1. The threads for oil replenishing hole plugs are R 1/4 and those for drain plugs are R 3/8.



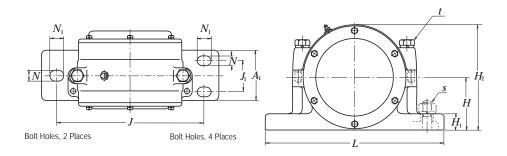
				Mass (kg)	Applicable Parts Spherical Roller Bearing Adapter	Oil Seals (²)
g H13	g_1 H13	t nominal	S nominal	approx.	Numbers $egin{array}{lll} {\sf Basic Dynamic Load} \\ {\sf Ratings } {\it C}_{ m r} ({\sf N}) \\ \end{array}$ Numbers	
128	118	M 36	M 36	300	23060 CAKE4 1 920 000 H 3060	GS 60
170	160	M 36	M 42	405	23160 CAKE4 2 670 000 H 3160	GS 60
150	140	M 36	M 42	465	22260 CAKE4 2 610 000 H 3160	GS 60
131	121	M 36	M 36	320	23064 CAKE4 1 960 000 H 3064	GS 64
186	176	M 36	M 42	480	23164 CAKE4 3 050 000 H 3164	GS 64
160	150	M 42	M 48	595	22264 CAKE4 2 990 000 H 3164	GS 64
143	133	M 36	M 42	410	23068 CAKE4 2 280 000 H 3068	GS 68
200	190	M 42	M 48	650	23168 CAKE4 3 600 000 H 3168	GS 68
144	134	M 36	M 42	465	23072 CAKE4 2 390 000 H 3072	GS 72
202	192	M 42	M 48	700	23172 CAKE4 3 800 000 H 3172	GS 72
145	135	M 36	M 42	480	23076 CAKE4 2 500 000 H 3076	GS 76
204	194	M 42	M 48	940	23176 CAKE4 4 000 000 H 3176	GS 76
158	148	M 42	M 48	690	23080 CAKE4 2 970 000 H 3080	GS 80
210	200	M 42	M 48	1 040	23180 CAKE4 4 150 000 H 3180	GS 80
160	150	M 42	M 48	770	23084 CAKE4 2 910 000 H 3084	GS 84
234	224	M 48	M 48	1 150	23184 CAKE4 5 000 000 H 3184	GS 84
167	157	M 42	M 48	870	23088 CAKE4 3 150 000 H 3088	GS 88
173	163	M 48	M 48	940	23092 CAKE4 3 450 000 H 3092	GS 92
175	165	M 48	M 48	1 040	23096 CAKE4 3 800 000 H 3096	GS 96

Note (2) Applicable to the ZF Type with the same number.

^{2.} The plummer block bearing boxes listed above are provided with eye bolts.



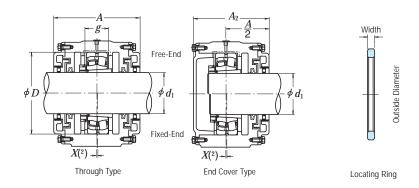
SG 5, SG 5-0 Types Shaft Diameter 50 – 180 mm



Shaft Diameter (mm)		ner Block ing Box							nension (mm)	S					
d_1	Num Through Type	bers (¹) End Cover Type	$_{ m H8}^{D}$	H h13	J	N	N_1	A	L	A_1	H_1	H_2	J_1	A_2	g H13
50	SG 511	SG 511-0	100	70	210	18	23	125	255	70	23	137	_	112.5	29
55	SG 512	SG 512-0	110	80	230	18	23	145	290	80	25	160	_	135	32
60	SG 513	SG 513-0	120	83	230	18	23	130	290	70	25	155	_	115	36
65	SG 515	SG 515-0	130	90	230	18	23	135	290	80	25	168	_	120	36
70	SG 516	SG 516-0	140	95	270	22	27	165	340	120	30	180	70	155	38
75	SG 517	SG 517-0	150	100	280	22	27	170	350	120	30	190	70	160	41
80	SG 518	SG 518-0	160	100	290	22	27	180	360	120	35	200	70	170	45
90	SG 520	SG 520-0	180	125	340	22	27	200	410	130	35	240	70	185	51
100	SG 522	SG 522-0	200	140	380	22	27	210	460	130	40	265	70	190	58
110	SG 524	SG 524-0	215	140	380	22	27	230	460	130	45	275	80	200	63
115	SG 526	SG 526-0	230	150	410	26	32	240	490	160	45	295	80	220	69
125	SG 528	SG 528-0	250	160	435	26	32	245	520	160	50	310	80	220	73
135	SG 530	SG 530-0	270	160	465	26	32	265	550	170	50	330	100	240	78
140	SG 532	SG 532-0	290	170	490	26	32	285	580	170	50	350	100	250	85
150	SG 534	SG 534-0	310	180	550	33	42	300	640	180	55	380	100	265	91
160	SG 536	SG 536-0	320	190	600	33	42	325	690	190	55	400	110	285	91
170	SG 538	SG 538-0	340	200	620	42	52	340	730	200	60	420	120	295	97
180	SG 540	SG 540-0	360	210	635	42	52	350	750	210	60	445	130	310	103



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter+locating ring".



			ass			Applic	able	Parts			Oil
		app	(g) orox.	Spherical I		9	Α	dapter	Locating Rin	ng	Seals (3)
t nominal	S nominal	Through Type	End Cover Type	Numbers		namic Load $C_{ m r}$ (N)	Nu	ımbers	Nominal (Outside Dia.×Width)	Q'ty	
M 12	M 16	8.5	7.5	22211 EAK	E4 11	9 000	Н	311 X	SR 100×4	1	GS 11
M 16	M 16	15	14	22212 EAK	E4 14	2 000	Н	312 X	SR 110×4	1	GS 12
M 16	M 16	9.5	8.5	22213 EAK	E4 17	7 000	Н	313 X	SR 120×5	1	GS 13
M 16	M 16	12.5	11	22215 EAK	E4 19	000 00	Н	315 X	SR 130×5	1	GS 15
M 20	M 20	18.5	17	22216 EAK	E4 21	2 000	Н	316 X	SR 140×5	1	GS 16
M 20	M 20	21	20	22217 EAK	E4 25	000 0	Н	317 X	SR 150×5	1	GS 17
M 20	M 20	25	23	22218 EAK	E4 28	9 000	Н	318 X	SR 160×5	1	GS 18
M 20	M 20	37	34	22220 EAK	E4 36	5 000	Н	320 X	SR 180×5	1	GS 20
M 20	M 20	50	45	22222 EAK	E4 48	5 000	Н	322 X	SR 200×5	1	GS 22
M 20	M 20	59	53	22224 EAK	E4 55	000 0	Н	3124	SR 215×5	1	GS 24
M 24	M 24	67	62	22226 EAK	E4 65	5 000	Н	3126	SR 230×5	1	GS 26
M 24	M 24	73	68	22228 CDk	Œ4 64	5 000	Н	3128	SR 250×5	1	GS 28
M 24	M 24	90	80	22230 CDk	E4 76	5 000	Н	3130	SR 270×5	1	GS 30
M 24	M 24	105	92	22232 CDk	Œ4 91	0 000	Н	3132	SR 290×5	1	GS 32
M 30	M 30	130	115	22234 CDK	Œ4 99	000 00	Н	3134	SR 310×5	1	GS 34
M 30	M 30	155	135	22236 CDk	E4 1 02	20 000	Н	3136	SR 320×5	1	GS 36
M 36	M 36	175	155	22238 CAK	E4 1 14	0 000	Н	3138	SR 340×5	1	GS 38
M 36	M 36	210	180	22240 CAK	E4 1 30	000 000	Н	3140	SR 360×5	1	GS 40

Notes (2) The X dimension indicates the offset of the bearing center from the center of plummer block bearing box, and it is 1/2 of the locating ring width.

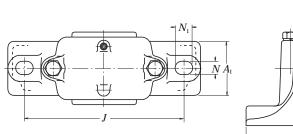
B 316 B 317

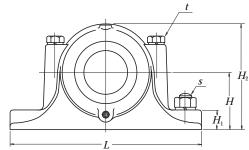
Remarks 1. The threads for grease nipples are R 1/8 for SG518 and under, and R 1/4 for SG520 and over.

^{2.} Bearing boxes larger than SG520 are provided with eye bolts.

⁽³⁾ Applicable to the ZF Type with the same number.

SN 2 C, SN 3 C Types Shaft Diameter 25 – 55 mm



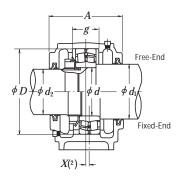


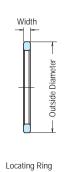
Shaft Diameter (mm)	Plummer Block								Dimens (mm							
d	Bearing Box Numbers (1)	d_1	d_2	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal
25	SN 205 C	30	20	52	40	130	15	20	67	165	46	22	75	25	M 8	M 12
	SN 305 C	30	20	62	50	150	15	20	80	185	52	22	90	34	M 8	M 12
30	SN 206 C	35	25	62	50	150	15	20	77	185	52	22	90	30	M 8	M 12
	SN 306 C	35	25	72	50	150	15	20	82	185	52	22	95	37	M 10	M 12
35	SN 207 C	45	30	72	50	150	15	20	82	185	52	22	95	33	M 10	M 12
	SN 307 C	45	30	80	60	170	15	20	90	205	60	25	110	41	M 10	M 12
40	SN 208 C	50	35	80	60	170	15	20	85	205	60	25	110	33	M 10	M 12
	SN 308 C	50	35	90	60	170	15	20	95	205	60	25	115	43	M 10	M 12
45	SN 209 C	55	40	85	60	170	15	20	85	205	60	25	112	31	M 10	M 12
	SN 309 C	55	40	100	70	210	18	23	105	255	70	28	130	46	M 12	M 16
50	SN 210 C	60	45	90	60	170	15	20	90	205	60	25	115	33	M 10	M 12
	SN 310 C	60	45	110	70	210	18	23	115	255	70	30	135	50	M 12	M 16
55	SN 211 C	65	50	100	70	210	18	23	95	255	70	28	130	33	M 12	M 16
	SN 311 C	65	50	120	80	230	18	23	120	275	80	30	150	53	M 12	M 16



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+nut+Lock-washer+locating ring".

Remarks The threads for plugs are R 1/8.



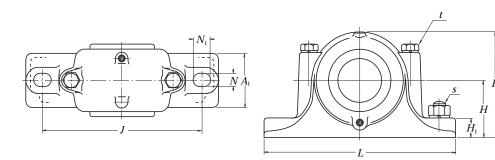


Mass				Applicable	e Parts				Oil Se	als (3)
(kg)		ng Ball Bearing	Spherical Rolle	r Bearing	Nut	Lock-washer	Locating Ring			
approx.	Numbers	B. D. L. R. (4) $C_{ m r}$ (N)	Numbers	B. D. L. R. (4) <i>C</i> _r (N)	Numbers	Numbers	Nominal (Outside Dia.×Width)	Q'ty	Side d_1	Side d ₂
1.1	1205 2205	12 200 12 400	 22205 CE4	 37 500	AN 05 AN 05	AW 05X AW 05X	SR 52 × 5 SR 52 × 7	2 1	GS 7	GS 5
1.6	1305 2305	18 200 24 900	21305 CDE4 —	43 000 —	AN 05 AN 05	AW 05X AW 05X	SR 62 × 8.5 SR 62 × 10	2 1	GS 7	GS 5
1.7	1206 2206	15 800 15 300	 22206 CE4	 50 000	AN 06 AN 06	AW 06X AW 06X	SR 62 × 7 SR 62 × 10	2	GS 8	GS 6
1.8	1306 2306	21 400 32 000	21306 CDE4 —	55 000 —	AN 06 AN 06	AW 06X AW 06X	SR 72 × 9 SR 72 × 10	2 1	GS 8	GS 6
1.9	1207 2207	15 900 21 700	 22207 CE4	 69 000	AN 07 AN 07	AW 07X AW 07X	SR 72 × 8 SR 72 × 10	2 1	GS 10	GS 7
2.6	1307 2307	25 300 40 000	21307 CDE4 —	71 500 —	AN 07 AN 07	AW 07X AW 07X	SR 80×10 SR 80×10	2 1	GS 10	GS 7
2.6	1208 2208	19 300 22 400	 22208 EAE4	_ 90 500	AN 08 AN 08	AW 08X AW 08X	SR 80 × 7.5 SR 80 × 10	2	GS 11	GS 8
2.9	1308 2308	29 800 45 500	21308 EAE4 22308 EAE4	94 500 136 000		AW 08X AW 08X	SR 90×10 SR 90×10	2 1	GS 11	GS 8
2.8	1209 2209	22 000 23 300	 22209 EAE4	 94 500	AN 09 AN 09	AW 09X AW 09X	SR 85 × 6 SR 85 × 8	2	GS 12	GS 9
4.1	1309 2309	38 500 55 000	21309 EAE4 22309 EAE4	119 000 166 000		AW 09X AW 09X	SR 100 × 10.5 SR 100 × 10	2 1	GS 12	GS 9
3.0	1210 2210	22 800 23 400	 22210 EAE4	_ 99 000	AN 10 AN 10	AW 10X AW 10X	SR 90 × 6.5 SR 90 × 10	2	GS 13	GS 10
4.7	1310 2310	43 500 65 000	21310 EAE4 22310 EAE4	142 000 197 000		AW 10X AW 10X	SR 110 × 11.5 SR 110 × 10	2 1	GS 13	GS 10
4.5	1211 2211	26 900 26 700	 22211 EAE4	 119 000	AN 11 AN 11	AW 11X AW 11X	SR 100 × 6 SR 100 × 8	2	GS 15	GS 11
5.8	1311 2311	51 500 76 500	21311 EAE4 22311 EAE4	142 000 234 000		AW 11X AW 11X	SR 120 × 12 SR 120 × 10	2 1	GS 15	GS 11

Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

⁽³⁾ Applicable to the ZF Type with the same number. (4) B. D. L. R.: Basic Dynamic Load Ratings

SN 2 C, SN 3 C Types Shaft Diameter 60 – 90 mm

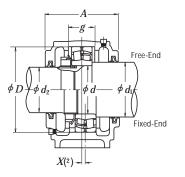


Shaft Diameter (mm)	Plummer Block								Dimensi (mm							
d	Bearing Box Numbers (1)	$d_{\scriptscriptstyle 1}$	d_2	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal
60	SN 212 C	70	55	110	70	210	18	23	105	255	70	30	135	38	M 12	M 16
	SN 312 C	70	55	130	80	230	18	23	125	280	80	30	155	56	M 12	M 16
65	SN 213 C	75	60	120	80	230	18	23	110	275	80	30	150	43	M 12	M 16
	SN 313 C	75	60	140	95	260	22	27	130	315	90	32	175	58	M 16	M 20
70	SN 214 C	80	65	125	80	230	18	23	115	275	80	30	155	44	M 12	M 16
	SN 314 C	80	65	150	95	260	22	27	130	320	90	32	185	61	M 16	M 20
75	SN 215 C	85	70	130	80	230	18	23	115	280	80	30	155	41	M 12	M 16
	SN 315 C	85	70	160	100	290	22	27	140	345	100	35	195	65	M 16	M 20
80	SN 216 C	90	75	140	95	260	22	27	120	315	90	32	175	43	M 16	M 20
	SN 316 C	90	75	170	112	290	22	27	145	345	100	35	212	68	M 16	M 20
85	SN 217 C	95	80	150	95	260	22	27	125	320	90	32	185	46	M 16	M 20
	SN 317 C	95	80	180	112	320	26	32	155	380	110	40	218	70	M 20	M 24
90	SN 218 C	100	85	160	100	290	22	27	145	345	100	35	195	62.4	M 16	M 20
	SN 318 C	105	85	190	112	320	26	32	160	380	110	40	225	74	M 20	M 24



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+nut+Lock-washer+locating ring".

Remarks The threads for plugs are R 1/8 for SN316C, SN218C, and under and R 1/4 for SN317C and over.





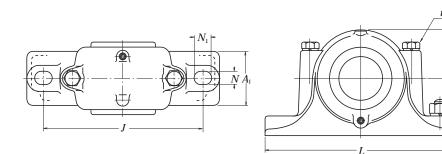
Locating	Ring
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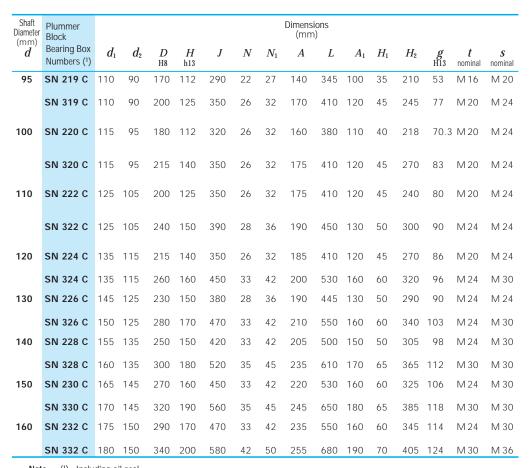
Mass				Applicable	e Parts				Oil Se	als (³)
(kg) approx.	Self-Aligni Numbers	ng Ball Bearing B. D. L. R. (4) $C_{ m r}$ (N)	Spherical Rolle Numbers	r Bearing B. D. L. R. (4) $C_{ m r}$ (N)	Nut Numbers	Lock-washer Numbers	Locating Ring Nominal (Outside Dia.×Width)	Q'ty	Side $d_{\scriptscriptstyle 1}$	Side d_2
5.0	1212 2212	30 500 34 000	 22212 EAE4	_ 142 000	AN 12 AN 12	AW 12X AW 12X	SR 110 × 8 SR 110 × 10	2	GS 16	GS 12
6.5	1312 2312	57 500 88 500	21312 EAE4 22312 EAE4	190 000 271 000	AN 12 AN 12	AW 12X AW 12X	SR 130 × 12.5 SR 130 × 10	2 1	GS 16	GS 12
5.6	1213 2213	31 000 43 500	 22213 EAE4	 177 000	AN 13 AN 13	AW 13X AW 13X	SR 120 × 10 SR 120 × 12	2	GS 17	GS 13
8.7	1313 2313	62 500 97 000	21313 EAE4 22313 EAE4	212 000 300 000		AW 13X AW 13X	SR 140 × 12.5 SR 140 × 10	2 1	GS 17	GS 13
6.2	1214 2214	35 000 44 000	 22214 EAE4	_ 180 000	AN 14 AN 14	AW 14X AW 14X	SR 125 × 10 SR 125 × 13	2	GS 18	GS 15
10	1314 2314	65 000 111 000	21314 EAE4 22314 EAE4	250 000 340 000	AN 14 AN 14	AW 14X AW 14X	SR 150 × 13 SR 150 × 10	2 1	GS 18	GS 15
7.0	1215 2215	39 000 44 500	 22215 EAE4	_ 190 000	AN 15 AN 15	AW 15X AW 15X	SR 130 × 8 SR 130 × 10	2	GS 19	GS 16
11.3	1315 2315	80 000 125 000	21315 EAE4 22315 EAE4	250 000 390 000	AN 15 AN 15	AW 15X AW 15X	SR 160 × 14 SR 160 × 10	2 1	GS 19	GS 16
9.0	1216 2216	40 000 49 000	 22216 EAE4	 212 000	AN 16 AN 16	AW 16X AW 16X	SR 140 × 8.5 SR 140 × 10	2	GS 20	GS 17
12.6	1316 2316	89 000 130 000	21316 EAE4 22316 EAE4	284 000 435 000		AW 16X AW 16X	SR 170 × 14.5 SR 170 × 10	2 1	GS 20	GS 17
10	1217 2217	49 500 58 500	 22217 EAE4	 250 000	AN 17 AN 17	AW 17X AW 17X	SR 150 × 9 SR 150 × 10	2	GS 21	GS 18
15	1317 2317	98 500 142 000	21317 EAE4 22317 EAE4	289 000 480 000	AN 17 AN 17	AW 17X AW 17X	SR 180 × 14.5 SR 180 × 10	2 1	GS 21	GS 18
13	1218 2218 —	57 500 70 500 —	 22218 EAE4 23218 CE4	 289 000 340 000	AN 18 AN 18 AN 18	AW 18X AW 18X AW 18X	SR 160 × 16.2 SR 160 × 11.2 SR 160 × 10	2 2 1	GS 22	GS 19
19	1318 2318	117 000 154 000	21318 EAE4 22318 EAE4	330 000 535 000		AW 18X AW 18X	SR 190 × 15.5 SR 190 × 10	2 1	GS 23	GS 19

Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

(3) Applicable to the ZF Type with the same number. (4) B. D. L. R.: Basic Dynamic Load Ratings

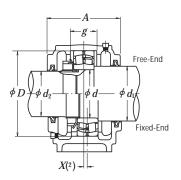
SN 2 C, SN 3 C Types Shaft Diameter 95 – 160 mm



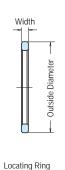




To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+nut+Lock-washer+locating ring".



 \dot{H}_1



Mass				Applicable	e Parts				Oil Se	als (³)
(kg)	Self-Aligni	ng Ball Bearing	g Spherical Rol	ler Bearing	Nut	Lock-washer	Locating Ring			
approx.	Numbers	B. D. L. R. (4) <i>C</i> _r (N)	Numbers	B. D. L. R. (4) $C_{ m r}$ (N)	Numbers	Numbers	Nominal (Outside Dia.×Width)	Q'ty	Side d_1	Side d ₂
15	1219 2219	64 000 84 000	 22219 EAE4	 330 000	AN 19 AN 19	AW 19X AW 19X	SR 170 × 10.5 SR 170 × 10	2 1	GS 24	GS 20
22	1319 2319		21319 CE4 22319 EAE4	345 000 590 000		AW 19X AW 19X	SR 200 × 16 SR 200 × 10	2	GS 24	GS 20
18.5	1220 2220 —	69 500 94 500 —	 22220 EAE4 23220 CE4	 365 000 420 000		AW 20X AW 20X AW 20X	SR 180 × 18.1 SR 180 × 12.1 SR 180 × 10	2 2 1	GS 26	GS 21
25	1320 2320		21320 CE4 22320 EAE4	395 000 690 000		AW 20X AW 20X	SR 215 × 18 SR 215 × 10	2 1	GS 26	GS 21
20	1222 2222 —	87 000 122 000 —	 22222 EAE4 23222 CE4	— 485 000 515 000		AW 22X AW 22X AW 22X	SR 200 × 21 SR 200 × 13.5 SR 200 × 10	2 2 1	GS 28	GS 23
32	1322 2322		21322 CAE4 22322 EAE4	395 000 825 000		AW 22X AW 22X	SR 240 × 20 SR 240 × 10	2 1	GS 28	GS 23
24.5	_	_	22224 EAE4 23224 CE4	550 000 630 000		AW 24 AW 24	SR 215 × 14 SR 215 × 10	2	GS 30	GS 26
48	_	_	22324 EAE4	955 000	AN 24	AW 24	SR 260×10	1	GS 30	GS 26
30	_		22226 EAE4 23226 CE4	655 000 700 000		AW 26 AW 26	SR 230 × 13 SR 230 × 10	2	GS 33	GS 28
56	_	_	22326 CE4	995 000	AN 26	AW 26	SR 280×10	1	GS 34	GS 28
38	_		22228 CDE4 23228 CE4	645 000 835 000		AW 28 AW 28	SR 250 × 15 SR 250 × 10	2	GS 35	GS 30
72	_	_	22328 CE4	1 160 000	AN 28	AW 28	SR 300 × 10	1	GS 36	GS 30
46	_		22230 CDE4 23230 CE4	765 000 975 000		AW 30 AW 30	SR 270 × 16.5 SR 270 × 10	2	GS 37	GS 33
98	_	_	22330 CAE4	1 220 000	AN 30	AW 30	SR 320 × 10	1	GS 38	GS 33
50	_	_	22232 CDE4 23232 CE4	910 000 1 100 000		AW 32 AW 32	SR 290 × 17 SR 290 × 10	2	GS 39	GS 34
115	_	_	22332 CAE4	1 360 000	AN 32	AW 32	SR 340 × 10	1	GS 40	GS 34

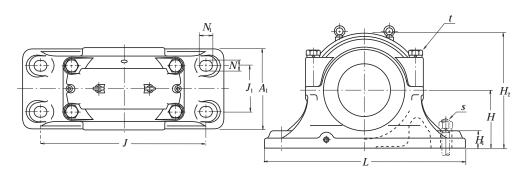
Notes (2) The X dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

Remarks 1. The threads for plugs are R 1/8 for SN219C, and R 1/4 for SN319C and SN220C and over.

^{2.} Bearing boxes larger than SN320C and SN224C are provided with eye bolts.

⁽³⁾ Applicable to the ZF Type with the same number. (4) B. D. L. R.: Basic Dynamic Load Ratings

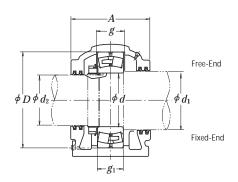
SD 2 C, SD 3 C Types Shaft Diameter 170 – 320 mm



Shaft Diameter (mm)		ner Block ing Box						D	imensi (mm						
d	Num Free-End	bers (¹) Fixed-End	d_1	d_2	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	J_1
170	SD 234 C	SD 234 CG	190	160	310	180	510	36	46	270	620	250	60	360	140
	SD 334 C	SD 334 CG	190	160	360	210	610	36	46	300	740	290	65	420	170
180	SD 236 C	SD 236 CG	200	170	320	190	540	36	46	280	650	260	60	380	150
100		SD 336 CG	200	170	380	225	640	43	59	320	780	310	70	450	180
190	SD 238 C	SD 238 CG	210	180	340	200	570	36	46	290	700	280	65	400	160
	SD 338 C	SD 338 CG	210	180	400	240	680	43	59	330	820	320	70	475	190
200	SD 240 C	SD 240 CG	220	190	360	210	610	36	46	300	740	290	65	420	170
	SD 340 C	SD 340 CG	220	190	420	250	710	43	59	350	860	340	85	500	200
220	SD 244 C	SD 244 CG	240	210	400	240	680	43	59	330	820	320	70	475	190
220	SD 344 C	SD 344 CG	240	210	460	280	770	43	59	360	920	350	85	550	210
			2.10	210	100	200	,,,	10	0,	500			00		210
240	SD 248 C	SD 248 CG	260	230	440	260	740	43	59	340	880	330	85	515	200
	SD 348 C	SD 348 CG	260	230	500	300	830	50	67	390	990	380	100	590	230
260	SD 252 C	SD 252 CG	280	250	480	280	790	43	59	370	940	360	85	560	210
	SD 352 C	SD 352 CG	280	250	540	325	890	50	67	410	1 060	400	100	640	250
200	CD 25/ C	CD 25/ 00	200	2/0	F00	200	020	Ε0	/ 7	200	000	380	100	F00	220
280		SD 256 CG	300	260	500	300	830	50	67	390	990		100	590	230
	SD 356 C	SD 356 CG	300	260	580	355	930	57	77	440	1 110	430	110	690	270
300	SD 260 C	SD 260 CG	320	280	540	325	890	50	67	410	1 060	400	100	640	250
320	SD 264 C	SD 264 CG	340	300	580	355	930	57	77	440	1 110	430	110	690	270



To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+nut+Lock-washer or stopper".



				Mass		Oil Se	als (²)			
		4		(kg)	Spherical Ro	oller Bearing	Nut	Lock-washer or Stopper	CLI. I	CLL I
g H13	g 1 H13	t nominal	S nominal	approx.	Numbers	Basic Dynamic Load Ratings $C_{ m r}$ (N)	Numbers	Numbers	Side d ₁	Side d_2
96	86	M 24	M 30	100	22234 CDE	990 000	AN 34	AW 34	GS 42	GS 36
130	120	M 30	M 30	160	22334 CAE	1 580 000	AN 34	AW 34	GS 42	GS 36
96	86	M 24	M 30	110	22236 CDE	1 020 000	AN 36	AW 36	GS 44	GS 38
136	126	M 30	M 36	195	22336 CAE	1 740 000	AN 36	AW 36	GS 44	GS 38
102	92	M 30	M 30	130	22238 CAE	1 140 000	AN 38	AW 38	GS 46	GS 40
142	132	M 30	M 36	210	22338 CAE	1 1 890 000	AN 38	AW 38	GS 46	GS 40
108	98	M 30	M 30	155	22240 CAE	1 300 000	AN 40	AW 40	GS 48	GS 42
148	138	M 36	M 36	240	22340 CAE	2 000 000	AN 40	AW 40	GS 48	GS 42
118	108	M 30	M 36	205	22244 CAE	1 570 000	AN 44	AL 44	GS 52	GS 46
155	145	M 36	M 36	315	22344 CAE	1 2 350 000	AN 44	AL 44	GS 52	GS 46
130	120	M 36	M 36	240	22248 CAE	1 870 000	AN 48	AL 44	GS 56	GS 50
165	155	M 36	M 42	405	22348 CAE	1 2 600 000	AN 48	AL 44	GS 56	GS 50
140	130	M 36	M 36	315	22252 CAE	2 180 000	AN 52	AL 52	GS 60	GS 54
175	165	M 36	M 42	480	22352 CAE	3 100 000	AN 52	AL 52	GS 60	GS 54
140	130	M 36	M 42	390	22256 CAE	2 280 000	AN 56	AL 52	GS 64	GS 56
185	175	M 42	M 48	610	22356 CAE	3 500 000	AN 56	AL 52	GS 64	GS 56
150	140	M 36	M 42	465	22260 CAE	2 610 000	AN 60	AL 60	GS 68	GS 60
160	150	M 42	M 48	595	22264 CAE	1 2 990 000	AN 64	AL 64	GS 72	GS 64

Note (2) Applicable to the ZF Type with the same number.

Remarks 1. The threads for oil replenishing hole plugs are R 1/4 and those for drain plugs are R 3/8.

^{2.} The plummer block bearing boxes listed above are provided with eye bolts.



CYLINDRICAL ROLLER BEARINGS FOR SHEAVES

CYLINDRICAL ROLLER BEARINGS FOR SHEAVES

Open Type	Bore Diameter 50 – 560mm ·····	B328
Prelubricated Type	Bore Diameter 40 – 400mm ·····	B332

DESIGN, TYPES, AND FEATURES

Cylindrical Roller Bearings for sheaves are specially designed thin-walled, broad-width, full-complement type double-row cylindrical roller bearings, but they are widely used also for general industrial machines running at low speed and under heavy loads. There are several series as shown in Table 1.

Table 1 Series of Cylindrical Roller Bearings for Sheaves

Bearin	g Type	Fixed-End	Free-End
Open Type	Without Snap Ring	RS-48E4 RS-49E4	RSF-48E4 RSF-49E4
Shielded Type	Without Snap Ring With Snap Ring	RS-50 RS-50NR	_

Table 3 Units : μm

	minal		Clear	ances	
	e Dia. mm)	C	N	C	3
over	incl.	min.	max.	min.	max.
30	40	15	50	35	70
40	50	20	55	40	75
50	65	20	65	45	90
65	80	25	75	55	105
80	100	30	80	65	115
100	100 120		90	80	135
120	140	40	105	90	155
140	160	50	115	100	165
160	180	60	125	110	175
180	200	65	135	125	195
200	225	75	150	140	215
225	250	90	165	155	230
250	280	100	180	175	255
280	315	110	195	195	280
315	355	125	215	215	305
355	400	140	235	245	340
400	450	155	275	270	390
450	500	180	300	300	420
					_

Since all are non-separable type bearings, the inner and outer rings cannot be separated, but the RSF type can be used as a free-end bearing. In this case, the permissible axial displacement is listed in the bearing tables.

Since cylindrical roller bearings for sheaves are a double-row, full-complement type, they can withstand heavy shock loads and moments and have sufficient axial load capacity for use in sheaves.

Since the shielded type is a kind of bearing unit, the number of parts surrounding the bearing can be reduced, so it allows for a simple compact design.

The surface of these bearings is treated for rust prevention.

TOLERANCES AND RUNNING ACCURACY...... Table 8.2 (Pages A60 to A63)

RECOMMENDED FITS AND INTERNAL CLEARANGES

When used with outer ring rotation for sheaves or wheels, the fit and radial internal clearance should conform to Table 2.

Table 2 Fits and Internal Clearances for Cylindrical Roller Bearings for Sheaves

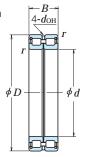
0	perating Conditions	Fitting between Inner Ring and Shaft	Fitting between Outer Ring and Housing Bore	Recommended Internal Clearance
	Thin walled housings and heavy loads	g6 or h6	P7	C3
Outer Ring Rotation	Normal to heavy loads	g6 or h6	N7	C3
	Light or fluctuating loads	g6 or h6	M7	CN

The fits listed in Tables 9.2 (Page A84) and 9.4 (Page A85) apply when they are used with inner ring rotation in general applications, and the internal clearance should conform to Table 3.

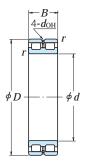
B 326 B 327

RS-48 · RS-49 Types RSF-48 · RSF-49 Types

Bore Diameter 50 – 220 mm



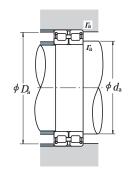




Free-End Bearing RSF

	Boundary [Dimensions m)	5	(Basic Loa		gf}	_ ~	Speeds
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
50	72	22	0.6	48 000	75 500	4 900	7 700	2 000	4 000
60	85	25	1	68 500	118 000	6 950	12 000	1 600	3 200
65	90	25	1	70 500	125 000	7 150	12 700	1 600	3 200
70	100	30	1	102 000	168 000	10 400	17 200	1 400	2 800
80	110	30	1	109 000	191 000	11 100	19 500	1 300	2 600
90	125	35	1.1	147 000	268 000	15 000	27 400	1 100	2 200
100	125	25	1	87 500	189 000	8 900	19 300	1 100	2 200
	140	40	1.1	194 000	400 000	19 800	41 000	1 000	2 000
105	130	25	1	89 000	196 000	9 100	19 900	1 000	2 000
	145	40	1.1	199 000	420 000	20 300	43 000	950	1 900
110	140	30	1	114 000	260 000	11 700	26 500	950	1 900
	150	40	1.1	202 000	430 000	20 600	44 000	900	1 800
120	150	30	1	119 000	283 000	12 200	28 900	900	1 800
	165	45	1.1	226 000	480 000	23 100	49 000	800	1 600
130	165	35	1.1	162 000	390 000	16 500	39 500	800	1 600
	180	50	1.5	262 000	555 000	26 700	56 500	750	1 500
140	175	35	1.1	167 000	415 000	17 000	42 500	750	1 500
	190	50	1.5	272 000	595 000	27 700	60 500	710	1 400
150	190	40	1.1	235 000	575 000	23 900	58 500	670	1 400
	210	60	2	390 000	865 000	40 000	88 500	670	1 300
160	200	40	1.1	243 000	615 000	24 800	63 000	630	1 300
	220	60	2	410 000	930 000	41 500	95 000	600	1 200
170	215	45	1.1	265 000	650 000	27 000	66 500	600	1 200
	230	60	2	415 000	975 000	42 500	99 500	600	1 200
180	225	45	1.1	272 000	685 000	27 800	70 000	560	1 100
	250	69	2	495 000	1 130 000	50 500	115 000	530	1 100
190	240	50	1.5	315 000	785 000	32 000	80 000	530	1 100
	260	69	2	510 000	1 180 000	52 000	120 000	500	1 000
200	250	50	1.5	320 000	825 000	33 000	84 000	500	1 000
	280	80	2.1	665 000	1 500 000	68 000	153 000	480	950
220	270	50	1.5	340 000	905 000	34 500	92 500	450	900
	300	80	2.1	695 000	1 620 000	70 500	165 000	430	850

Remarks Cylindrical roller bearings for sheaves are designed for specific applications, when using them, please contact NSK.



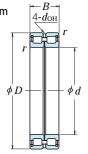
Bearing N	lumbers ⁽¹⁾		nsions im)		butment and Dimensions (n	nm)	Mass (kg)
Fixed-End Bearing	Free-End Bearing	$d_{ m OH}^{(2)}$	Axial Disp.(3)	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{r_{\mathrm{a}}}{max}.$	approx.
RS-4910E4	RSF-4910E4	2.5	1.5	54	68	0.6	0.30
RS-4912E4	RSF-4912E4	2.5	1.5	65	80	1	0.46
RS-4913E4	RSF-4913E4	2.5	2	70	85	1	0.50
RS-4914E4	RSF-4914E4	3	2	75	95	1	0.79
RS-4916E4	RSF-4916E4	3	2	85	105	1	0.89
RS-4918E4	RSF-4918E4	3	2	96.5	118.5	1	1.35
RS-4820E4	RSF-4820E4	2.5	1.5	105	120	1	0.74
RS-4920E4	RSF-4920E4	3	2	106.5	133.5	1	1.97
RS-4821E4	RSF-4821E4	2.5	1.5	110	125	1	0.77
RS-4921E4	RSF-4921E4	3	2	111.5	138.5	1	2.05
RS-4822E4	RSF-4822E4	3	2	115	135	1	1.09
RS-4922E4	RSF-4922E4	3		116.5	143.5	1	2.15
RS-4824E4	RSF-4824E4	3	2 3	125	145	1	1.28
RS-4924E4	RSF-4924E4	4		126.5	158.5	1	2.95
RS-4826E4	RSF-4826E4	3	2	136.5	158.5	1	1.9
RS-4926E4	RSF-4926E4	5	3.5	138	172	1.5	3.95
RS-4828E4	RSF-4828E4	3	2	146.5	168.5	1	2.03
RS-4928E4	RSF-4928E4	5	3.5	148	182	1.5	4.25
RS-4830E4	RSF-4830E4	3	2	156.5	183.5	1	2.85
RS-4930E4	RSF-4930E4	5	3.5	159	201	2	6.65
RS-4832E4	RSF-4832E4	3	2	166.5	193.5	1	3.05
RS-4932E4	RSF-4932E4	5	3.5	169	211	2	7.0
RS-4834E4	RSF-4834E4	4	3	176.5	208.5	1	4.1
RS-4934E4	RSF-4934E4	4	3.5	179	221	2	7.35
RS-4836E4	RSF-4836E4	4	3	186.5	218.5	1	4.3
RS-4936E4	RSF-4936E4	6	4.5	189	241	2	10.7
RS-4838E4	RSF-4838E4	5	3.5	198	232	1.5	5.65
RS-4938E4	RSF-4938E4	6	4.5	199	251	2	11.1
RS-4840E4	RSF-4840E4	5	3.5	208	242	1.5	5.95
RS-4940E4	RSF-4940E4	7	5	211	269	2	15.7
RS-4844E4	RSF-4844E4	5	3.5	228	262	1.5	6.45
RS-4944E4	RSF-4944E4	7	5	231	289	2	17

Notes (1) The suffix E4 indicates that the outer ring is provided with oil holes and oil groove.

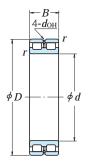
- (2) d_{OH} represents the oil hole diameter in the outer ring.
- (3) Permissible axial displacement for free-end bearings.

RS-48 · RS-49 Types RSF-48 · RSF-49 Types

Bore Diameter 240 – 560 mm



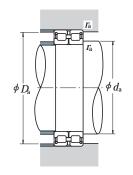




Free-End Bearing RSF

	Boundary (m	Dimension	s	(Basic Lo N)	ad Ratings	kgf}	Limiting Speeds (min ⁻¹)	
d	D	В	$m{r}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
240	300	60	2	495 000	1 340 000	50 500	137 000	430	850
	320	80	2.1	725 000	1 770 000	74 000	181 000	400	800
260	320	60	2	515 000	1 450 000	52 500	148 000	380	750
	360	100	2.1	1 050 000	2 530 000	107 000	258 000	360	710
280	350	69	2	610 000	1 690 000	62 500	173 000	340	710
	380	100	2.1	1 090 000	2 720 000	111 000	277 000	340	670
300	380	80	2.1	805 000	2 160 000	82 000	220 000	320	630
	420	118	3	1 460 000	3 400 000	149 000	350 000	300	600
320	400	80	2.1	835 000	2 310 000	85 000	236 000	300	600
	440	118	3	1 500 000	3 600 000	153 000	365 000	280	560
340	420	80	2.1	855 000	2 430 000	87 500	248 000	280	560
	460	118	3	1 560 000	3 900 000	159 000	395 000	260	530
360	440	80	2.1	885 000	2 580 000	90 000	264 000	260	530
	480	118	3	1 600 000	4 050 000	163 000	415 000	260	500
380	480	100	2.1	1 260 000	3 600 000	128 000	365 000	240	500
	520	140	4	2 040 000	5 200 000	209 000	530 000	240	450
400	500	100	2.1	1 290 000	3 750 000	132 000	385 000	240	480
	540	140	4	2 100 000	5 450 000	214 000	555 000	220	450
420	520	100	2.1	1 320 000	3 950 000	135 000	405 000	220	450
	560	140	4	2 150 000	5 700 000	219 000	580 000	200	430
440	540	100	2.1	1 350 000	4 150 000	138 000	420 000	200	430
	600	160	4	2 840 000	7 350 000	289 000	750 000	190	380
460	580	118	3	1 730 000	5 150 000	177 000	525 000	190	380
	620	160	4	2 870 000	7 500 000	293 000	765 000	190	380
480	600	118	3	1 760 000	5 300 000	180 000	545 000	190	380
	650	170	5	3 200 000	8 500 000	325 000	865 000	180	360
500	620	118	3	1 810 000	5 600 000	184 000	570 000	180	360
	670	170	5	3 300 000	8 900 000	335 000	910 000	170	340
530		180	5	3 400 000	9 200 000	350 000	935 000	160	320
560		190	5	3 800 000	10 100 000	385 000	1 030 000	150	300

Remarks Cylindrical roller bearings for sheaves are designed for specific applications, when using them, please contact NSK.



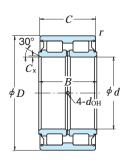
Bearing N	lumbers ⁽¹⁾		nsions im)		Abutment and Dimensions (r	mm)	Mass (kg)
Fixed-End Bearing	Free-End Bearing	$d_{ m OH}^{(2)}$	Axial Disp.(3)	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{r_{\mathrm{a}}}$ max.	approx.
RS-4848E4	RSF-4848E4	5	3.5	249	291	2 2	10.3
RS-4948E4	RSF-4948E4	7	5	251	309		18.4
RS-4852E4	RSF-4852E4	5	3.5	269	311	2	11
RS-4952E4	RSF-4952E4	8	6	271	349	2	32
RS-4856E4	RSF-4856E4	6	4.5	289	341	2	16
RS-4956E4	RSF-4956E4	8	6	291	369	2	34
RS-4860E4	RSF-4860E4	6	5	311	369	2	23
RS-4960E4	RSF-4960E4	9	7	313	407	2.5	52
RS-4864E4	RSF-4864E4	6	5	331	389	2	24.3
RS-4964E4	RSF-4964E4	9	7	333	427	2.5	55
RS-4868E4	RSF-4868E4	6	5	351	409	2	25.6
RS-4968E4	RSF-4968E4	9	7	353	447	2.5	58
RS-4872E4	RSF-4872E4	6	5	371	429	2	27
RS-4972E4	RSF-4972E4	9	7	373	467	2.5	61
RS-4876E4	RSF-4876E4	8	6	391	469	2	45.5
RS-4976E4	RSF-4976E4	11	8	396	504		90.5
RS-4880E4	RSF-4880E4	8	6	411	489	2	47.5
RS-4980E4	RSF-4980E4	11	8	416	524		94.5
RS-4884E4	RSF-4884E4	8	6	431	509	2	49.5
RS-4984E4	RSF-4984E4	11	8	436	544	3	98.5
RS-4888E4	RSF-4888E4	8	6	451	529	2	51.5
RS-4988E4	RSF-4988E4	11	8	456	584		136
RS-4892E4	RSF-4892E4	9	7	473	567	2.5	77.5
RS-4992E4	RSF-4992E4	11	8	476	604	3	142
RS-4896E4	RSF-4896E4	9	7	493	587	2.5	80.5
RS-4996E4	RSF-4996E4	12	9	500	630	4	167
RS-48/500E4	RSF-48/500E4	9	7	513	607	2.5	83.5
RS-49/500E4	RSF-49/500E4	12	9	520	650	4	173
RS-49/530E4	RSF-49/530E4	12	11	550	690	4	206
RS-49/560E4	RSF-49/560E4	12	11	580	730	4	231

Notes (1) The suffix E4 indicates that the outer ring is provided with oil holes and oil groove.

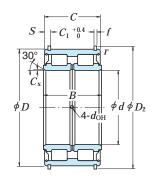
- (2) d_{OH} represents the oil hole diameter in the outer ring.
- (3) Permissible axial displacement for free-end bearings.



RS-50 Type (Prelubricated) Bore Diameter 40 – 400 mm







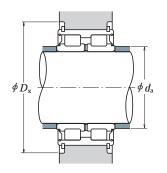
With Locating Ring

	E	Boundary [(m	Dimensior m)	ns		(Basic Load I		(gf)	Limiting Speeds
d	D	В	С	$C_{\rm x}^{(1)}$ min.	r min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	(min ⁻¹) Grease
40	68	38	37	0.4	0.6	79 500	116 000	8 100	11 800	2 400
45	75	40	39	0.4	0.6	95 500	144 000	9 750	14 700	2 200
50	80	40	39	0.4	0.6	100 000	158 000	10 200	16 100	2 000
55	90	46	45	0.6	0.6	118 000	193 000	12 100	19 700	1 800
60	95	46	45	0.6	0.6	123 000	208 000	12 600	21 200	1 700
65	100	46	45	0.6	0.6	128 000	224 000	13 100	22 800	1 600
70	110	54	53	0.6	0.6	171 000	285 000	17 500	29 000	1 400
75	115	54	53	0.6	0.6	179 000	305 000	18 200	31 500	1 400
80	125	60	59	0.6	0.6	251 000	430 000	25 600	43 500	1 200
85	130	60	59	0.6	0.6	256 000	445 000	26 200	45 500	1 200
90	140	67	66	1	0.6	305 000	540 000	31 000	55 000	1 100
95	145	67	66	1	0.6	310 000	565 000	32 000	57 500	1 100
100	150	67	66	1	0.6	320 000	585 000	32 500	59 500	1 000
110	170	80	79	1.1	1	385 000	695 000	39 000	71 000	900
120	180	80	79	1.1	1	400 000	750 000	40 500	76 500	850
130	200	95	94	1.1	1	535 000	1 000 000	54 500	102 000	750
140	210	95	94	1.1	1	550 000	1 040 000	56 000	106 000	710
150	225	100	99	1.3	1	620 000	1 210 000	63 500	124 000	670
160	240	109	108	1.3	1.1	695 000	1 370 000	71 000	140 000	630
170	260	122	121	1.3	1.1	860 000	1 680 000	88 000	171 000	600
180	280	136	135	1.3	1.1	980 000	1 910 000	100 000	195 000	530
190	290	136	135	1.3	1.1	1 120 000	2 230 000	114 000	227 000	500
200	310	150	149	1.3	1.1	1 310 000	2 650 000	133 000	270 000	480
220	340	160	159	1.5	1.1	1 510 000	3 100 000	154 000	320 000	430
240	360	160	159	1.5	1.1	1 570 000	3 350 000	160 000	340 000	400
260	400	190	189	2	1.5	2 130 000	4 500 000	217 000	460 000	360
280	420	190	189	2	1.5	2 170 000	4 700 000	221 000	480 000	340
300	460	218	216	2	1.5	2 670 000	5 850 000	272 000	600 000	300
320	480	218	216	2	1.5	2 720 000	6 100 000	277 000	620 000	300
340	520	243	241	2.1	2	3 350 000	7 550 000	345 000	770 000	260
360	540	243	241	2.1	2	3 450 000	7 850 000	350 000	800 000	260
380	560	243	241	2.1	2	3 550 000	8 400 000	365 000	855 000	240
400	600	272	270	2.1	2	4 250 000	9 950 000	435 000	1 010 000	220

Note (1) Chamfer dimension of inner ring in radial direction.

Remarks 1. Good quality grease is prepacked in bearings.

2. Grease can be supplied through oil holes in the inner rings.



Bearing N	lumbers			ing Ring ions (mm)		Oil Holes (mm)		ent and nsions (mm)	Mass (kg)
Without Locating Ring	With Locating Ring	C_1	S	D_2	f	$d_{ m OH}$	$d_{ m a}$ min.	D_{x} min.	approx.
RS-5008	RS-5008NR	28	4.5	71.8	2	2.5	43.5	77.5	0.56
RS-5009	RS-5009NR	30	4.5	78.8	2	2.5	48.5	84.5	0.70
RS-5010	RS-5010NR	30	4.5	83.8	2	2.5	53.5	89.5	0.76
RS-5011	RS-5011NR	34	5.5	94.8	2.5	3	60	101	1.17
RS-5012	RS-5012NR	34	5.5	99.8	2.5	3	65	106	1.25
RS-5013	RS-5013NR	34	5.5	104.8	2.5	3	70	111	1.32
RS-5014	RS-5014NR	42	5.5	114.5	2.5	3	75	121	1.87
RS-5015	RS-5015NR	42	5.5	119.5	2.5	3	80	126	2.0
RS-5016	RS-5016NR	48	5.5	129.5	2.5	3	85	136	2.65
RS-5017	RS-5017NR	48	5.5	134.5	2.5	3	90	141	2.75
RS-5018	RS-5018NR	54	6	145.4	2.5	4	96	153.5	3.75
RS-5019	RS-5019NR	54	6	150.4	2.5	4	101	158.5	3.95
RS-5020	RS-5020NR	54	6	155.4	2.5	4	106	163.5	4.05
RS-5022	RS-5022NR	65	7	175.4	2.5	5	116.5	183.5	6.1
RS-5024	RS-5024NR	65	7	188	3	5	126.5	197	7.0
RS-5026	RS-5026NR	77	8.5	207	3	5	136.5	217	10.6
RS-5028	RS-5028NR	77	8.5	217	3	5	146.5	227	11.3
RS-5030	RS-5030NR	81	9	232	3	6	157	242	13.7
RS-5032	RS-5032NR	89	9.5	247	3	6	167	257	16.8
RS-5034	RS-5034NR	99	11	270	4	6	177	285	22.2
RS-5036	RS-5036NR	110	12.5	294	5	6	187	318	30
RS-5038	RS-5038NR	110	12.5	304	5	6	197	328	32
RS-5040	RS-5040NR	120	14.5	324	5	6	207	352	41
RS-5044	RS-5044NR	130	14.5	356	6	7	228.5	382	53
RS-5048	RS-5048NR	130	14.5	376	6	7	248.5	402	57
RS-5052	RS-5052NR	154	17.5	416	7	8	270	444	86
RS-5056	RS-5056NR	154	17.5	436	7	8	290	472	92
RS-5060 RS-5064 RS-5068	RS-5060NR — —	178 — —	19 — —	476 — —	7 	8 8 10	310 330 352	512 — —	130 135 185
RS-5072 RS-5076 RS-5080	=	=	_ _ _	_ _ _	=	10 10 10	372 392 412	_ _ _	

Remarks 3. Cylindrical roller bearings for sheaves are designed for specific applications, when using them, please contact NSK.

For shield with outside diameter larger than 180mm, the above figure is different actual shape. For detail drawing, please contact NSK.





ROLL-NECK BEARINGS

FOUR-ROW **TAPERED ROLLER BEARINGS**

FOUR-ROW CYLINDRICAL ROLLER BEARINGS Bore Diameter 100 – 939.800mm ····· B338

Bore Diameter 100 – 920mm ----- B340

DESIGN, TYPES, AND FEATURES

Four-row tapered roller bearings and four-row cylindrical roller bearings used for rolling-mill roll necks are easy to service and check, and are designed to have the highest load rating possible for the limited space around roll necks. Also, they are designed for high speed to satisfy the demand for fast rolling. In addition to the open type (KV) four-row tapered roller bearings listed in this catalog, sealed-clean type four-row tapered roller bearings are also available. Please refer to "Large-Size Rolling Bearings" catalog (CAT. No. E125) or "Extra-Capacity Sealed-CleanTM Roll Neck Bearings" catalog (CAT. No. E1225) for more detailed information.

TOLERANCES AND RUNNING ACCURACY

METRIC DESIGN FOUR-ROW TAPERED ROLLER BEARINGSTable 8.3 (Pages A64 to A67)	
INCH DESIGN FOUR-ROW TAPERED ROLLER BEARINGSTable 8.4 (Pages A68 to A69)	
FOUR-ROW CYLINDRICAL ROLLER BEARINGSTable 8.2 (Pages A60 to A63) (Not applicable to combined width)	

RECOMMENDED FITS

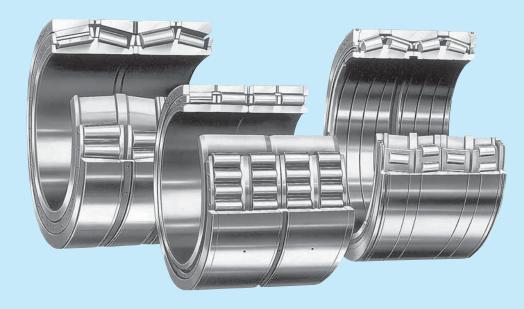
FOUR-ROW TAPERED ROLLER BEARINGS (CYLINDRICAL BORES)

Tables 1 and 2 apply to metric series bearings and Tables 3 and 4 to inch design.

Table 1 Fits of Metric Design Four-Row Tapered Roller Bearings with Roll Necks

Units: µm

Diam	Nominal Bore Diameter d (mm)		Single Plane Mean Bore Dia. Deviation $\Delta d_{\rm mp}$		rance	Clear	ance	Wear Limits
over	incl.	high	low	high	low	min.	max.	Ref.
80	120	0	- 20	- 120	- 150	100	150	300
120	180	0	- 25	- 150	- 175	125	175	350
180	250	0	- 30	- 175	- 200	145	200	400
250	315	0	- 35	- 210	- 250	175	250	500
315	400	0	- 40	- 240	- 300	200	300	600
400	500	0	- 45	- 245	- 300	200	300	600
500	630	0	- 50	- 250	- 300	200	300	600
630	800	0	- 75	- 325	- 400	250	400	800



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Table 2 Fits of Metric Design Four-Row Tapered Roller Bearings with Chock

Units: µm

Nominal Outside Diameter D (mm)		Outside Di	lane Mean ia. Deviation <i>D</i> mp	Tolerai Chock Dian		Clea	rance	Wear Limits of Chock
over	incl.	high	low	high	low	min.	max.	Ref.
120 150 180 250 315 400	150 180 250 315 400 500	0 0 0 0	- 18 - 25 - 30 - 35 - 40 - 45	+ 57 +100 +120 +115 +110 +105	+25 +50 +50 +50 +50 +50	25 50 50 50 50 50	75 125 150 150 150 150	150 250 300 300 300 300 300
500 630 800	630 800 1 000	0 0 0	- 50 - 75 - 100	+100 +150 +150	+50 +75 +75	50 75 75	150 225 250	300 450 500

Table 3 Fits of Inch Design Four-Row Tapered Roller Bearings with Roll Necks

Units: µm

N	Nominal Bore Diameter $oldsymbol{d}$						Tolerance for Roll Neck Diameter		rance	Wear Limits of
ove (mm)	r 1/25.4	incl (mm)	. 1/25.4	high	low	high	low	min.	max.	Roll Neck Ref.
152.400 203.200 304.800 609.600 914.400	6.0000 8.0000 12.0000 24.0000 36.0000	203.200 304.800 609.600 914.400	8.0000 12.0000 24.0000 36.0000	+ 25 + 25 + 51 + 76 +102	0 0 0 0	- 150 - 175 - 200 - 250 - 300	- 175 - 200 - 250 - 325 - 400	175 200 250	200 225 301 401 502	400 450 600 800 1 000

Table 4 Fits of Inch Design Four-Row Tapered Roller Bearings with Chocks

Units: µm

Nor	Outside Deviation		Tolerance Bore D	for Chock iameter	Clea	rance	Wear Limits of			
over (mm) 1/25.4		incl. (mm)	1/25.4	high	low	high	low	min.	max.	Chock Ref.
304.800 609.600 914.400 1 219.200	12.0000 24.0000 36.0000 48.0000	304.800 609.600 914.400 1 219.200 1 524.000	12.0000 24.0000 36.0000 48.0000 60.0000	+ 25 + 51 + 76 +102 +127	0 0 0 0	+ 75 +150 +225 +300 +375	+ 50 +100 +150 +200 +250	98	75 150 225 300 375	150 300 450 600 750

FOUR-ROW CYLINDRICAL ROLLER BEARINGS (CYLINDRICAL BORES)

When they are used on backup rolls of four stage rolling mills, the tolerances for roll neck diameters are shown in Table 5. For the fitting between the bearing and chock bore, we recommend ${\bf G7}$.

For the fitting of four-row cylindrical roller bearings on the roll necks of other rolling mills, Table 9.2 (Page A84) and Table 9.4 (Page A85) usually apply.

Table 5 Recommended Backup Roll Neck Tolerances

Units : µm

Nominal Bo	re Diameter 1	Tolerances for Roll Neck Diameter				
over	incl.	high	low			
280	355	+0.165	+0.13			
355	400	+0.19	+0.15			
400	450	+0.22	+0.17			
450	500	+0.25	+0.19			
500	560	+0.28	+0.21			
560	630	+0.32	+0.25			
630	710	+0.35	+0.27			
710	800	+0.39	+0.31			
800	900	+0.44	+0.35			
900	1 000	+0.48	+0.39			

INTERNAL CLEARANCES

FOUR-ROW TAPERED ROLLER BEARINGS

The radial internal clearances in four-row tapered roller bearings (cylindrical bores) used on rolling mill roll necks with a loose fit are C2 or often smaller than C2. The NSK standard clearances for four-row tapered roller bearings for roll necks are shown in Table 6. Depending on the operating conditions, special radial clearance selection may become necessary, please contact NSK in such a case.

The internal clearance in four-row tapered roller bearings is peadjusted for individual bearing sets, therefore it is necessary to use each part of a given set by observing mating marks when assembling them.

FOUR-ROW CYLINDRICAL ROLLER BEARINGS

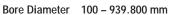
Please contact NSK regarding internal clearance.

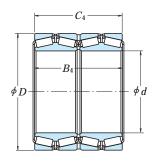
Table 6 Standard Radial Internal Clearances in Four-Row Tapered Roller Bearings (Cylindrical Bores)

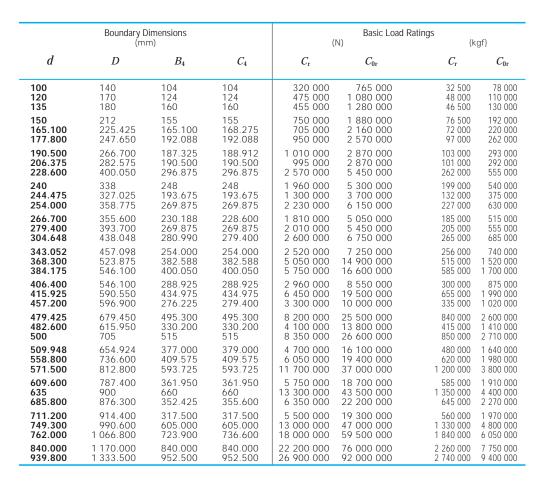
Units : µm

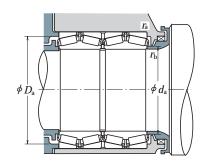
	re Diameter nm)	Radial Interr	nal Clearance
over	incl.	min.	max.
80	120	25	45
120	180	30	50
180	250	40	60
250	315	50	70
315	400	60	80
400	500	70	90
500	630	80	100
630	800	100	120
800	1 000	120	140

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	Abutı	ment and Fill (mn		ons	Mass (kg)	2.5
Bearing Numbers	$d_{\scriptscriptstyle m a}$	D_{a}	$r_{ m a}$ max.	$\emph{\textbf{r}}_{ m b}$ max.	арргох.	Reference Numbers
100 KV 895	109	130	2	1.5	4.9	_
120 KV 895	131	158	2	2	8.5	_
135 KV 1802	145	169	1.5	2	11.1	_
150 KV 895	162	196	2	2	17	—
*165 KV 2252	178	209	3.3	0.8	20.2	46791D -720-721D
*177 KV 2452	192	228	3.3	1.5	27.9	67791D -720-721D
*190 KV 2651	204	246	3.3	1.5	32.8	67885D -820-820D
*206 KV 2854	218	261	3.3	0.8	35.2	67986D -920-921D
*228 KV 4051	264	367	3.3	3.3	152	EE 529091D -157-158XD
240 KV 895	257	315	2.5	2.5	68.5	
*244 KV 3251	260	306	3.3	1.5	44.6	LM 247748D -710-710D
*254 KV 3551	272	335	3.3	1.5	85.6	M 249748DW -710-710D
*266 KV 3552	281	335	3.3	1.5	60.6	LM 451349D -310-310D
*279 KV 3951	302	363	6.4	1.5	100	EE 135111D -155-156XD
*304 KV 4353	329	407	4.8	3.3	133	M 757448DW -410-410D
*343 KV 4555	362	430	3.3	1.5	114	LM 761649DW -610-610D
*368 KV 5251	396	487	6.4	3.3	274	HM 265049D -010-010D
*384 KV 5452	417	510	6.4	3.3	309	HM 266449D -410-410D
*406 KV 5455	430	512	6.4	1.5	186	LM 767749DW -710-710D
*415 KV 5951	451	550	6.4	3.3	395	M 268749D -710-710D
*457 KV 5952	487	566	3.3	1.5	201	L 770849DW -810-810D
*479 KV 6751	520	635	6.4	3.3	595	M 272749DW -710-710D
*482 KV 6152	508	582	6.4	3.3	242	LM 272249DW -210-210D
500 KV 895	544	657	5	5	654	—
*509 KV 6551 *558 KV 7352 *571 KV 8151	536 588 622	619 697 755	6.4 6.4 6.4	1.5 3.3 3.3	312 457 1 020	LM 377449DW -410-410D M 278749DW -710-710D
*609 KV 7851 A	644	745	6.4	3.3	454	EE 649241DW -310-311D
635 KV 9001	695	840	5	4	1 380	—
*685 KV 8751	730	833	6.4	3.3	543	EE 655271DW -345-346D
*711 KV 9151	770	870	6.4	3.3	549	EE 755281DW -360-361D
*749 KV 9951	804	940	6.4	3.3	1 310	LM 283649DW -610-610D
*762 KV 1051	828	996	12.7	5	2 100	—
*840 KV 1151	910	1 095	7	7	2 900	
*939 KV 1351	1 035	1 245	12.7	4.8	4 380	LM 287849DW -810-810D

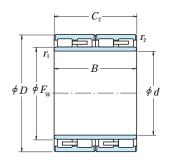
(*) Bearings marked * are inch design.

Remarks 1. For four-row tapered roller bearings not listed above, please contact NSK.

2. Four-row tapered roller bearings are designed for specific applications, when using them, please contact NSK.

B 338 B 339





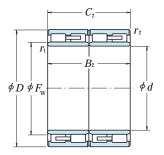


Figure 1

Figure 2

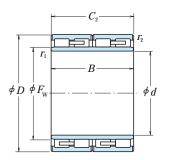
		Воц	undary D (mr	imensions n)			1)	Basic Load Rat N)	ings {kg	gf}
d	D	B, B ₂	C_2	$F_{ m w}$	$r_1 \atop ext{min.}$	r_{2} min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$
100	140	104	104	111	1.5	1.1	345 000	820 000	35 000	84 000
145	225	156	156	169	2	2	835 000	1 820 000	85 000	185 000
150	220 230	150 156	150 156	168 174	2 2	2 2	770 000 825 000	1 700 000 1 810 000	78 500 84 500	174 000 185 000
160	230 230	130 168	130 168	178 180	2 2	2 2	665 000 895 000	1 340 000 2 200 000	68 000 91 500	136 000 225 000
170	250	168	168	192	2.1	2.1	1 040 000	2 320 000	106 000	237 000
	255	180	180	193	2.1	2.1	1 130 000	2 500 000	115 000	255 000
180	250	156	156	200	2	2	880 000	2 230 000	89 500	227 000
	260	168	168	202	2.1	2.1	990 000	2 300 000	101 000	235 000
190	260	168	168	212	2	2	980 000	2 600 000	100 000	265 000
	270	200	200	212	2.1	2.1	1 260 000	3 100 000	128 000	315 000
200	280	200	200	224	2.1	2.1	1 210 000	3 200 000	123 000	325 000
	290	192	192	226	2.1	2.1	1 220 000	3 000 000	124 000	305 000
220	310	192	192	247	2.1	2.1	1 320 000	3 450 000	134 000	350 000
	310	225	225	245	2.1	2.1	1 500 000	3 900 000	153 000	395 000
	320	210	210	248	2.1	2.1	1 530 000	3 650 000	156 000	375 000
230	330	206	206	260	2.1	2.1	1 510 000	3 900 000	154 000	395 000
	340	260	260	261	3	3	2 050 000	5 100 000	209 000	520 000
240	330	220	220	270	3	3	1 520 000	4 400 000	155 000	445 000
250	350	220	220	278	3	3	1 660 000	4 200 000	169 000	430 000
260	370	220	220	292	3	3	1 760 000	4 450 000	179 000	455 000
	380	280	280	294	3	3	2 420 000	6 250 000	247 000	635 000
270	380	230	230	298	2.1	2.1	2 000 000	5 050 000	204 000	515 000
280	390	220	220	312	3	3	1 820 000	4 800 000	186 000	490 000
300	400 420	300 240	300 240	328 332	2 3	2 3	2 330 000 2 280 000	6 900 000 5 750 000	238 000 233 000	700 000 585 000
310	430	240	240	344.5	3	3	2 240 000	5 950 000	228 000	605 000
320	450	240	240	355	3	3	2 320 000	5 750 000	237 000	585 000
330	460	340	340	365	4	4	3 050 000	8 650 000	310 000	880 000

Bearing Numbers	Mass (kg)	Figures	Reference Bearing Numbers
100 RV 1401	4	2	_
145 RV 2201	23		313924A
150 RV 2201	20	1	
150 RV 2302	23	1	313891A
160 RV 2301	16	1	_
160 RV 2302	22	1	
170 RV 2501	27	1	_
170 RV 2503	31	1	
180 RV 2501	23	1	
180 RV 2601	29	1	313812
190 RV 2601	26	1	
190 RV 2701	36	1	314199В
200 RV 2801	38	1	
200 RV 2901	42	1	313811
220 RV 3101	46	1	_
220 RV 3102	52	1	_
220 RV 3201	56	1	_
230 RV 3301	58	1	313824
230 RV 3401	81	1	—
240 RV 3301	57	1	313921
250 RV 3501	64	1	—
260 RV 3701	76	1	313823
260 RV 3801	107	1	—
270 RV 3801	83	1	
280 RV 3901	80	1	313822
300 RV 4021	103	2	_
300 RV 4201	101	1	_
310 RV 4301	107	1	_
320 RV 4502	116	1	_
330 RV 4601	174	1	_

Remarks 1. For four-row cylindrical roller bearings not listed above, please contact NSK.

^{2.} Four-row cylindrical roller bearings are designed for specific applications, when using them, please contact NSK.





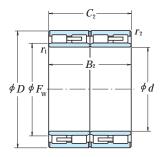
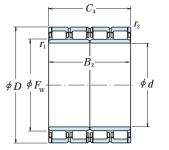


Figure 1

Figure 2



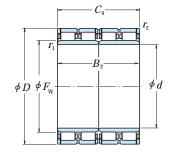


Figure 3

Figure 4

		Во		imensions				Basic Load		
			(mr	n)			(1	N)	{k	gf}
d	D	B, B ₂	C_2	$F_{ m w}$	$r_1 \atop ext{min.}$	$r_{ m 2}$ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$
370 380 390	540 540 550	400 400 400	400 400 400	415 424 434	4 5 5	4 5 5	4 500 000 4 300 000 4 400 000	12 000 000 12 000 000 12 400 000	440 000	1 230 000 1 220 000 1 260 000
400 430 440	560 591 620	410 420 450	410 420 450	445 476 490	5 4 4	2 4 4	5 600 000 4 450 000 6 350 000	16 500 000 13 400 000 19 000 000	455 000	1 680 000 1 370 000 1 940 000
450 460 480	630 670 680	450 500 500	450 500 500	500 522 534	4 6 5	4 6 5	5 950 000 7 650 000 7 700 000	17 500 000 22 700 000 23 100 000	780 000	1 780 000 2 320 000 2 360 000
500	690 700 720	510 515 530	510 515 530	552 554 560	5 5 6	5 5 6	7 750 000 7 800 000 8 550 000	24 600 000 23 800 000 25 300 000	800 000	2 500 000 2 430 000 2 580 000
520 530 570	735 780 815	535 570 594	535 570 594	574.5 601 628	5 6 6	5 6 6	8 900 000 10 100 000 11 700 000	26 300 000 29 200 000 33 500 000	910 000 1 030 000 1 190 000	
610 650 690	870 920 980	660 690 715	660 690 715	680 723 767.5	6 7.5 7.5	6 7.5 7.5	13 200 000 14 200 000 15 300 000	41 500 000 45 000 000 48 000 000	1 340 000 1 450 000 1 560 000	4 600 000
700	930 980	620 700	620 700	763 774	6	6 6	11 100 000 15 300 000	38 000 000 49 000 000	1 130 000 1 560 000	
725 760 800	1 000 1 080 1 080	700 805 750	700 790 750	796 845 880	6 6 6	6 6 6	15 600 000 19 000 000 16 000 000	51 000 000 61 000 000 56 500 000	1 590 000 1 940 000 1 630 000	6 200 000
820	1 160 1 100	840 745	840 720	911 892	7.5 6	7.5 3	21 900 000 16 900 000	71 500 000 58 500 000	2 230 000 1 720 000	
850	1 180	850	850	940	7.5	7.5	21 100 000	72 000 000	2 150 000	7 350 000
860	1 130 1 160	670 735	670 710	934 940	6 7.5	6 4	15 700 000 17 500 000	56 500 000 60 000 000	1 600 000 1 780 000	
900 920	1 230 1 280	895 865	870 850	985 1 015	7.5 7.5	7.5 7.5	22 100 000 24 000 000	76 000 000 80 000 000	2 250 000 2 450 000	

Remarks	1.	For four-row c	vlindrical roll	er bearings	not listed a	bove.	please contact NS	K.
Kemarks		TOT TOUT TOW C	yiii laricar rom	ci bearings	not nateu t	ibovc,	picase contact 145	1

^{2.} Four-row cylindrical roller bearings are designed for specific applications, when using them, please contact NSK.

Bearing Numbers	Mass (kg)	Figures	Reference Bearing Numbers
370 RV 5401	311	1	_
380 RV 5401	280	1(¹)	
390 RV 5521	303	2(1)	_
400 RV 5611	315	3	313015
430 RV 5921	347	2	—
440 RV 6221	430	2	—
450 RV 6321	440	2	_
460 RV 6721	596	2(¹)	_
480 RV 6811	610	3	_
500 RV 6921	580	2(1)	_
500 RV 7021	622	2(1)	_
500 RV 7211	782	3	_
520 RV 7331	750	4	_
530 RV 7811	960	3	_
570 RV 8111	960	3	_
610 RV 8711	1 330	3	_
650 RV 9211	1 520	3	_
690 RV 9831	1 790	4	_
700 RV 9311	1 200	3	_
700 RV 9821	1 720	2(¹)	_
725 RV 1011	1 670	3	_
760 RV 1032	2 430	4	_
800 RV 1032	2 050	4	_
820 RV 1121	2 900	2(¹)	_
820 RV 1132	2 000	4	_
850 RV 1111	2 850	3	_
860 RV 1132	1 780	4	_
860 RV 1133	2 200	4	_
900 RV 1211	3 200	3	_
920 RV 1211	3 510	3	_

Note (1) Oil holes and oil grooves are provided at the center of outer rings.

Axle Bearings Traction Motor Bearings Gear Unit Bearings

Railway Rolling Stock Bearings

Railway rolling stock bearings are important components of rolling stocks that require high reliability.

The main bearings consist of axle bearings that are mounted at both ends of axle and support the entire weight of the rolling stock. Additionally, there are railway traction motor bearings that are used for the motor that drives the axle; and gear unit bearings that transfer the power from the motor to the axle. NSK has designed and manufactured specific bearings for these very applications.

Types and Features

Axle Bearings

- Axle bearings consist of the following types of bearings to meet operator demands for high-speed capability of rolling stock, weight reductions, and minimal maintenance and inspection requirements:
 - > Cylindrical roller bearings with a thrust collar (oil bath lubrication, grease lubrication)
 - > Tapered roller bearings (oil bath lubrication)
 - > RCC Bearings (sealed-clean rotating end cap cylindrical roller bearings) (grease lubrication)
 - > RCT bearings (sealed-clean rotating end cap tapered roller bearings) (grease lubrication)
- NSK has been approved by AAR (Association of American Railroads).

Traction Motor Bearings

- Bearings for inverter controlled AC motors are speciality designed to meet high-speed specifications and requirements for ensuring dimensional stability. NSK recommends longlife grease for these bearings.
- NSK offers the following bearings as a measure against electric erosion, which occurs
 when electric current is allowed to flow through the motor bearings:
- > Ceramic-insulated bearings (ceramic-coated bearings) and PPS-insulated bearings
- High capacity bearings also available for locomotive-type large traction motors

Gear Unit Bearings

- These bearings are designed to meet high-speed specifications and offer excellent seizure resistance.
- · A reinforced cage has been adopted for these bearings.

Specified catalogs

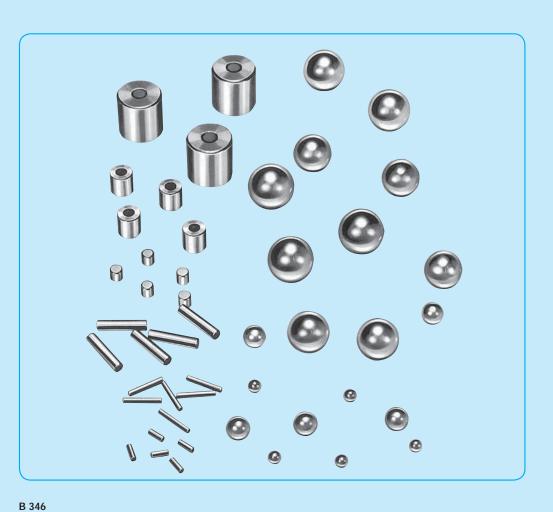
- Bearings for Railway Rolling Stock CAT. No. E1156
- Axle Bearings for Railway Rolling Stock (Cylindrical Roller Bearings) CAT. No. E1239
- Axle Bearings for Railway Rolling Stock (Spherical Roller Bearings) CAT. No. E1240
- Bearings for Traction Motors CAT. No. E1241

B 344 B 345

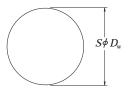


STEEL BALLS AND ROLLERS

STEEL BALLS FOR BALL BEARINGS	Nominal Diameter 0.3 – 114.3mm B34
CYLINDRICAL ROLLERS FOR ROLLER BEARINGS	Nominal Diameter 3 – 80mm····· B35
LONG CYLINDRICAL ROLLERS FOR ROLLER BEARINGS	Nominal Diameter 5.5 – 15mm····· B35
NEEDLE ROLLERS FOR ROLLER BEARINGS	Nominal Diameter 1 – 5mm B35







Nominal Size, Basic Diameters, and Mass

Nominal Size	Basic Diameter $D_{ m w}$ (mm)	Mass (kg) per 10000 pcs approx.	Nominal Size	Basic Diameter $D_{ m w}$ (mm)	Mass (kg) per 1000 pcs approx.	Nominal Size	Basic Diameter $D_{\rm w}$ (mm)	Mass (kg) per 10 pcs approx.
0.3 mm	0.30000	0.0011	3/8	9.52500	3.523	30 mm	30.00000	1.101
0.4 mm	0.40000	0.0026	10 mm	10.00000	4.076	1 ³ /16	30.16250	1.119
0.5 mm	0.50000	0.0051	13/32	10.31875	4.479	1 ¹ /4	31.75000	1.305
0.6 mm	0.60000	0.0088	11 mm	11.00000	5.425	32 mm	32.00000	1.336
0.025	0.63500	0.0104	7/16	11.11250	5.594	1 ⁵ /16	33.33750	1.510
0.7 mm	0.70000	0.0140	11.5 mm	11.50000	6.199	34 mm	34.00000	1.602
1/32	0.79375	0.0204	15/32	11.90625	6.880	1 ³ / ₈	34.92500	1.736
0.8 mm	0.80000	0.0209	12 mm	12.00000	7.044	35 mm	35.00000	1.748
1 mm	1.00000	0.0408	1/2	12.70000	8.350	36 mm	36.00000	1.902
3/64	1.19062	0.0688	13 mm	13.00000	8.955	1 ⁷ / ₁₆	36.51250	1.984
1.2 mm	1.20000	0.0704	17/32	13.49375	10.02	38 mm	38.00000	2.237
1.5 mm	1.50000	0.1376	14 mm	14.00000	11.19	1 ¹ / ₂	38.10000	2.254
1/16	1.58750	0.1631	9/16	14.28750	11.89	1 9/16	39.68750	2.548
5/64	1.98438	0.3185	15 mm	15.00000	13.76	40 mm	40.00000	2.609
2 mm	2.00000	0.3261	19/32	15.08125	13.98	1 5/8	41.27500	2.866
3/32	2.38125	0.5504	5/8	15.87500	16.31	1 ¹¹ / ₁₆	42.86250	3.210
2.5 mm	2.50000	0.6369	16 mm	16.00000	16.70	1 ³ / ₄	44.45000	3.580
7/64	2.77812	0.8740	21/32	16.66875	18.88	45 mm	45.00000	3.714
3 mm	3.00000	1.101	17 mm	17.00000	20.03	1 ¹³ /16	46.03750	3.977
1/8	3.17500	1.305	11/16	17.46250	21.71	1 ⁷ /8	47.62500	4.403
3.5 mm	3.50000	1.748	18 mm	18.00000	23.77	1 ¹⁵ /16	49.21250	4.858
9/64	3.57188	1.858	23/32	18.25625	24.80	50 mm	50.00000	5.095
5/32	3.96875	2.548	19 mm	19.00000	27.96	2	50.80000	5.344
4 mm	4.00000	2.609	3/4	19.05000	28.18	2 1/8	53.97500	6.410
4.5 mm	4.50000	3.714	25/32	19.84375	31.85	55 mm	55.00000	6.782
3/16	4.76250	4.403	20 mm	20.00000	32.61	2 1/4	57.15000	7.609
5 mm	5.00000	5.095	13/16	20.63750	35.83	60 mm	60.00000	8.805
5.5 mm	5.50000	6.782	21 mm	21.00000	37.75	2 3/8	60.32500	8.948
7/32	5.55625	7.016	27/32	21.43125	40.12	2 1/2	63.50000	10.44
15/64	5.95312	8.600	22 mm	22.00000	43.40	65 mm	65.00000	11.19
6 mm	6.00000	8.805	7/8	22.22500	44.75	2 ⁵ / ₈	66.67500	12.08
1/4	6.35000	10.44	23 mm	23.00000	49.60	2 ³ / ₄	69.85000	13.89
6.5 mm	6.50000	11.19	29/32	23.01875	49.72	2 ⁷ / ₈	73.02500	15.87
7 mm 9/32	6.74688 7.00000 7.14375	12.52 13.98 14.86	15/16 24 mm 31/32	23.81250 24.00000 24.60625	55.04 56.35 60.73	3 3 1/4 3 1/2	76.20000 82.55000 88.90000	18.04 22.93 28.64
7.5 mm 5/16 8 mm	7.50000 7.93750 8.00000	17.20 20.38 20.87	25 mm 1 26 mm	25.00000 25.40000 26.00000	63.69 66.80 71.64	3 ³ / ₄	95.25000 101.60000	35.23 42.75
8.5 mm 11/32 9 mm	8.50000 8.73125 9.00000	25.03 27.13 29.72	1 1/16 28 mm 1 1/8	26.98750 28.00000 28.57500	80.12 89.48 95.11			

Application, Nominal Size, Tolerances, Roughness, and Gauges

Units : µm

						•	
1		Tolerances(1)		Gauges			
Class	Variation in Dia. max.	Sphericity max.	Roughness R_a max.	Diameter Difference per Lot max.	Gauge Interval	Gauge	
G 3	0.08	0.08	0.010	0.13	0.5	- 5, ·····, - 0.5, 0, + 0.5, ·····, + 5	
G 5	0.13	0.13	0.014	0.25	1	- 5,, - 1 , 0, + 1 ,, + 5	
G 10	0.25	0.25	0.020	0.5	1	- 9,, - 1 , 0, + 1 ,, + 9	
G 16	0.4	0.4	0.025	0.8	2	-10,, - 2 , 0, + 2 ,, +10	
G 20	0.5	0.5	0.032	1	2	-10,, - 2 , 0, + 2 ,, +10	
G 24	0.6	0.6	0.040	1.2	2	-12, ·····, - 2 , 0, + 2 , ·····, +12	
G 28	0.7	0.7	0.050	1.4	2	-12, ·····, - 2 , 0, + 2 , ·····, +12	
G 40	1	1	0.060	2	4	-16, ·····, - 4 , 0, + 4 , ·····, +16	
G 60	1.5	1.5	0.080	3	6	-18, ·····, - 6 , 0, + 6 , ·····, +18	
G100	2.5	2.5	0.100	5	10	-40, ·····, -10 , 0, +10 , ·····, +40	
G200	5	5	0.150	10	15	–60, ······, –15 , 0, +15 , ······, +60	

Note (1) The values do not take into account surface defects; hence measurement shall be taken outside such defects.

Hardness

	Hardness			
Nominal Size	HV	HRC		
0.3 mm ~ 3 mm	772~900	(63~67)(1)		
1/8 ~ 30 mm	_	62~67		
1 3/16 ~ 4	_	61~67		

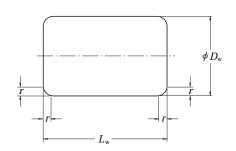
Note (1) Values in () are converted values for reference.

Remarks A column blue letter of Nominal Size is inch dimensions.



Tolerances for Cylindrical Roller Chamfers

Units: mm



	Units : mm
min.	max.
0.1 0.2 0.3 0.5 0.6 0.7 1 1.5 2	0.3 0.5 0.8 1.2 1.5 1.7 2.2(1) 3.5

Note (1) If $D_{\rm W}$ exceeds 40 mm, r (max.) is 2.7 mm.

U	n	its	:	mn
_		113		11111

Nominal Size	$D_{ m W}$	$L_{ m W}$	r min.	Mass (kg) per 100 pcs approx.
3 × 3	3	3	0.1	0.016
3 × 5		5	0.1	0.027
3.5× 5	3.5	5	0.2	0.037
4 × 4	4	4	0.2	0.039
4 × 6	4	6	0.2	0.058
4 × 8	4	8	0.2	0.078
4.5× 4.5	4.5	4.5	0.2	0.055
4.5× 6	4.5	6	0.2	0.073
5 × 5	5	5	0.2	0.075
5 × 8	5	8	0.2	0.121
5 ×10	5	10	0.2	0.152
5.5× 5.5	5.5	5.5	0.2	0.10
5.5× 8	5.5	8	0.2	0.146
6 × 6	6	6	0.2	0.13
6 × 8	6	8	0.2	0.178
6 ×12	6	12	0.2	0.261
6.5× 6.5	6.5	6.5	0.3	0.166
6.5× 9	6.5	9	0.3	0.23
7 × 7	7	7	0.3	0.206
7 ×10	7	10	0.3	0.296
7 ×14	7	14	0.3	0.415
7.5× 7.5	7.5	7.5	0.3	0.254
7.5×11	7.5	11	0.3	0.375
8 × 8	8	8	0.3	0.31
8 ×12	8	12	0.3	0.465
9 × 9	9	9	0.3	0.44
9 ×14	9	14	0.3	0.68
10 ×10	10	10	0.3	0.60
10 ×14	10	14	0.3	0.85
11 ×11	11	11	0.3	0.81
11 ×15	11	15	0.3	1.1
12 ×12	12	12	0.3	1.04
12 ×18	12	18	0.3	1.57

13 ×13 13 ×20

14 ×14 14 ×20

13 13

14 14

13 20

14 20

0.3 0.3

0.3 0.3

1.33 2.04

1.66 2.38

Nominal Size	D_{W}	$L_{ m W}$	r min.	Mass (kg) per 100 pcs approx.
15 × 15 15 × 22 16 × 16 16 × 24 17 × 17 17 × 24 18 × 18 18 × 26 19 × 19 19 × 28 20 × 20 20 × 30 21 × 21 21 × 30 22 × 22 22 × 34 23 × 23 23 × 34 24 × 24 24 × 26 25 × 25 26 × 40 28 × 28 28 × 28 28 × 24 24 × 36 25 × 25 26 × 36 26 × 36 30 × 30 30 × 48 32 × 32 32 × 32 33 × 34 40 × 40 40 × 65	15 15 16 16 17 17 18 18 19 20 20 21 21 22 23 23 24 24 25 26 26 28 28 30 30 32 32 34 34 36 36 38 38 40 40	15 22 16 24 17 24 18 26 19 28 20 30 21 30 22 34 23 34 24 36 25 36 40 28 44 30 48 32 55 36 55 36 55 36 56 40 40 48 57 57 57 57 58 58 58 58 58 58 58 58 58 58 58 58 58	0.5 0.5 0.5 0.5 0.5 0.5 0.6 0.6 0.6 0.6 0.6 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 1 1 1 1 1	2.04 3.0 2.48 3.75 2.97 4.2 3.55 5.1 4.16 6.1 4.85 7.3 5.6 8.0 6.4 10 7.4 11.2 8.4 11.2 8.4 10.7 10.7 10.7 16.4 13.3 21 16.3 22.9 32.5 23.9 32.5 23.9 33.5 33.5 33.5 33.5 33.5 33.5 33.5 3
- 1 0 / 03	70	0.5	'	0.5

1	ī	ni	ts	m	m

				OTHER THIN
Nominal Size	D_{W}	$L_{ m W}$	r min.	Mass (kg) per 100 pcs approx.
42 × 42	42	42	1	45
45 × 45	45	45	1	55.5
48 × 48	48	48	1	67
50 × 50	50	50	1	76
52 × 52	52	52	1.5	85
54 × 54	54	54	1.5	95.5
56 × 56	56	56	1.5	107
60 × 60	60	60	1.5	131
64 × 64	64	64	1.5	159
68 × 68	68	68	1.5	191
75 × 75	75	75	2	256
80 × 80	80	80	2	310

Accuracy of Cylindrical Rollers

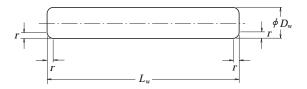
Units : μm

Class		w m)	Out-of- Roundness (1)	Single Plane Mean Roller Diameter Variation(2)	Lot Diameter Variation(1)	Length Deviation ⁽³⁾ $\Delta L_{ m Ws}$		heter $\Delta L_{ m ws}$ Length Deviation (1) Lot Length $\Delta L_{ m ws}$			End Face Runout
	over	incl.	ΔR max.	$V\!D_{ m Wmp}$ max.	$V\!D_{ m WL}$ max.	high	low ⁽⁴⁾	$VL_{ m WL}$ max.	$S_{ m W}$ max.		
1	3	18	0.5	0.8	1	+10	-[(IT9)-10]	5	3		
1A	3	30	0.7	1	1.5	+10	-[(IT9)-10]	7	5		
2	3	50	1	1.5	2	+10	-[(IT9)-10]	10	6		
2A	10	80	1.3	2	2.5	+10	-[(IT9)-10]	13	8		
3	18	80	1.5	3	3	+10	-[(IT9)-10]	15	10		
5	30	80	2.5	4	5	+10	-[(IT9)-10]	25	15		

- (¹) Applicable to roller center (length direction).
 (²) Applicable to cylindrical outside surface.
 (³) To find the IT9 standard tolerance according to the L_W size classification, refer to the IT9 column of the Appendix Table 11
- (4) The value for low of length deviation is subtracted 10 μm from the value of the standard tolerance for each roller length.

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Remarks The figure shows an example of a flat-end long cylindrical roller.

U	In	its	÷	mm

				Units : mm
Nominal Size	$D_{ m W}$	$L_{ m W}$	r (¹) min.	Mass (kg) per 100 pcs approx.
5.5×18	5.5	18	0.2	0.333
5.5×22.4	5.5	22.4	0.2	0.414
5.5×28	5.5	28	0.2	0.518
6 ×20 6 ×25 6 ×31.5 6 ×40 6 ×50	6 6 6 6	20 25 31.5 40 50	0.2 0.2 0.2 0.2 0.2 0.2	0.44 0.55 0.693 0.88 1.1
6.5×20	6.5	20	0.3	0.516
6.5×25	6.5	25	0.3	0.645
6.5×31.5	6.5	31.5	0.3	0.813
7 ×22.4	7	22.4	0.3	0.671
7 ×28	7	28	0.3	0.838
7 ×35.5	7	35.5	0.3	1.06
7 ×45	7	45	0.3	1.35
7 ×56	7	56	0.3	1.68
7.5×31.5	7.5	31.5	0.3	1.08
7.5×40	7.5	40	0.3	1.38

Nominal Size	$D_{ m W}$	$L_{ m W}$	<i>r</i> (¹) min.	Mass (kg) per 100 pcs approx.
8 ×25 8 ×31.5 8 ×40 8 ×50 8 ×63	0000000	25 31.5 40 50 63	0.3 0.3 0.3 0.3 0.3	0.978 1.23 1.56 1.96 2.46
9 ×28 9 ×35.5 9 ×45 9 ×56	9 9 9	28 35.5 45 56	0.3 0.3 0.3 0.3	1.39 1.76 2.23 2.77
10×31.5 10×40 10×50 10×63	10 10 10 10	31.5 40 50 63	0.3 0.3 0.3 0.3	1.93 2.44 3.06 3.85
12×40 12×50 12×63	12 12 12	40 50 63	0.3 0.3 0.3	3.52 4.4 5.54
15×45 15×56 15×71 15×90	15 15 15	45 56 71 90	0.5 0.5 0.5 0.5	6.16 7.68 9.74 12.4

Units: mm

(1) Only for flat-end rollers.

Tolerances for Long Cylindrical Roller Chamfers

	Units : mm
min.	max.
0.2 0.3 0.5	0.5 0.8 1.2

Accuracy of Long Cylindrical Rollers

Units: um

				- · · · · · · · · · · · · · · · · · · ·
Class	Out-of-Roundness (1)	Single Plane Mean Roller Diameter Variation ⁽³⁾ <i>VD</i> _{Wmp} max.	Roller Gauge Lot Diameter Variation $^{(1)}$ $VD_{ m WL}$ max.	Length Deviation(2) $ extstyle eta L_{ extstyle Ws}$
3	1.5	3	3	h12
5	2	5	5	h12

- $\begin{array}{ll} \text{(1)} & \text{Applicable to roller center (length direction).} \\ \text{(2)} & \text{Classified by L_{W}}. \text{ Refer to Tolerauce for Length Doviation.} \\ \text{(3)} & \text{Applicable to cylindrical outside surface.} \end{array}$

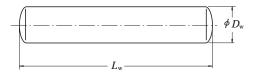
Tolerance for Length Deviation

Units: mm

Length		h12		h13	
over	incl.	high low		high	low
3	6	_		0	- 0.18
6	10	_		0	- 0.22
10	18		_		- 0.27
18	30	0	- 0.21	0	-0.33
30	50	0	- 0.25	0	-0.39
50	80	0 - 0.30			_
80	120	0	- 0.35	-	_

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Spherical-end Type

Units: mm

Units: mm

				Units : mm					Units : mm
Nominal Size	$D_{ m W}$	$L_{ m W}$	<i>r</i> (¹) min.	Mass (kg) per 1000 pcs approx.	Nominal Size	$D_{ m W}$	$L_{ m W}$	<i>r</i> (¹) min.	Mass (kg) per 1000 pcs approx.
1 × 5.8 1 × 6.8 1 × 7.8 1 × 7.8 1 × 9.8 1.5× 6.8 1.5× 1.8 1.5× 13.8 2 × 7.8 2 × 13.8 2 × 15.8 2 × 15.8 2 × 15.8 2 × 17.8 2 × 15.8 2 × 15.8 2 × 17.8 2 × 19.8 2 × 13.8 2 × 15.8 2 × 19.8 2 × 19.8 3 × 19.8 3 × 11.8 3 × 11.8 3 × 11.8 3 × 21.8 3 × 21.8	111111111222 222 22 22 22 22 22 22 22 23 23 33 33	5.88	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.035 0.0428 0.060 0.080 0.105 0.1360 0.190 0.190 0.190 0.240 0.290 0.335 0.435 0.435 0.435 0.435 0.435 0.455 0.6680 0.755 0.685 0.755 0.760 0.755 0.760 0.7	3.5×19.8 3.5×21.8 3.5×25.8 3.5×27.8 3.5×27.8 3.5×31.8 3.5×31.8 4 ×17.8 4 ×17.8 4 ×21.8 4 ×21.8 5 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 5 ×31.8 4 5×21.8 4 5×21.8 4 5×21.8 5 ×21.8 5 ×21.8	55 55 55 55 55 55 55 55 55 55 55 55 55	19.8 21.8 22.3 25.8 27.8 29.8 31.8 15.8 17.8 22.3 25.8 21.8 22.3 34.8 25.8 31.8 25.8 31.8 25.8 31.8 25.8 31.8 25.8 31.8 25.8 31.8 31.8 31.8 31.8 31.8 31.8 31.8 31	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	1.50 1.65 1.80 1.95 2.240 2.260 1.55 1.75 1.75 2.35 2.570 3.40 3.70 2.245 2.35 2.790 3.470 3.70 4.700 3.35 4.25 4.80 5.70 4.80 5.70 6.70 6.70 6.70 6.70 6.70 6.70 6.70 6

(1) Only for flat-end rollers.

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Remarks 1. The figure shows a spherical-end type and a flat-end type.

2. The radius R of the spherical-end type is bounded by the following range:

Minimum: $D_{\rm w}/2$ Maximum: $L_{\rm W}/2$



Flat-end Type

Tolerances for Needle Roller Chamfers

			0111101111111
L	W	г	r
over	incl.	min.	max.
_	1	0.1	0.4
1	3	0.1	0.6
3	5	0.1	0.9

Remarks Only for flat-end needle rollers.

Accuracy of Needle Rollers

Units: µm

Class	Single Plane Mean Roller Diameter Variation ⁽¹⁾ <i>VD</i> _{WP} max.	Out-of- Roundness (1) \$\(\Delta R \\ \max. \)	Roller Gauge Lot Diameter Variation ⁽¹⁾ <i>VD</i> _{WL} max.	Length Deviation $^{(2)}$
2	1	1	2	h13
3	1.5	1.5	3	h13
5	2	2.5	5	h13

Remarks The actual diameter at any place along the entire length should not exceed the following figures compared to the actual maximum diameter at the roller center (length direction).

> Class2: 0.5µm Class3: 0.8µm

Class5: 1.0µm



ACCESSORIES FOR ROLLING BEARINGS

ADAPTERS FOR ROLLING BEARINGS	Shaft Diameter 17 – 470mm·····	B358
WITHDRAWAL SLEEVES FOR ROLLING BEARINGS	Shaft Diameter 35 – 480mm·····	B36
NUTS FOR ROLLING BEARINGS		B37:
STOPPERS FOR ROLLING BEARI	NGS	B37
LOCK-WASHERS FOR ROLLING	BEARINGS	B378

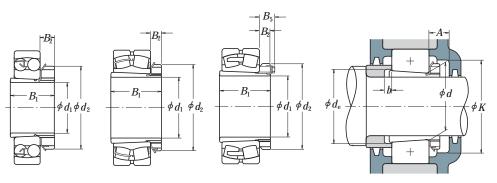


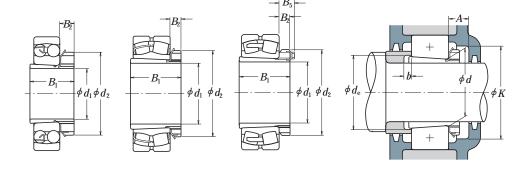
B 356 B 357

NSK

Shaft Diameter 45 – 60 mm

Shaft Diameter 17 – 40 mm





Shaft	Nominal Bearing			Dimens (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	(mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	A min.	<i>K</i> min.	$d_{ m e}$ min.	${\color{red} b}_{\text{min.}}$	approx.
17	20 20 20 20	1204K + H 204X 2204K + H 304X 1304K + H 304X 2304K + H2304X	24 28 28 31	32 32 32 32	7 7 7 7	_ _ _ _	A 204X A 304X A 304X A 2304X	14 14 14 14	39 39 39 39	23 24 24 24	5 5 8 5	0.045 0.045 0.045 0.050
20	25 25 25	1205K + H 205X 2205K + H 305X 1305K + H 305X	26 29 29	38 38 38	8 8 8		A 205X A 305X A 305X	15 15 15	45 45 45	28 29 29	5 5 6	0.065 0.075 0.075
	25 25	21305C DKE4 + H 305X 2305K + H2305X	29 35	38 38	8 8	_	A 305X A 2305X	15 15	45 45	29 29	6 5	0.075 0.090
25	30 30 30	1206K + H 206X 2206K + H 306X 1306K + H 306X	27 31 31	45 45 45	8 8 8	_	A 206X A 306X A 306X	15 15 15	50 50 50	33 34 34	5 5 6	0.10 0.11 0.11
	30 30	21306C DKE4 + H 306X 2306K + H2306X	31 38	45 45	8 8	_	A 306X A 2306X	15 15	50 50	34 35	6 5	0.11 0.125
30	35 35 35	1207K + H 207X 2207K + H 307X 1307K + H 307X	29 35 35	52 52 52	9 9 9	_	A 207X A 307X A 307X	17 17 17	58 58 58	38 39 39	5 5 7	0.125 0.145 0.145
	35 35	21307C DKE4 + H 307X 2307K + H2307X	35 43	52 52	9 9	_	A 307X A2307X	17 17	58 58	39 40	7 5	0.145 0.16
35	40 40 40	1208K + H 208X 2208K + H 308X 1308K + H 308X	31 36 36	58 58 58	10 10 10		A 208X A 308X A 308X	17 17 17	65 65 65	44 44 44	5 5 5	0.175 0.19 0.19
	40 40 40	21308E AKE4 + H 308X 2308K + H2308X 22308E AKE4 + H2308X	36 46 46	58 58 58	10 10 10		A 308X A 2308X A 2308X	17 17 17	65 65 65	44 45 45	5 5 5	0.19 0.225 0.225
40	45 45 45	1209K + H 209X 2209K + H 309X 1309K + H 309X	33 39 39	65 65 65	11 11 11	_ _ _	A 209X A 309X A 309X	17 17 17	72 72 72	49 49 49	5 8 5	0.225 0.26 0.26
	45 45 45	21309E AKE4 + H 309X 2309K + H2309X 22309E AKE4 + H2309X	39 50 50	65 65 65	11 11 11	_ _	A 309X A 2309X A 2309X	17 17 17	72 72 72	49 50 50	5 5 5	0.26 0.30 0.30

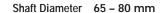
Shaft	Nominal Bearing			Dimens (mn			Adapter	Abut	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$A \atop ext{min.}$	<i>K</i> min.	$d_{\!$	$m{b}_{ ext{min.}}$	approx.
45	50 50 50	1210K + H 210X 2210K + H 310X 1310K + H 310X	35 42 42	70 70 70	12 12 12	_ _ _	A 210X A 310X A 310X	19 19 19	76 76 76	53 54 54	5 10 5	0.275 0.30 0.30
	50 50 50	21310E AKE4 + H 310X 2310K + H2310X 22310E AKE4 + H2310X	42 55 55	70 70 70	12 12 12		A 310X A 2310X A 2310X	19 19 19	76 76 76	54 56 56	5 5 5	0.30 0.35 0.35
50	55 55 55	1211K + H 211X 2211K + H 311X 22211E AKE4 + H 311X	37 45 45	75 75 75	12 12 12		A 211X A 311X A 311X	19 19 19	85 85 85	60 60 60	6 11 11	0.305 0.35 0.35
	55 55 55 55	1311K + H 311X 21311E AKE4 + H 311X 2311K + H2311X 22311E AKE4 + H2311X	45 45 59 59	75 75 75 75	12 12 12 12	_ _ _	A 311X A 311X A2311X A2311X	19 19 19 19	85 85 85 85	60 60 61 61	6 6 6	0.35 0.35 0.40 0.40
55	60 60 60	1212K + H 212X 2212K + H 312X 22212E AKE4 + H 312X	38 47 47	80 80 80	13 13 13		A 212X A 312X A 312X	20 20 20	90 90 90	64 65 65	5 9 9	0.365 0.40 0.40
	60 60 60	1312K + H 312X 21312E AKE4 + H 312X 2312K + H2312X 22312E AKE4 + H2312X	47 47 62 62	80 80 80 80	13 13 13 13	_ _ _	A 312X A 312X A2312X A2312X	20 20 20 20	90 90 90 90	65 65 66 66	5 5 5 5	0.40 0.40 0.45 0.45
60	65 65 65	1213K + H 213X 2213K + H 313X 22213E AKE4 + H 313X	40 50 50	85 85 85	14 14 14	_ _ _	A 213X A 313X A 313X	21 21 21	96 96 96	70 70 70	5 8 8	0.40 0.45 0.45
	65 65 65 65	1313K + H 313X 21313E AKE4 + H 313X 2313K + H2313X 22313E AKE4 + H2313X	50 50 65 65	85 85 85 85	14 14 14 14	_ _ _	A 313X A 313X A2313X A2313X	21 21 21 21	96 96 96 96	70 70 72 72	5 5 5 5	0.45 0.45 0.55 0.55
	70 70 70	22214E AKE4 + H 314X 21314E AKE4 + H 314X 22314E AKE4 + H2314X	52 52 68	92 92 92	14 14 14	_ _ _	A 314X A 314X A2314X	21 21 21	96 96 96	70 70 72	8 5 5	0.65 0.65 0.80

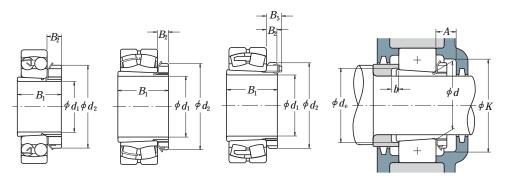
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

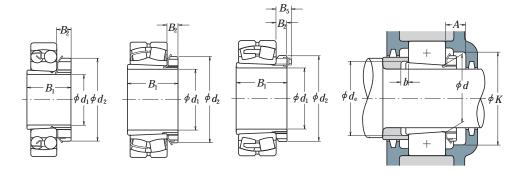
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

---- NSK

Shaft Diameter 85 – 115 mm







Shaft	Nominal Bearing			Dimens (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	(mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	A min.	<i>K</i> min.	$d_{ m e}$ min.	$m{b}_{ ext{min.}}$	арргох.
65	75 75 75	1215K + H 215X 2215K + H 315X 22215E AKE4 + H 315X	43 55 55	98 98 98	15 15 15	_ _ _	A 215X A 315X A 315X	23 23 23	110 110 110	80 80 80	5 12 12	0.70 0.85 0.85
	75 75 75 75	1315K + H 315X 21315E AKE4 + H 315X 2315K + H2315X 22315E AKE4 + H2315X	55 55 73 73	98 98 98 98	15 15 15 15		A 315X A 315X A 2315X A 2315X	23 23 23 23	110 110 110 110	80 80 82 82	5 5 5 5	0.85 0.85 1.05 1.05
70	80 80 80	1216K + H 216X 2216K + H 316X 22216E AKE4 + H 316X	46 59 59	105 105 105	17 17 17		A 216X A 316X A 316X	25 25 25	120 120 120	85 86 86	5 12 12	0.85 1.05 1.05
	80 80 80 80	1316K + H 316X 21316E AKE4 + H 316X 2316K + H2316X 22316E AKE4 + H2316X	59 59 78 78	105 105 105 105	17 17 17 17	_ _ _	A 316X A 316X A 2316X A 2316X	25 25 25 25 25	120 120 120 120	86 86 87 87	5 5 5 5	1.05 1.05 1.3 1.3
75	85 85 85	1217K + H 217X 2217K + H 317X 22217E AKE4 + H 317X	50 63 63	110 110 110	18 18 18		A 217X A 317X A 317X	27 27 27	128 128 128	90 91 91	6 12 12	1.0 1.2 1.2
	85 85 85 85	1317K + H 317X 21317E AKE4 + H 317X 2317K + H2317X 22317E AKE4 + H2317X	63 63 82 82	110 110 110 110	18 18 18 18	_ _ _	A 317X A 317X A 2317X A 2317X	27 27 27 27	128 128 128 128	91 91 94 94	6 6 6	1.2 1.2 1.45 1.45
80	90 90 90	1218K + H 218X 2218K + H 318X 22218E AKE4 + H 318X	52 65 65	120 120 120	18 18 18	 	A 218X A 318X A 318X	28 28 28	139 139 139	95 96 96	6 10 10	1.15 1.4 1.4
	90 90 90	1318K + H 318X 21318E AKE4 + H 318X 2318K + H2318X	65 65 86	120 120 120	18 18 18		A 318X A 318X A 2318X	28 28 28	139 139 139	96 96 99	6 6 6	1.4 1.4 1.7
	90 90	23218C KE4 + H2318X 22318E AKE4 + H2318X	86 86	120 120	18 18	_	A 2318X A 2318X	28 28	139 139	99 99	6 6	1.7 1.7

Shaft Diameter	Nominal Bearing Bore Dia.	Nominal Numbers		Dimen: (mr			Adapter Sleeve	Abu	tment D (m)		ons	Mass (kg)
(mm) d_1	(mm) d	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	$A \atop ext{min.}$	<i>K</i> min.	$d_{ m e}$ min.	$m{b}$ min.	approx.
85	95 95 95	1219K + H 219X 2219K + H 319X 22219E AKE4 + H 319X	55 68 68	125 125 125	19 19 19	_	A 219X A 319X A 319X	29 29 29	145 145 145	101 102 102	7 9 9	1.35 1.55 1.55
	95 95 95 95	1319K + H 319X 21319C KE4 + H 319X 2319K + H2319X 22319E AKE4 + H2319X	68 68 90 90	125 125 125 125	19 19 19 19	_ _ _	A 319X A 319X A2319X A2319X	29 29 29 29	145 145 145 145	102 102 105 105	7 7 7 7	1.55 1.55 1.9 1.9
90	100 100 100	1220K + H 220X 2220K + H 320X 22220E AKE4 + H 320X	58 71 71	130 130 130	20 20 20	_	A 220X A 320X A 320X	30 30 30	150 150 150	106 107 107	7 8 8	1.45 1.7 1.7
	100 100 100	1320K + H 320X 21320C KE4 + H 320X 2320K + H2320X	71 71 97	130 130 130	20 20 20	_	A 320X A 320X A 2320X	30 30 30	150 150 150	107 107 110	7 7 7	1.7 1.7 2.15
	100 100	23220C KE4 + H2320X 22320E AKE4 + H2320X	97 97	130 130	20 20	_	A 2320X A 2320X	30 30	150 150	110 110	7 7	2.15 2.15
100	110 110 110	23122C KE4 + H3122X 1222K + H 222X 2222K + H 322X	81 63 77	145 145 145	21 21 21	_	A 3122X A 222X A 322X	32 32 32	170 170 170	117 116 117	7 7 6	2.25 1.95 2.3
	110 110 110	22222E AKE4 + H 322X 1322K + H 322X 2322K + H2322X	77 77 105	145 145 145	21 21 21	_	A 322X A 322X A 2322X	32 32 32	170 170 170	117 117 121	6 9 7	2.3 2.3 2.75
	110 110	23222C KE4 + H2322X 22322E AKE4 + H2322X	105 105	145 145	21 21	_	A 2322X A 2322X	32 32	170 170	121 121	17 7	2.75 2.75
110	120 120 120	23024C DKE4 + H3024 23124C KE4 + H3124 22224E AKE4 + H3124	72 88 88	145 155 155	22 22 22		A 3024 A 3124 A 3124	33 33 33	180 180 180	127 128 128	7 7 11	1.95 2.65 2.65
	120 120	23224C KE4 + H2324 22324E AKE4 + H2324	112 112	155 155	22 22	=	A 2324 A 2324	33 33	180 180	131 131	17 7	3.2 3.2
115	130 130 130	23026C DKE4 + H3026 23126C KE4 + H3126 22226E AKE4 + H3126	80 92 92	155 165 165	23 23 23		A 3026 A 3126 A 3126	34 34 34	190 190 190	137 138 138	8 8 8	2.85 3.65 3.65
	130 130	23226C KE4 + H2326 22326C KE4 + H2326	121 121	165 165	23 23	_	A 2326 A 2326	34 34	190 190	142 142	21 8	4.6 4.6

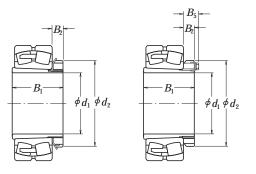
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

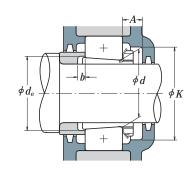
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

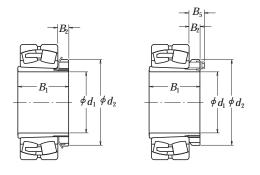
Shaft Diameter 180 – 260 mm

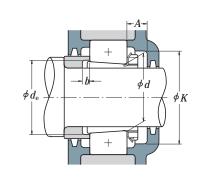
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Shaft Diameter 125 – 170 mm









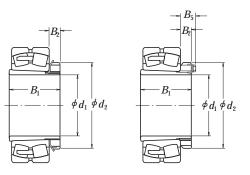
Shaft	Nominal Bearing	Newsteel November		Dimen: (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	(mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$A \atop ext{min.}$	<i>K</i> min.	$d_{ m e}$ min.	b min.	арргох.
125	140 140 140	23028C DKE4 + H3028 23128C KE4 + H3128 22228C DKE4 + H3128	82 97 97	165 180 180	24 24 24	_	A 3028 A 3128 A 3128	36 36 36	205 205 205	147 149 149	8 8 8	3.15 4.35 4.35
	140 140	23228C KE4 + H2328 22328C KE4 + H2328	131 131	180 180	24 24	_	A 2328 A 2328	36 36	205 205	152 152	22 8	5.55 5.55
135	150 150 150	23030C DKE4 + H3030 23130C KE4 + H3130 22230C DKE4 + H3130	87 111 111	180 195 195	26 26 26	_	A 3030 A 3130 A 3130	37 37 37	220 220 220	158 160 160	8 8 15	3.9 5.5 5.5
	150 150	23230C KE4 + H2330 22330C AKE4 + H2330	139 139	195 195	26 26	_	A 2330 A 2330	37 37	220 220	163 163	20 8	6.6 6.6
140	160 160 160	23932C AKE4 + H3932 23032C DKE4 + H3032 23132C KE4 + H3132	78 93 119	190 190 210	28 28 28	_	A 3932 A 3032 A 3132	39 39 39	205 230 230	168 168 170	8 8 8	4.64 5.2 7.65
	160 160 160	22232C DKE4 + H3132 23232C KE4 + H2332 22332C AKE4 + H2332	119 147 147	210 210 210	28 28 28	_	A 3132 A 2332 A 2332	39 39 39	230 230 230	170 174 174	14 18 8	7.65 9.15 9.15
150	170 170 170	23934B CAKE4 + H3934 23034C DKE4 + H3034 23134C KE4 + H3134	79 101 122	200 200 220	29 29 29	_	A 3934 A 3034 A 3134	40 40 40	215 250 250	179 179 180	8 8 8	5.07 6.0 8.4
	170 170 170	22234C DKE4 + H3134 23234C KE4 + H2334 22334C AKE4 + H2334	122 154 154	220 220 220	29 29 29		A 3134 A 2334 A 2334	40 40 40	250 250 250	180 185 185	10 18 8	8.4 10 10
160	180 180 180	23936C AKE4 + H3936 23036C DKE4 + H3036 23136C KE4 + H3136	87 109 131	210 210 230	30 30 30		A 3936 A 3036 A 3136	41 41 41	230 260 260	189 189 191	8 8 8	5.87 6.85 9.5
	180 180 180	22236C DKE4 + H3136 23236C KE4 + H2336 22336C AKE4 + H2336	131 161 161	230 230 230	30 30 30	_	A 3136 A 2336 A 2336	41 41 41	260 260 260	191 195 195	18 22 8	9.5 11.5 11.5
170	190 190 190	23938C AKE4 + H3938 23038C AKE4 + H3038 23138C KE4 + H3138	89 112 141	220 220 240	31 31 31	_	A 3938 A 3038 A 3138	43 43 43	240 270 270	199 199 202	9 9 9	6.35 7.45 11
	190 190 190	22238C AKE4 + H3138 23238C KE4 + H2338 22338C AKE4 + H2338	141 169 169	240 240 240	31 31 31	_ _ _	A 3138 A 2338 A 2338	43 43 43	270 270 270	202 206 206	21 21 9	11 12.5 12.5

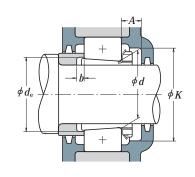
Shaft	Nominal Bearing	Name in al Number		Dimen: (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	(mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$A \atop ext{min.}$	K min.	$d_{\! m e}$ min.	$m{b}_{ ext{min.}}$	approx.
180	200 200 200	23940C AKE4 + H3940 23040C AKE4 + H3040 23140C KE4 + H3140	98 120 150	240 240 250	32 32 32	_	A 3940 A 3040 A 3140	46 46 46	260 280 280	210 210 212	10 10 10	8.0 9.2 12
	200 200 200	22240C AKE4 + H3140 23240C KE4 + H2340 22340C AKE4 + H2340	150 176 176	250 250 250	32 32 32		A 3140 A 2340 A 2340	46 46 46	280 280 280	212 216 216	24 20 10	12 14 14
200	220	23944C AKE4 + H3944	96	260	30	41	A 3944	55	280	231	10	8.32
	220	23044C AKE4 + H3044	128	260	30	41	A 3044	55	320	231	12	10.5
	220	23144C KE4 + H3144	158	280	32	44	A 3144	55	320	233	10	14.5
	220	22244C AKE4 + H3144	158	280	32	44	A 3144	55	320	233	22	14.5
	220	23244C KE4 + H2344	183	280	32	44	A 2344	55	320	236	11	16.5
	220	22344C AKE4 + H2344	183	280	32	44	A 2344	55	320	236	10	16.5
220	240	23948C AKE4 + H3948	101	290	34	46	A 3948	60	300	251	11	11.2
	240	23048C AKE4 + H3048	133	290	34	46	A 3048	60	340	251	11	13
	240	23148C KE4 + H3148	169	300	34	46	A 3148	60	340	254	11	17.5
	240	22248C AKE4 + H3148	169	300	34	46	A 3148	60	340	254	19	17.5
	240	23248C AKE4 + H2348	196	300	34	46	A 2348	60	340	257	6	19.5
	240	22348C AKE4 + H2348	196	300	34	46	A 2348	60	340	257	11	19.5
240	260	23952C AKE4 + H3952	116	310	34	46	A 3952	60	330	272	11	13.4
	260	23052C AKE4 + H3052	147	310	34	46	A 3052	60	370	272	13	15.5
	260	23152C AKE4 + H3152	187	330	36	49	A 3152	60	370	276	11	22
	260	22252C AKE4 + H3152	187	330	36	49	A 3152	60	370	276	25	22
	260	23252C AKE4 + H2352	208	330	36	49	A 2352	60	370	278	2	24
	260	22352C AKE4 + H2352	208	330	36	49	A 2352	60	370	278	11	24
260	280	23956C AKE4 + H3956	121	330	38	50	A 3956	65	350	292	12	15.5
	280	23056C AKE4 + H3056	152	330	38	50	A 3056	65	390	292	12	17.5
	280	23156C AKE4 + H3156	192	350	38	51	A 3156	65	390	296	12	24.5
	280	22256C AKE4 + H3156	192	350	38	51	A 3156	65	390	296	28	24.5
	280	23256C AKE4 + H2356	221	350	38	51	A 2356	65	390	299	11	28
	280	22356C AKE4 + H2356	221	350	38	51	A 2356	65	390	299	12	28

Shaft Diameter 430 – 470 mm

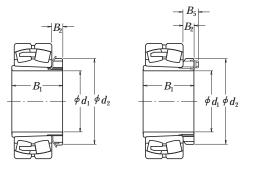
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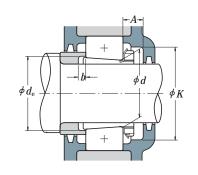
Shaft Diameter 280 – 410 mm





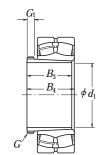
Shaft	Nominal Bearing	Novel of Novel on		Dimens (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$A \atop ext{min.}$	<i>K</i> min.	$d_{ m e}$ min.	b min.	approx.
280	300	23960C AKE4 + H3960	140	360	42	54	A 3960	69	380	313	12	20.7
	300	23060C AKE4 + H3060	168	360	42	54	A 3060	69	430	313	12	23
	300	23160C AKE4 + H3160	208	380	40	53	A 3160	69	430	317	12	30
	300	22260C AKE4 + H3160	208	380	40	53	A 3160	69	430	317	32	30
	300	23260C AKE4 + H3260	240	380	40	53	A 3260	69	430	321	12	34
300	320	23964C AKE4 + H3964	140	380	42	55	A 3964	72	400	334	13	21.8
	320	23064C AKE4 + H3064	171	380	42	55	A 3064	72	450	334	13	24.5
	320	23164C AKE4 + H3164	226	400	42	56	A 3164	72	450	339	13	35
	320	22264C AKE4 + H3164	226	400	42	56	A 3164	72	450	339	39	35
	320	23264C AKE4 + H3264	258	400	42	56	A 3264	72	450	343	13	39.5
320	340	23968C AKE4 + H3968	144	400	45	58	A 3968	75	430	354	14	24.6
	340	23068C AKE4 + H3068	187	400	45	58	A 3068	75	490	355	14	28.5
	340	23168C AKE4 + H3168	254	440	55	72	A 3168	75	490	360	14	49.5
	340	23268C AKE4 + H3268	288	440	55	72	A 3268	75	490	364	14	54.5
340	360	23972C AKE4 + H3972	144	420	45	58	A 3972	75	450	374	14	25.7
	360	23072C AKE4 + H3072	188	420	45	58	A 3072	75	510	375	14	30.5
	360	23172C AKE4 + H3172	259	460	58	75	A 3172	75	510	380	14	54
	360	23272C AKE4 + H3272	299	460	58	75	A 3272	75	510	385	14	60.5
360	380	23976C AKE4 + H3976	164	450	48	62	A 3976	82	480	396	15	31.9
	380	23076C AKE4 + H3076	193	450	48	62	A 3076	82	540	396	15	36
	380	23176C AKE4 + H3176	264	490	60	77	A 3176	82	540	401	15	61.5
	380	23276C AKE4 + H3276	310	490	60	77	A 3276	82	540	405	15	69.5
380	400	23980C AKE4 + H3980	168	470	52	66	A 3980	86	500	417	15	35.2
	400	23080C AKE4 + H3080	210	470	52	66	A 3080	86	580	417	15	41.5
	400	23180C AKE4 + H3180	272	520	62	82	A 3180	86	580	421	15	70.5
	400	23280C AKE4 + H3280	328	520	62	82	A 3280	86	580	427	15	81
400	420	23984C AKE4 + H3984	168	490	52	66	A 3984	86	520	437	16	36.6
	420	23084C AKE4 + H3084	212	490	52	66	A 3084	86	600	437	16	43.5
	420	23184C AKE4 + H3184	304	540	70	90	A 3184	86	600	443	16	84
	420	23284C AKE4 + H3284	352	540	70	90	A 3284	86	600	448	16	94
410	440	23988C AKE4 + H3988	189	520	60	77	A 3988	99	550	458	17	58.6
	440	23088C AKE4 + H3088	228	520	60	77	A 3088	99	620	458	17	65
	440	23188C AKE4 + H3188	307	560	70	90	A 3188	99	620	464	17	104
	440	23288C AKE4 + H3288	361	560	70	90	A 3288	99	620	469	17	118

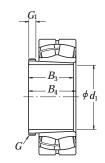




Shaft Diameter	Nominal Bearing Bore Dia	Nominal Numbers		Dimen: (mr			Adapter Sleeve	Abu	tment D (mr		ons	Mass (kg)
d_1	(mm) d	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	A min.	<i>K</i> min.	$d_{\! m e}$ min.	b min.	арргох.
430	460	23992C AKE4 + H3992	189	540	60	77	A 3992	99	570	478	17	62
	460	23092C AKE4 + H3092	234	540	60	77	A 3092	99	650	478	17	69.5
	460	23192C AKE4 + H3192	326	580	75	95	A 3192	99	650	485	17	116
	460	23292C AKE4 + H3292	382	580	75	95	A 3292	99	650	491	17	132
450	480	23996C AKE4 + H3996	200	560	60	77	A 3996	99	600	499	18	67.5
	480	23096C AKE4 + H3096	237	560	60	77	A 3096	99	690	499	18	73.5
	480	23196C AKE4 + H3196	335	620	75	95	A 3196	99	690	505	18	133
	480	23296C AKE4 + H3296	397	620	75	95	A 3296	99	690	512	18	152
470	500	239/500C AKE4 + H39/500	208	580	68	85	A 39/500	109	620	519	18	74.6
	500	230/500C AKE4 + H30/500	247	580	68	85	A 30/500	109	700	519	18	82
	500	231/500C AKE4 + H31/500	356	630	80	100	A 31/500	109	700	527	18	143
	500	232/500C AKE4 + H32/500	428	630	80	100	A 32/500	109	700	534	18	166

Shaft Diameter 35 – 85 mm Shaft Diameter 90 – 135 mm



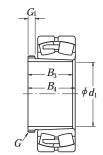


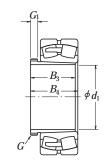
Shaft	Nominal Bearing	Naminal Number	Screw Thread	D	imensions (mm)	i	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	approx.
35 40	40 40 45 45	21308EAKE4 + AH 308 22308EAKE4 + AH 2308 21309EAKE4 + AH 309 22309EAKE4 + AH 2309	M 45 × 1.5 M 45 × 1.5 M 50 × 1.5 M 50 × 1.5	29 40 31 44	6 7 6 7	32 43 34 47	0.09 0.13 0.11 0.165
45	50	21310EAKE4 + AHX 310	M 55 × 2	35	7	38	0.16
	50	22310EAKE4 + AHX 2310	M 55 × 2	50	9	53	0.235
50	55	22211EAKE4 + AHX 311	M 60 × 2	37	7	40	0.19
	55	21311EAKE4 + AHX 311	M 60 × 2	37	7	40	0.19
	55	22311EAKE4 + AHX 2311	M 60 × 2	54	10	57	0.285
55	60	22212EAKE4 + AHX 312	M 65 × 2	40	8	43	0.215
	60	21312EAKE4 + AHX 312	M 65 × 2	40	8	43	0.215
	60	22312EAKE4 + AHX 2312	M 65 × 2	58	11	61	0.34
60	65	22213EAKE4 + AH 313	M 75 × 2	42	8	45	0.255
	65	21313EAKE4 + AH 313	M 75 × 2	42	8	45	0.255
	65	22313EAKE4 + AH 2313	M 75 × 2	61	12	64	0.395
65	70	22214EAKE4 + AH 314	M 80 × 2	43	8	47	0.28
	70	21314EAKE4 + AH 314	M 80 × 2	43	8	47	0.28
	70	22314EAKE4 + AHX 2314	M 80 × 2	64	12	68	0.53
70	75	22215EAKE4 + AH 315	M 85 × 2	45	8	49	0.315
	75	21315EAKE4 + AH 315	M 85 × 2	45	8	49	0.315
	75	22315EAKE4 + AHX 2315	M 85 × 2	68	12	72	0.605
75	80	22216EAKE4 + AH 316	M 90 × 2	48	8	52	0.365
	80	21316EAKE4 + AH 316	M 90 × 2	48	8	52	0.365
	80	22316EAKE4 + AHX 2316	M 90 × 2	71	12	75	0.665
80	85	22217EAKE4 + AHX 317	M 95 × 2	52	9	56	0.48
	85	21317EAKE4 + AHX 317	M 95 × 2	52	9	56	0.48
	85	22317EAKE4 + AHX 2317	M 95 × 2	74	13	78	0.745
85	90	22218E AKE4 + AHX 318	M 100 × 2	53	9	57	0.52
	90	21318E AKE4 + AHX 318	M 100 × 2	53	9	57	0.52
	90	23218C KE4 + AHX 3218	M 100 × 2	63	10	67	0.58
	90	22318E AKE4 + AHX 2318	M 100 × 2	79	14	83	0.845

Shaft	Nominal Bearing Bore Dia.	Nominal Numbers	Screw Thread	D	imensions (mm)	i	Mass (kg)
Diameter (mm) d_1	(mm) d	Applicable Bearings	G	B_3	G_1	B_4	approx.
90	95	22219EAKE4 + AHX 319	M 105 × 2	57	10	61	0.595
	95	21319CKE4 + AHX 319	M 105 × 2	57	10	61	0.595
	95	22319EAKE4 + AHX 2319	M 105 × 2	85	16	89	0.89
95	100	21320CKE4 + AHX 3120	M 110 × 2	64	11	68	0.70
	100	22220EAKE4 + AHX 320	M 110 × 2	59	10	63	0.66
	100	21320CKE4 + AHX 320	M 110 × 2	59	10	63	0.66
	100	23220CKE4 + AHX 3220	M 110 × 2	73	11	77	0.77
	100	22320EAKE4 + AHX 2320	M 110 × 2	90	16	94	1.0
105	110	23122CKE4 + AHX 3122	M 120 × 2	68	11	72	0.76
	110	22222EAKE4 + AHX 3122	M 120 × 2	68	11	72	0.76
	110	24122CK30E4 + AH 24122	M 115 × 2	82	13	91	0.73
	110	23222CKE4 + AHX 3222	M 125 × 2	82	11	86	1.04
	110	22322EAKE4 + AHX 2322	M 125 × 2	98	16	102	1.35
115	120	23024C DKE4 + AHX 3024	M 130 x 2	60	13	64	0.75
	120	24024C K30E4 + AH 24024	M 125 x 2	73	13	82	0.70
	120	23124C KE4 + AHX 3124	M 130 x 2	75	12	79	0.95
	120	22224E AKE4 + AHX 3124	M 130 × 2	75	12	79	0.95
	120	24124C K30E4 + AH 24124	M 130 × 2	93	13	102	1.02
	120	23224C KE4 + AHX 3224	M 135 × 2	90	13	94	1.3
	120	22324E AKE4 + AHX 2324	M 135 × 2	105	17	109	1.6
125	130	23026C DKE4 + AHX 3026	M 140 × 2	67	14	71	0.95
	130	24026C K30E4 + AH 24026	M 135 × 2	83	14	93	0.89
	130	23126C KE4 + AHX 3126	M 140 × 2	78	12	82	1.08
	130	22226EAKE4 + AHX 3126	M 140 × 2	78	12	82	1.08
	130	24126CK30E4 + AH 24126	M 140 × 2	94	14	104	1.14
	130	23226CKE4 + AHX 3226	M 145 × 2	98	15	102	1.58
	130	22326CKE4 + AHX 2326	M 145 × 2	115	19	119	1.97
135	140	23028C DKE4 + AHX 3028	M 150 × 2	68	14	73	1.01
	140	24028C K30E4 + AH 24028	M 145 × 2	83	14	93	0.96
	140	23128C KE4 + AHX 3128	M 150 × 2	83	14	88	1.28
	140	22228C DKE4 + AHX 3128	M 150 × 2	83	14	88	1.28
	140	24128C K30E4 + AH 24128	M 150 × 2	99	14	109	1.3
	140	23228C KE4 + AHX 3228	M 155 × 3	104	15	109	1.84
	140	22328C KE4 + AHX 2328	M 155 × 3	125	20	130	2.33

NSK

Shaft Diameter 145 – 180 mm



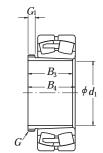


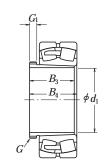
Shaft Diameter	Nominal Bearing Bore Dia.	Nominal Numbers	Screw Thread	D	imensions (mm)	5	Mass (kg)
(mm) d_1	(mm) d	Applicable Bearings	G	B_3	G_1	B_4	арргох.
145	150	23030C DKE4 + AHX 3030	M 160 × 3	72	15	77	1.15
	150	24030C K30E4 + AH 24030	M 155 × 3	90	15	101	1.11
	150	23130C KE4 + AHX 3130	M 165 × 3	96	15	101	1.79
	150	22230C DKE4 + AHX 3130	M 165 × 3	96	15	101	1.79
	150	24130C K30E4 + AH 24130	M 160 × 3	115	15	126	1.63
	150	23230C KE4 + AHX 3230	M 165 × 3	114	17	119	2.22
	150	22330C AKE4 + AHX 2330	M 165 × 3	135	24	140	2.82
150	160	23032C DKE4 + AH 3032	M 170 × 3	77	16	82	2.05
	160	24032C K30E4 + AH 24032	M 170 × 3	95	15	106	2.28
	160	23132C KE4 + AH 3132	M 180 × 3	103	16	108	3.2
	160	22232C DKE4 + AH 3132	M 180 × 3	103	16	108	3.2
	160	24132C K30E4 + AH 24132	M 170 × 3	124	15	135	3.03
	160	23232C KE4 + AH 3232	M 180 × 3	124	20	130	4.1
	160	22332C AKE4 + AH 2332	M 180 × 3	140	24	146	4.7
160	170	23034C DKE4 + AH 3034	M 180 × 3	85	17	90	2.45
	170	24034C K30E4 + AH 24034	M 180 × 3	106	16	117	2.74
	170	23134C KE4 + AH 3134	M 190 × 3	104	16	109	3.4
	170	22234C DKE4 + AH 3134	M 190 × 3	104	16	109	3.4
	170	24134C K30E4 + AH 24134	M 180 × 3	125	16	136	3.26
	170	23234C KE4 + AH 3234	M 190 × 3	134	24	140	4.8
	170	22334C AKE4 + AH 2334	M 190 × 3	146	24	152	5.25
170	180	23036C DKE4 + AH 3036	M 190 x 3	92	17	98	2.8
	180	24036C K30E4 + AH 24036	M 190 x 3	116	16	127	3.19
	180	23136C KE4 + AH 3136	M 200 x 3	116	19	122	4.2
	180	24136CK30E4 + AH 24136	M 190 × 3	134	16	145	3.74
	180	22236CDKE4 + AH 2236	M 200 × 3	105	17	110	3.75
	180	23236CKE4 + AH 3236	M 200 × 3	140	24	146	5.3
	180	22336CAKE4 + AH 2336	M 200 × 3	154	26	160	5.85
180	190	23038C AKE4 + AH 3038	Tr 205 × 4	96	18	102	3.35
	190	24038C K30E4 + AH 24038	M 200 × 3	118	18	131	3.47
	190	23138C KE4 + AH 3138	Tr 210 × 4	125	20	131	4.9
	190	24138CK30E4 + AH 24138	M 200 × 3	146	18	159	4.38
	190	22238CAKE4 + AH 2238	Tr 210 × 4	112	18	117	4.25
	190	23238CKE4 + AH 3238	Tr 210 × 4	145	25	152	5.9
	190	22338CAKE4 + AH 2338	Tr 210 × 4	160	26	167	6.65

Shaft Diameter	Nominal Bearing Bore Dia.	Nominal Numbers	Screw Thread	D	imensions (mm)	;	Mass (kg)
d_1	(mm) d	Applicable Bearings	G	B_3	G_1	B_4	арргох.
190	200	23040CAKE4 + AH 3040	Tr 215 × 4	102	19	108	3.8
	200	24040CK30E4 + AH 24040	Tr 210 × 4	127	18	140	3.92
	200	23140CKE4 + AH 3140	Tr 220 × 4	134	21	140	5.5
	200	24140CK30E4 + AH 24140	Tr 210 × 4	158	18	171	5.0
	200	22240CAKE4 + AH 2240	Tr 220 × 4	118	19	123	4.7
	200	23240CKE4 + AH 3240	Tr 220 × 4	153	25	160	6.7
	200	22340CAKE4 + AH 2340	Tr 220 × 4	170	30	177	7.55
200	220	23044CAKE4 + AH 3044	Tr 235 × 4	111	20	117	7.4
	220	24044CK30E4 + AH 24044	Tr 230 × 4	138	20	152	8.23
	220	23144CKE4 + AH 3144	Tr 240 × 4	145	23	151	10.5
	220 220 220 220	24144CK30E4 + AH 24144 22244CAKE4 + AH 2244 23244CKE4 + AH 2344 22344CAKE4 + AH 2344	Tr 230 × 4 Tr 240 × 4 Tr 240 × 4 Tr 240 × 4	170 130 181 181	20 20 30 30	184 136 189 189	10.3 9.1 13.5 13.5
220	240	23048C AKE4 + AH 3048	Tr 260 × 4	116	21	123	8.75
	240	24048C K30E4 + AH 24048	Tr 250 × 4	138	20	153	9.0
	240	23148C KE4 + AH 3148	Tr 260 × 4	154	25	161	12
	240 240 240 240	24148CK30E4 + AH 24148 22248CAKE4 + AH 2248 23248CAKE4 + AH 2348 22348CAKE4 + AH 2348	Tr 260 × 4 Tr 260 × 4 Tr 260 × 4 Tr 260 × 4	180 144 189 189	20 21 30 30	195 150 197 197	12.6 11 15.5 15.5
240	260	23052CAKE4 + AH 3052	Tr 280 × 4	128	23	135	10.5
	260	24052CAK30E4 + AH 24052	Tr 270 × 4	162	22	178	11.7
	260	23152CAKE4 + AH 3152	Tr 290 × 4	172	26	179	16
	260	24152C AK30E4 + AH 24152	Tr 280 × 4	202	22	218	15.5
	260	22252C AKE4 + AH 2252	Tr 290 × 4	155	23	161	14
	260	23252C AKE4 + AH 2352	Tr 290 × 4	205	30	213	19.5
	260	22352C AKE4 + AH 2352	Tr 290 × 4	205	30	213	19.5
260	280	23056C AKE4 + AH 3056	Tr 300 × 4	131	24	139	12
	280	24056C AK30E4 + AH 24056	Tr 290 × 4	162	22	179	12.6
	280	23156C AKE4 + AH 3156	Tr 310 × 5	175	28	183	17.5
	280	24156C AK30E4 + AH 24156	Tr 300 × 4	202	22	219	16.8
	280	22256C AKE4 + AH 2256	Tr 310 × 5	155	24	163	15
	280	23256C AKE4 + AH 2356	Tr 310 × 5	212	30	220	21.5
	280	22356C AKE4 + AH 2356	Tr 310 × 5	212	30	220	21.5

Shaft Diameter 400 – 480 mm

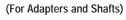
Shaft Diameter 280 – 380 mm

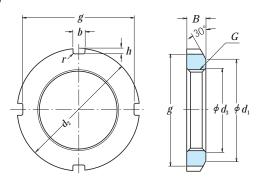




Shaft	Nominal Bearing		Screw Thread	D	imensions (mm)	5	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	арргох.
280	300	23060CAKE4 + AH 3060	Tr 320 × 5	145	26	153	14.5
	300	24060CAK30E4 + AH 24060	Tr 310 × 5	184	24	202	15.5
	300	23160CAKE4 + AH 3160	Tr 330 × 5	192	30	200	21
	300	24160C AK30E4 + AH 24160	Tr 320 × 5	224	24	242	20.3
	300	22260C AKE4 + AH 2260	Tr 330 × 5	170	26	178	18
	300	23260C AKE4 + AH 3260	Tr 330 × 5	228	34	236	20
300	320	23064C AKE4 + AH 3064	Tr 345 × 5	149	27	157	16
	320	24064C AK30E4 + AH 24064	Tr 330 × 5	184	24	202	16.4
	320	23164C AKE4 + AH 3164	Tr 350 × 5	209	31	217	24.5
	320	24164CAK30E4 + AH 24164	Tr 340 × 5	242	24	260	23.5
	320	23264CAKE4 + AH 3264	Tr 350 × 5	246	36	254	25
320	340	23068CAKE4 + AH 3068	Tr 365 × 5	162	28	171	19.5
	340	24068CAK30E4 + AH 24068	Tr 360 × 5	206	26	225	21.2
	340	23168CAKE4 + AH 3168	Tr 370 × 5	225	33	234	29
	340	24168CAK30E4 + AH 24168	Tr 360 × 5	269	26	288	28.3
	340	23268CAKE4 + AH 3268	Tr 370 × 5	264	38	273	35.5
340	360	23072CAKE4 + AH 3072	Tr 385 × 5	167	30	176	21
	360	24072CAK30E4 + AH 24072	Tr 380 × 5	206	26	226	22.5
	360	23172CAKE4 + AH 3172	Tr 400 × 5	229	35	238	33
	360	24172CAK30E4 + AH 24172	Tr 380 × 5	269	26	289	30
	360	23272CAKE4 + AH 3272	Tr 400 × 5	274	40	283	41.5
360	380	23076C AKE4 + AH 3076	Tr 410 × 5	170	31	180	23.5
	380	24076C AK30E4 + AH 24076	Tr 400 × 5	208	28	228	24.1
	380	23176C AKE4 + AH 3176	Tr 420 × 5	232	36	242	35.5
	380	24176CAK30E4 + AH 24176	Tr 400 × 5	271	28	291	32.1
	380	23276CAKE4 + AH 3276	Tr 420 × 5	284	42	294	45.5
380	400	23080CAKE4 + AH 3080	Tr 430 × 5	183	33	193	27.5
	400	24080CAK30E4 + AH 24080	Tr 420 × 5	228	28	248	28
	400	23180CAKE4 + AH 3180	Tr 440 × 5	240	38	250	39.5
	400	24180CAK30E4 + AH 24180	Tr 420 × 5	278	28	298	34.8
	400	23280CAKE4 + AH 3280	Tr 440 × 5	302	44	312	51.5

Shaft	Nominal Bearing		Screw Thread	Dimensions (mm)			Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	арргох.
400	420	23084CAKE4 + AH 3084	Tr 450 × 5	186	34	196	29
	420	24084CAK30E4 + AH 24084	Tr 440 × 5	230	30	252	29.8
	420	23184CAKE4 + AH 3184	Tr 460 × 5	266	40	276	46.5
	420	24184CAK30E4 + AH 24184	Tr 440 × 5	310	30	332	41.4
	420	23284CAKE4 + AH 3284	Tr 460 × 5	321	46	331	59
420	440	23088CAKE4 + AHX 3088	Tr 470 × 5	194	35	205	42
	440	24088CAK30E4 + AH 24088	Tr 460 × 5	242	30	264	33
	440	23188CAKE4 + AHX 3188	Tr 480 × 5	270	42	281	50
	440	24188CAK30E4 + AH 24188	Tr 460 × 5	310	30	332	43.5
	440	23288CAKE4 + AHX 3288	Tr 480 × 5	330	48	341	64
440	460	23092C AKE4 + AHX 3092	Tr 490 × 5	202	37	213	46
	460	24092C AK30E4 + AH 24092	Tr 480 × 5	250	32	273	35.9
	460	23192C AKE4 + AHX 3192	Tr 510 × 6	285	43	296	58
	460	24192CAK30E4 + AH 24192	Tr 480 × 5	332	32	355	49.7
	460	23292CAKE4 + AHX 3292	Tr 510 × 6	349	50	360	74.5
460	480	23096CAKE4 + AHX 3096	Tr 520 × 6	205	38	217	51
	480	24096CAK30E4 + AH 24096	Tr 500 × 5	250	32	273	37.5
	480	23196CAKE4 + AHX 3196	Tr 530 × 6	295	45	307	63
	480	24196C AK30E4 + AH 24196	Tr 500 × 5	340	32	363	53
	480	23296C AKE4 + AHX 3296	Tr 530 × 6	364	52	376	82
480	500	230/500CAKE4 + AHX 30/500	Tr 540 × 6	209	40	221	54.5
	500	240/500CAK30E4 + AH 240/500	Tr 530 × 6	253	35	276	41.9
	500	231/500CAKE4 + AHX 31/500	Tr 550 × 6	313	47	325	71
	500	241/500C AK30E4 + AH 241/500	Tr 530 × 6	360	35	383	61.2
	500	232/500C AKE4 + AHX 32/500	Tr 550 × 6	393	54	405	94.5





Nut with Washer

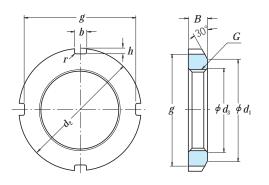
III VVASIICI	
	Units : mm

						Reference									
	ominal umbers	Screw Thread		d_2	d_1	g B	asic Di	mensio <i>h</i>	ns d_3	В	r max.	Mass (kg) approx.	Adapter (¹) Sleeve Bore Dia. Numbers	Washer Numbers	Shaft Dia.
F	AN 02 AN 03 AN 04	M 15×1 M 17×1 M 20×1	2	!5 !8 !2	21 24 26	21 24 28	4 4 4	2 2 2	15.5 17.5 20.5	5 5 6	0.4 0.4 0.4	0.010 0.013 0.019	_ _ 04	AW 02 X AW 03 X AW 04 X	15 17 20
F	AN 05 AN 06 AN 07	M 25×1.5 M 30×1.5 M 35×1.5	1	18 5 5 2	32 38 44	34 41 48	5 5 5	2 2 2	25.8 30.8 35.8	7 7 8	0.4 0.4 0.4	0.025 0.043 0.053	05 06 07	AW 05 X AW 06 X AW 07 X	25 30 35
F	AN 08 AN 09 AN 10	M 40×1.5 M 45×1.5 M 50×1.5	1 6	18 15 10	50 56 61	53 60 65	6 6 6	2.5 2.5 2.5	40.8 45.8 50.8	9 10 11	0.5 0.5 0.5	0.085 0.119 0.148	08 09 10	AW 08 X AW 09 X AW 10 X	40 45 50
F	AN 11 AN 12 AN 13	M 55×2 M 60×2 M 65×2	8	5 80 85	67 73 79	69 74 79	7 7 7	3 3 3	56 61 66	11 11 12	0.5 0.5 0.5	0.158 0.174 0.203	11 12 13	AW 11 X AW 12 X AW 13 X	55 60 65
F	AN 14 AN 15 AN 16	M 70×2 M 75×2 M 80×2)2)8)5	85 90 95	85 91 98	8 8 8	3.5 3.5 3.5	71 76 81	12 13 15	0.5 0.5 0.6	0.242 0.287 0.395	14 15 16	AW 14 X AW 15 X AW 16 X	70 75 80
F	AN 17 AN 18 AN 19	M 85×2 M 90×2 M 95×2	11 12 12	0	102 108 113	103 112 117	8 10 10	3.5 4 4	86 91 96	16 16 17	0.6 0.6 0.6	0.45 0.555 0.66	17 18 19	AW 17 X AW 18 X AW 19 X	85 90 95
F	AN 20 AN 21 AN 22	M 100×2 M 105×2 M 110×2	13 14 14	0	120 126 133	122 130 135	10 12 12	4 5 5	101 106 111	18 18 19	0.6 0.7 0.7	0.70 0.845 0.965	20 21 22	AW 20 X AW 21 X AW 22 X	100 105 110
F	AN 23 AN 24 AN 25	M 115×2 M 120×2 M 125×2	15 15 16	5	137 138 148	140 145 150	12 12 12	5 5 5	116 121 126	19 20 21	0.7 0.7 0.7	1.01 1.08 1.19	 24 	AW 23 AW 24 AW 25	115 120 125

Note (1) Applicable to adapter sleeve Series A31, A2, A3, and A23.

Remarks The basic design and dimensions of screw threads are in accordance with JIS B 0205.





Nut with Washer

Units: mm

						Reference							
Nominal Numbers	Screw Threads $oldsymbol{G}$	$d_{\scriptscriptstyle 2}$	$d_{\scriptscriptstyle 1}$	в g	asic Di b	mensio <i>h</i>	ns $oldsymbol{d}_3$	В	r max.	Mass (kg) approx.	Adapter (¹) Sleeve Bore Dia. Numbers	Washer Numbers	Shaft Dia.
AN 26	M 130×2	165	149	155	12	5	131	21	0.7	1.25	26	AW 26	130
AN 27	M 135×2	175	160	163	14	6	136	22	0.7	1.55	—	AW 27	135
AN 28	M 140×2	180	160	168	14	6	141	22	0.7	1.56	28	AW 28	140
AN 29 AN 30 AN 31	M 145×2 M 150×2 M 155×3	190 195 200	172 171 182	178 183 186	14 14 16	6 6 7	146 151 156.5	24 24 25	0.7 0.7 0.7	2.0 2.03 2.21	30	AW 29 AW 30	145 150 —
AN 32 AN 33 AN 34	M 160×3 M 165×3 M 170×3	210 210 220	182 193 193	196 196 206	16 16 16	7 7 7	161.5 166.5 171.5	25 26 26	0.7 0.7 0.7	2.59 2.43 2.8	32 — 34	AW 32 AW 34	160 — 170
AN 36	M 180×3	230	203	214	18	8	181.5	27	0.7	3.05	36	AW 36	180
AN 38	M 190×3	240	214	224	18	8	191.5	28	0.7	3.4	38	AW 38	190
AN 40	M 200×3	250	226	234	18	8	201.5	29	0.7	3.7	40	AW 40	200
				Nut S	Series <i>i</i>	ANL							
ANL 24	M 120×2	145	133	135	12	5	121	20	0.7	0.78	24	AWL 24	120
ANL 26	M 130×2	155	143	145	12	5	131	21	0.7	0.88	26	AWL 26	130
ANL 28	M 140×2	165	151	153	14	6	141	22	0.7	0.99	28	AWL 28	140
ANL 30	M 150×2	180	164	168	14	6	151	24	0.7	1.38	30	AWL 30	150
ANL 32	M 160×3	190	174	176	16	7	161.5	25	0.7	1.56	32	AWL 32	160
ANL 34	M 170×3	200	184	186	16	7	171.5	26	0.7	1.72	34	AWL 34	170
ANL 36	M 180×3	210	192	194	18	8	181.5	27	0.7	1.95	36	AWL 36	180
ANL 38	M 190×3	220	202	204	18	8	191.5	28	0.7	2.08	38	AWL 38	190
ANL 40	M 200×3	240	218	224	18	8	201.5	29	0.7	2.98	40	AWL 40	200

Note (1) Series AN is applicable to adapter sleeve Series A31 and A23.

Series ANL is applicable to adapter sleeve Series A30.

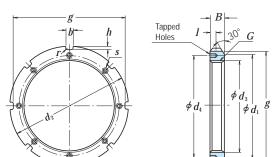
Remarks The basic design and dimensions of screw threads are in accordance with **JIS B 0205**.

B 372 B 373 (For Adapters and Shafts)

ANL 76 Tr 380×5

ANL 80 Tr 400×5

ANL 84 Tr 420×5



Nut with Stopper

Nut Series AN Reference Nominal Screw Basic Dimensions Mass Adapter (1) Stopper Shaft Numbers Threads Tapped Holes Sleeve Bore (kg) b В d_2 d_1 h Numbers Dia. d_4 Dia. Numbers 1 Screw Threads (S) max. approx. 280 250 260 20 10 222 300 270 280 20 10 242 32 0.8 15 M 8×1.25 238 34 0.8 15 M 8×1.25 258 AL 44 220 **AL 44** 240 **AN 48** Tr 240×4 48 5.95 **AN 52** Tr 260×4 330 300 306 24 12 262 36 0.8 18 M 10×1.5 281 8.05 52 **AL 52** 260 **56** Tr 280×4 350 320 326 24 12 282 **60** Tr 300×4 380 340 356 24 12 302 18 M 10×1.5 **AN 56** Tr 280×4 38 0.8 **AL 52** 280 40 0.8 18 M 10×1.5 AL 60 300 60 64 Tr 320×5 | 400 360 376 24 12 322.5 42 0.8 | 18 M 10×1.5 345 | 13.1 **AL 64** 320 **AN 68** Tr 340×5 440 400 410 28 15 342.5 55 1 21 M 12×1.75 372 23.1 **AL 68** 340 **72** Tr 360×5 460 420 430 28 15 362.5 58 1 **76** Tr 380×5 490 450 454 32 18 382.5 60 1 21 M 12×1.75 392 25.1 72 **AL 68** 360 **AL 76** 380 21 M 12×1.75 414 31 520 470 484 32 18 402.5 62 1 540 490 504 32 18 422.5 70 1 560 510 520 36 20 442.5 70 1 **AN 80** Tr 400×5 27 M 16×2 439 37 80 **AL 80** 400 **84** Tr 420×5 27 M 16×2 459 43.5 AL 80 420 84 **88** Tr 440×5 1 27 M 16×2 477 | 45 88 **AL 88** 440 **AN 92** Tr 460×5 580 540 540 36 20 462.5 75 1 **AN 96** Tr 480×5 620 560 580 36 20 482.5 75 1 27 M 16×2 27 M 16×2 497 50.5 **AL 88** 460 527 62 **AL 96** 480 96 **AN 100** Tr 500×5 630 580 584 40 23 502.5 80 1 27 M 16×2 /500 539 63.5 **AL 100** 500 Nut Series ANL **ANL 44** Tr 220×4 260 242 242 20 222 0.8 12 M **ALL 44** 220 ANL 48 Tr 240×4 290 270 270 20 10 242 34 0.8 15 M 8×1.25 253 5 15 48 **ALL 48** 240 **ANL 52** Tr 260×4 310 290 290 20 10 262 34 0.8 15 M 8×1.25 273 5.65 52 **ALL 48** 260 ANL 56 Tr 280×4 330 310 310 24 10 282 38 0.8 15 M 8×1.25 293 **ALL 56** 280 **ANL 60** Tr 300×4 360 336 336 24 12 302 42 0.8 15 M 8×1.25 316 380 356 356 24 12 322.5 42 0.8 15 M 8×1.25 335 **ALL 60** 300 **ANL 64** Tr 320×5 9.95 64 ALL 64 320 400 376 376 24 12 342.5 45 1 **ANL 68** Tr 340×5 15 M 8×1.25 355 11.7 68 **ALL 64** 340 **ANL 72** Tr 360×5 420 394 394 28 13 362.5 45 450 422 422 28 14 382.5 48 15 M 8×1.25 374 **ALL 72** 360

(1) Series AN is applicable to adapter sleeve Series A31, A32 and A23. Series ANL is applicable to adapter sleeve Series A30.

18 M 10×1.5 398 14.9

18 M 10×1.5 438 17.4

21 M 12×1.75 462 26.2 21 M 12×1.75 482 28

21 M 12×1.75 522 33.5

21 M 12×1.75 502

18 M 10×1.5

76

80

84

88

92

ALL 76 380

ALL 76 400

ALL 84 420

ALL 88 440

ALL 88 460

ALL 96 480

ALL 96 500

Remarks 1. The basic design and dimensions of screw threads are in accordance with JIS B 0216.

470 442 442 28 14 402.5 52 1

490 462 462 32 14 422.5 52 1

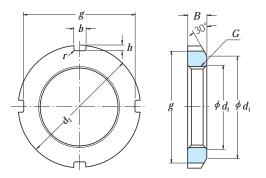
ANL 88 Tr 440×5 520 490 490 32 15 442.5 60 1 **ANL 92** Tr 460×5 540 510 510 32 15 462.5 60 1

 ANL 96
 Tr 480×5
 560
 530
 530
 36
 15
 482.5
 60
 1

 ANL 100
 Tr 500×5
 580
 550
 550
 36
 15
 502.5
 68
 1

2. The basic design and dimensions of threads in tapped holes are in accordance with JIS B 0205.

(For Withdrawal Sleeves)



NSK

												l	Jnits : mm		
					Nut	Serie	s HN						Refer	ence	
	Nominal Numbers	Screw			Bas	ic Dir	mens	ions			Mass	w	ithdrawal Sle	eeve Numbers	
	Number 5	Threads $\it G$	d_2	d_1	g	b	h	d_3	В	r max.	(kg) approx.	AH 31	AH 22	AH 32	AH 23
	HN 42 HN 44 HN 48	Tr 210×4 Tr 220×4 Tr 240×4	270 280 300		250 260 280		10 10 10	212 222 242	30 32 34	0.8 0.8 0.8	4.75 5.35 6.2	AH 3138 AH 3140 AH 3144	AH 2238 AH 2240 AH 2244	AH 3238 AH 3240	AH 2338 AH 2340 AH 2344
	HN 52 HN 58 HN 62	Tr 260×4 Tr 290×4 Tr 310×5	330 370 390	350	346 366	24 24	12	262 292 312.5	36 40 42	0.8 0.8 0.8	8.55 11.8 13.4	AH 3148 AH 3152 AH 3156	AH 2248 AH 2252 AH 2256	_ _	AH 2348 AH 2352 AH 2356
	HN 66 HN 70 HN 74	Tr 330×5 Tr 350×5 Tr 370×5	420 450 470	410 430		28 28	15 15 15	332.5 352.5 372.5	52 55 58	1 1 1	20.4 25.2 28.2	AH 3160 AH 3164 AH 3168	AH 2260 AH 2264	AH 3260 AH 3264 AH 3268	_ _ _
	HN 80 HN 84 HN 88	Tr 400×5 Tr 420×5 Tr 440×5	520 540 560	490 510	484 504 520	32 36	18 18 20	402.5 422.5 442.5	62 70 70	1 1 1	40 46.9 48.5	AH 3172 AH 3176 AH 3180		AH 3272 AH 3276 AH 3280	_ _ _
	HN 92 HN 96 HN 102	Tr 460×5 Tr 480×5 Tr 510×6	580 620 650	560 590		36 40	20 20 23	462.5 482.5 513	75 75 80	1 1 1	55 67 75	AH 3184 AHX 3188 AHX 3192		AH 3284 AHX 3288 AHX 3292	_ _ _
	HN 106 HN 110	Tr 530×6 Tr 550×6	670 700		624 654		23 23	533 553	80 80	1 1	78 92.5	AHX 3196 AHX 31/500	_	AHX 3296 AHX 32/500	_
Ī					Nut S	Series	s HNI	_				AH 30	AH 2		
	HNL 41 HNL 43 HNL 47		250 260 280	242	234 242 262	20	8 9 9	207 217 237	30 30 34	0.8 0.8 0.8	3.45 3.7 4.6	AH 3038 AH 3040 AH 3044	AH 238 AH 240 AH 244		
	HNL 52 HNL 56 HNL 60	Tr 280×4 Tr 300×4	310 330 360	310 336	290 310 336	24 24	10 10 12	262 282 302	34 38 42	0.8 0.8 0.8	5.8 6.7 9.6	AH 3048 AH 3052 AH 3056	AH 248 AH 252 AH 256		
	HNL 64 HNL 69 HNL 73		380 410 430	384 404	356 384 404	28 28	12 13 13	322.5 347.5 367.5	42 45 48	1 1 1	10.3 11.5 14.2	AH 3060 AH 3064 AH 3068	_ _ _		
	HNL 77 HNL 82 HNL 86	Tr 430×5	450 480 500	452 472	422 452 472	32 32	14 14 14	387.5 412.5 432.5	48 52 52	1 1 1	15 19 19.8	AH 3072 AH 3076 AH 3080	_ _ _		
		Tr 470×5 Tr 490×5	520 540 580	510 550	490 510 550	32 36	15 15 15	452.5 472.5 492.5	60 60	1 1 1	23.8 25 34	AH 3084 AHX 3088 AHX 3092			
	HNL 104 HNL 108	Tr 520×6 Tr 540×6	600 630		570 590	36 40	15 20	523 543	68 68	1 1	37 43.5	AHX 3096 AHX 30/500	_		

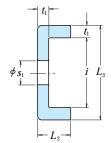
Remarks 1. The basic design and dimensions of screw threads are in accordance with JIS B 0216

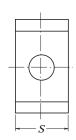
2. The number of notches in the nut may be bigger than that shown in the above figure

B 374 B 375

Units: mm

(Combination of Withdrawal Sleeves and Nuts)

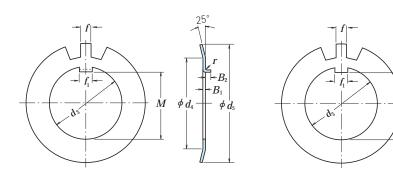




								Units : mm
				Stopper S	eries AL			Reference
Nominal Numbers	t_1	S	Basic L_2	Dimensions S_1	i	L3	Mass (kg) per 100 pcs approx.	Nut Numbers
AL 44 AL 52 AL 60	4 4 4 4	20 24 24	12 12 12 12	9 12 12	22.5 25.5 30.5	30.5 33.5 38.5	2.6 3.4 3.8	AN 44, AN 48 AN 52, AN 56 AN 60
AL 64	5	24	15	12	31	41	5.35	AN 64
AL 68	5	28	15	14	38	48	6.65	AN 68, AN 72
AL 76	5	32	15	14	40	50	7.95	AN 76
AL 80	5	32	15	18	45	55	8.2	AN 80, AN 84
AL 88	5	36	15	18	43	53	9.0	AN 88, AN 92
AL 96	5	36	15	18	53	63	10.4	AN 96
AL 100	5	40	15	18	45	55	10.5	AN 100
				Stopper Se	ries ALL			
ALL 44	4	20	12	7	13.5	21.5	2.12	ANL 44
ALL 48	4	20	12	9	17.5	25.5	2.29	ANL 48, ANL 52
ALL 56	4	24	12	9	17.5	25.5	2.92	ANL 56
ALL 60	4	24	12	9	20.5	28.5	3.15	ANL 60
ALL 64	5	24	15	9	21	31	4.55	ANL 64, ANL 68
ALL 72	5	28	15	9	20	30	5.05	ANL 72
ALL 76	5	28	15	12	24	34	5.3	ANL 76, ANL 80
ALL 84	5	32	15	12	24	34	6.1	ANL 84
ALL 88	5	32	15	14	28	38	6.45	ANL 88, ANL 92
ALL 96	5	36	15	14	28	38	7.3	ANL 96, ANL 100

				Reference			
Nominal Numbers			Witho	drawal Sleeve Nu	mbers		
	AH 30	AH 31	AH 2	AH 22	AH 32	AH 3	AH 23
AN 09 AN 10 AN 11	_ _ _	_ _ _	AH 208 AH 209 AH 210	_ _ _	_ _ _	AH 308 AH 309 AHX 310	AH 2308 AH 2309 AHX 2310
AN 12 AN 13 AN 14	_ _ _	_ _ _	AH 211 AH 212 —	_ _ _	_ _ _	AHX 311 AHX 312	AHX 2311 AHX 2312
AN 15 AN 16 AN 17	_ _ _	_ _ _	AH 213 AH 214 AH 215	_ _ _	_ _ _	AH 313 AH 314 AH 315	AH 2313 AHX 2314 AHX 2315
AN 18 AN 19 AN 20	_ _ _	_ _ _	AH 216 AH 217 AH 218	_ _ _	_	AH 316 AHX 317 AHX 318	AHX 2316 AHX 2317 AHX 2318
AN 21 AN 22 AN 23	_ _ _	_ _ _	AH 219 AH 220 AH 221	_ _ _	AHX 3220	AHX 319 AHX 320 AHX 321	
AN 24 AN 25 AN 26	 AHX 3024	_	AH 222 — AH 224	_ _ _	AHX 3222 —	AHX 322 AHX 324	AHX 2322 —
AN 27 AN 28 AN 29	AHX 3026	AHX 3126	AH 226		AHX 3224 AHX 3226	AHX 326	AHX 2324 AHX 2326
AN 30 AN 31 AN 32	AHX 3028 — AHX 3030	AHX 3128 — —	AH 228 — AH 230	_ _ _	AHX 3228	AHX 328 	AHX 2328
AN 33 AN 34 AN 36	— AH 3032 AH 3034	AHX 3130 — AH 3132	— AH 232 AH 234	_ _ _	AHX 3230 AH 3232	AHX 330 AH 332	AHX 2330 AH 2332
AN 38 AN 40	AH 3036 —	AH 3134 AH 3136	AH 236 —	— AH 2236	AH 3234 AH 3236	AH 334 —	AH 2334 AH 2336







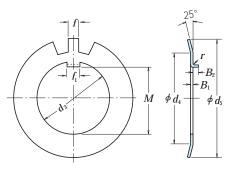
 $M \phi d_{\Lambda}$

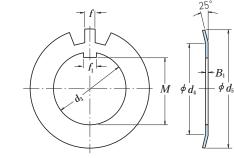
Units: mm Lock-washer Series AW Reference Nominal Numbers No. of Teeth Per 100 pcs Adapter (1) Sleeve Bore **Basic Dimensions** Nut Shaft Numbers Dia. Bent-Tab Bent-Tab Straight-Tab M $f_1 \quad B_1 \quad f$ d_4 Dia. Numbers approx. B_{2} 2.5 2.5 2.5 13.5 15.5 21 24 26 AW 02 X 28 32 13 0.253 AN 02 17 **AW 03 X** 13 13 AN 03 0.315 AW 04 X 20 0.35 04 AN 04 0.64 AN 05 49 0.78

15 AW 02 AW 03 17 AW 04 20 AW 05 X AW 06 X AW 05 5 5 5 25 25 30 23 27.5 5 5 1.2 1.2 32 38 2.5 2.5 13 13 AW 06 30 06 AN 06 2.5 AW 07 AW 07 X 15 1.04 07 **AN 07** 35 80 WA **X 80 WA** 40 37.5 1.2 6 50 62 2.5 15 1.23 80 **AN 08** 40 6 AW 09 AW 09 X 45 50 42.5 47.5 1.2 1.2 6 56 61 69 2.5 2.5 17 1.52 09 AN 09 45 6 AW 10 17 **AW 10 X** 74 10 AN 10 50 1.6 67 73 79 AW 11 **AW 11 X** 8 1.2 81 17 1.96 11 AN 11 55 60 65 57.5 8 1.5 1.2 1.2 2.53 AW 12 **AW 12 X** 86 17 AN 12 60 4 12 13 AW 13 **AW 13 X** 19 AN 13 65 **AW 14 AW 14 X** 1.2 1.2 3.35 3.55 **AN 14** 70 1.5 1.5 8 19 14 AW 15 AW 15 X 75 71.5 8 90 104 19 19 15 AN 15 75 **AW 16 AW 16 X** 76.5 10 95 1.2 4.65 16 AN 16 80 AW 17 **AW 17 X** 85 81.5 10 1.8 8 102 119 1.2 19 5.25 17 AN 17 85 AW 18 **AW 18 X** 90 86.5 91.5 10 1.8 10 108 113 126 1.2 1.2 4 19 6.25 18 AN 18 90 AW 19 AW 19 X 95 10 133 19 19 95 10 1.8 6.7 AN 19 AW 20 **AW 20 X** 100 96.5 100.5 12 1.8 12 1.8 10 12 120 126 142 145 1.2 1.2 7.65 AN 20 100 20 19 AW 21 **AW 21 X** 105 8.25 21 AN 21 105 12 1.8 12 1.2 19 22 AW 22 AW 22 X 110 105.5 133 154 9.4 AN 22 110 AW 23 10.8 AW 23 X 115 110.5 12 2 12 137 159 1.5 19 AN 23 115 AW 24 AW 24 X 120 115 14 12 138 164 1.5 19 19 10.5 24 120 6 AN 24 AW 25 AW 25 X 125 120 14 2 12 148 170 1.5 11.8 AN 25 125

Note (1) Applicable to adapter sleeve Series A31, A2, A3, and A23.

Remarks Lock-washers with straight tabs shall be used with adapter sleeves having narrow slits, and for those having wide slits, either type of lock-washer may be used.





Bent-Tab

Straight-Tab

Units : mm

Nomina	Lock-washer Series AW												F	Reference	
Bent-Tab	Straight-Tab	d_3	M	f_1	Basic	Dimen	sions d_4	d_5	Ben r	it-Tab B_2	No. of Teeth	Mass (kg) per 100 pcs approx.	Adapter (¹) Sleeve Bore Dia. Numbers	Nut Numbers	Shaft Dia.
AW 26	AW 26 X	130	125	14	2	12	149	175	1.5	6	19	11.3	26	AN 26	130
AW 27	AW 27 X	135	130	14	2	14	160	185	1.5	6	19	14.4	—	AN 27	135
AW 28	AW 28 X	140	135	16	2	14	160	192	1.5	8	19	14.2	28	AN 28	140
AW 29 AW 30 AW 31	AW 29 X AW 30 X AW 31 X	145 150 155	140 145 147.5	16 16 16	2 2 2.5	14 14 16	172 171 182	202 205 212	1.5 1.5 1.5	8 8 8	19 19 19	16.8 15.9 20.9	30 —	AN 29 AN 30 AN 31	145 150 155
AW 32	AW 32 X	160	154	18	2.5	16	182	217	1.5	8	19	22.2	32	AN 32	160
AW 33	AW 33 X	165	157.5	18	2.5	16	193	222	1.5	8	19	24.1	—	AN 33	165
AW 34	AW 34 X	170	164	18	2.5	16	193	232	1.5	8	19	24.7	34	AN 34	170
AW 36	AW 36 X	180	174	20	2.5	18	203	242	1.5	8	19	26.8	36	AN 36	180
AW 38	AW 38 X	190	184	20	2.5	18	214	252	1.5	8	19	27.8	38	AN 38	190
AW 40	AW 40 X	200	194	20	2.5	18	226	262	1.5	8	19	29.3	40	AN 40	200
						Wash	ner Seri	es AWL	=						
AWL 24	AWL 24 X	120	115	14	2	12	133	155	1.5	6	19	7.7	24	ANL 24	120
AWL 26	AWL 26 X	130	125	14	2	12	143	165	1.5	6	19	8.7	26	ANL 26	130
AWL 28	AWL 28 X	140	135	16	2	14	151	175	1.5	8	19	10.9	28	ANL 28	140
AWL 30	AWL 30 X	150	145	16	2	14	164	190	1.5	8	19	11.3	30	ANL 30	150
AWL 32	AWL 32 X	160	154	18	2.5	16	174	200	1.5	8	19	16.2	32	ANL 32	160
AWL 34	AWL 34 X	170	164	18	2.5	16	184	210	1.5	8	19	19	34	ANL 34	170
AWL 36	AWL 36 X	180	174	20	2.5	18	192	220	1.5	8	19	18	36	ANL 36	180
AWL 38	AWL 38 X	190	184	20	2.5	18	202	230	1.5	8	19	20.5	38	ANL 38	190
AWL 40	AWL 40 X	200	194	20	2.5	18	218	250	1.5	8	19	21.4	40	ANL 40	200
Note	(¹) Series AW is applicable to adapter sleeve Series A31 and A23.														

Note (1) Series AW is applicable to adapter sleeve Series A31 and A23 Series AWL is applicable to adapter sleeve Series A30.

Remarks Lock-washers with straight tabs shall be used with adapter sleeves having narrow slits, and for those having wide slits, either type of lock-washer may be used.



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INTRODUCTION OF NSK PRODUCTS

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NSK

AUTOMOTIVE PRODUCTS

Column Type Electric Power Steering (CAT.No. E4102)



Pinion Type Electric Power Steering (CAT.No. E4102)



Offeet Ball Screw Type Electric Power Steering (CAT.No. E4102)



Long Life Water Pump Bearings (CAT.No. E396, E4102)



Hub Unit Bearings (CAT.No. E4201)



One-Way Clutch

PRECISION MACHINE COMPONENTS

BALL SCREWS



NSK Standard Ball Screws Compact FA Series (CAT. No. E3239, E3162)



Ball Screws for High-Speed Machine Tools HMD Series (CAT. No. E3162)



Highly Dust-Resistant Ball Screws, **NSK Linear Guides** V1 Series (CAT. No. E3162)

MONOCARRIERS



Monocarriers (CAT. No. E3419, E3162)



NSK Standard Ball Screws High Speed SS Series (CAT.No.E3241)



Ball Screws for Twin-Drive Systems TW Series (CAT. No. E3162)



High-Speed, Low-Noise Ball Screws BSS Series (CAT. No. E3162)



Ball Screws for High-Load Drive HTF-SRC Series, HTF-SRD Series, HTF Series, A1 Series (CAT. No. E3238, E3162)



Ball Screws, NSK Linear Guides with NSK K1™ Lubrication Unit (CAT. No. E3331, E3162)



Ball Screws, NSK Linear Guides with E-DFO Thin-Film Lubrication for Vacuum Environments (CAT. No. E1258)



Toughcarrier (CAT. No. E3421)

NSK

PRECISION MACHINE COMPONENTS

LINEAR BEARINGS



NSK Linear Guides Roller Guides RA Series (CAT. No. E3328, E3162)



NSK Linear Guides High-Accuracy Series (CAT. No. E3329, E3162)



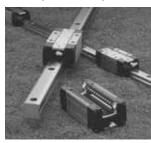
NSK Linear Guides LH Series, LS Series (CAT. No. E3162)



NSK Linear Guides Miniature PU Series, PE Series (CAT. No. E3327, E3162)



NSK Low-Noise Linear Guides SH Series, SS Series (CAT. No. E3162)



NSK Linear Guides TS Series (CAT. No. E3324, E3162)

PRECISION MACHINE COMPONENTS

MECHATRONIC ACTUATORS

Megatorque Motor™ (CAT.No. E3511)



XY Modules



Megapositioner™



XY Tables



ASSORTED SPINDLES



High Speed Integrated Motor Spindles



Precision Grinding Spindles (CAT.No. E2202)



Live Centers (CAT.No. E2202)



Oil/Air Lubricating Unit, Fine Lube (CAT.No. E1254/A1387)



Standard Type Precision Boring Heads (CAT.No. E2202)

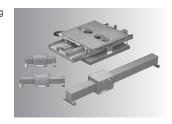


Spindles for Electrical and Electric Equipment

Positioning Actuator™



Air Bearing Slides





AIR SPINDLES



Air-spindle



RELATED PRODUCT WITH BEARING



Bearing Induction Heater (CAT.No. E398)



Extra Small Bearing Monitor NB-4 (Bearing Abnormality Detector) (CAT.No. E410)

Large Size Proximity Stepper RZ Series





Appendix Table 1 Conversion Table from SI (International Units) System

Comparison of SI, CGS, and Engineering Units

Units Unit System	Length	ı Mass	Time	Temp.	Acceleration	Force	Stress	Pressure	Energy	Power
SI	m	kg	s	K, °C	m/s ²	N	Pa	Pa	J	W
CGS System	cm	g	s	°C	Gal	dyn	dyn/cm²	dyn/cm²	erg	erg/s
Engineering Unit System	m	$kgf\cdot s^2/m$	s	°C	m/s²	kgf	kgf/m²	kgf/m²	kgf ⋅ m	kgf⋅m/s

Conversion Factors from SI Units

Parameter	SI Units		Units other than S	I	Conversion Factors	
rarameter	Names of Units	Symbols	Name of Units	Symbols	from SI Units	
Angle	Radian	rad	Degree Minute Second	°	180/π 10 800/π 648 000/π	
Length	Meter	m	Micron Angstrom	$\overset{\mu}{\text{\AA}}$	10 ⁶ 10 ¹⁰	
Area	Square meter	m²	Are Hectare	a ha	10 ⁻² 10 ⁻⁴	
Volume	Cubic meter	m ³	Liter Deciliter	l, L dl, dL	10 ³ 10 ⁴	
Time	Second	s	Minute Hour Day	min h d	1/60 1/3 600 1/86 400	
Frequency	Hertz	Hz	Cycle	S^{-1}	1	
Speed of Rotation	Revolution per second	s^{-1}	Revolution per miunte	rpm	60	
Speed	Meter per second	m/s	Kilometer per hour Knot	km/h kn	3 600/1 000 3 600/1 852	
Acceleration	Meter per second per second	m/s²	Gal g	Gal G	10 ² 1/9.806 65	
Mass	Kilogram	kg	Ton	t	10 ⁻³	
Force	Newton	N	Kilogram-force Ton-force Dyne	kgf tf dyn	1/9.806 65 1/ (9.806 65×10³) 10⁵	
Torque or Moment	Newton · meter	N·m	Kilogram-force meter	kgf · m	1/9.806 65	
Stress	Pascal	Pa (N/m²)	Kilogram-force per square centimeter Kilogram-force per square millimeter		1/ (9.806 65×10 ⁴) 1/ (9.806 65×10 ⁶)	

Prefixes Used In SI System

Multiples	Prefix	Symbols	Multiples	Prefix	Symbols
10 ¹⁸	Exa	E	10 ⁻¹	Deci	d
10 ¹⁵	Peta	P	10 ⁻²	Centi	c
10 ¹²	Tera	T	10 ⁻³	Milli	m
10 ⁹	Giga	G	10-6	Micro	μ
10 ⁶	Mega	M	10-9	Nano	n
10 ³	Kilo	k	10-12	Pico	p
10²	Hecto	h	10 ⁻¹⁵	Femto	f
10	Deca	da	10 ⁻¹⁸	Ato	a

Conversion Factors from SI Units (Continued)

Parameter	SI Units		Units other than S	I	Conversion Factors	
T di difficioi	Names of Units	Symbols	Names of Units	Units	from SI Units	
Pressure	Pascal (Newton per square meter)	Pa (N/m²)	Kilogram-force per square meter Water Column Mercury Column Torr Bar Atmosphere	kgf/m² mH ₂ O mmHg Torr bar atm	1/9.806 65 1/(9.806 65×10³) 760/(1.013 25×10⁵) 760/(1.013 25×10⁵) 10-5 1/(1.013 25×10⁵)	
Energy	Joule (Newton · meter)	J (N·m)	Erg Calorie (International) Kilogram-force meter Kilowatt hour French horse power hour	erg cal _{IT} kgf·m kW·h PS·h	10 ⁷ 1/4.186 8 1/9.806 65 1/(3.6×10 ⁶) ≈ 3.776 72×10 ⁻⁷	
Work	Watt (Joule per second)	W (J/s)	Kilogram-force meter per second Kilocalorie per hour French horse power	kgf·m/s kcal/h PS	1/9.806 65 1/1.163 ≈ 1/735.498 8	
Viscosity, Viscosity Index	Pascal second	Pa·s	Poise	P	10	
Kinematic Viscosity, Kinematic Viscosity Index	Square meter per second	m ² /s	Stokes Centistokes	St cSt	10 ⁴ 10 ⁶	
Temperature	Kelvin, Degree celsius	K, °C	Degree	°C	(See note (1))	
Electric Current, Magnetomotive Force	Ampere	A	Ampere	A	1	
Voltage, Electromotive Force	Volt	V	(Watts per ampere)	(W/A)	1	
Magnetic Field Strength	Ampere per meter	A/m	Oersted	Oe	$4\pi/10^3$	
Magnetic Flux Density	Tesla	T	Gauss Gamma	Gs γ	10 ⁴ 10 ⁹	
Electrical Resistance	Ohm	Ω	(Volts per ampere)	(V/A)	1	

Note (1) The conversion from TK into θ °C is $\theta = T$ —273.15 but for a temperature difference, it is $\Delta T = \Delta \theta$. However, ΔT and $\Delta \theta$ represent temperature differences measured using the Kelvin and Celsius scales respectively.

Remarks The names and symbols in () are equivalent to those directly above them or on their left. Example of conversion 1N=1/9.806 65kgf



Appendix Table 2 N-kgf Conversion Table

Appendix Table 3 kg-lb Conversion Table

[Method of using this table] For example, to convert 10N into kgf, read the figure in the right kgf column adjacent to the 10 in the center column in the 1st block. This means that 10N is 1.0197kgf. To convert 10kgf into N, read the figure in the left N column of the same row, which indicates that the answer is 98.066N.

1 N=0.1019716 kgf 1 kgf=9.80665 N

[Method of using this table] For example, to convert 10kg into lb, read the figure in the right lb column adjacent to the 10 in the center column in the 1st block. This means that 10kg is 22.046lb. To convert 10lb into kg, read the figure in the left kg column of the same row, which indicates that the answer is 4.536kg.

1 kg=2.2046226 lb 1 lb=0.45359237 kg

N		kgf	N		kgf	N		kgf	kg		lb	kg		lb	kg		lb
9.8066 19.613 29.420 39.227 49.033	1 2 3 4 5	0.1020 0.2039 0.3059 0.4079 0.5099	333.43 343.23 353.04 362.85 372.65	34 35 36 37 38	3.4670 3.5690 3.6710 3.7729 3.8749	657.05 666.85 676.66 686.47 696.27	67 68 69 70 71	6.8321 6.9341 7.0360 7.1380 7.2400	0.454 0.907 1.361 1.814 2.268	1 2 3 4 5	2.205 4.409 6.614 8.818 11.023	15.422 15.876 16.329 16.783 17.237	34 35 36 37 38	74.957 77.162 79.366 81.571 83.776	30.391 30.844 31.298 31.751 32.205	67 68 69 70 71	147.71 149.91 152.12 154.32 156.53
58.840 68.647 78.453 88.260 98.066	6 7 8 9 10	0.6118 0.7138 0.8158 0.9177 1.0197	382.46 392.27 402.07 411.88 421.69	39 40 41 42 43	3.9769 4.0789 4.1808 4.2828 4.3848	706.08 715.89 725.69 735.50 745.31	72 73 74 75 76	7.3420 7.4439 7.5459 7.6479 7.7498	2.722 3.175 3.629 4.082 4.536	6 7 8 9 10	13.228 15.432 17.637 19.842 22.046	17.690 18.144 18.597 19.051 19.504	39 40 41 42 43	85.980 88.185 90.390 92.594 94.799	32.659 33.112 33.566 34.019 34.473	72 73 74 75 76	158.73 160.94 163.14 165.35 167.55
107.87 117.68 127.49 137.29 147.10	11 12 13 14 15	1.1217 1.2237 1.3256 1.4276 1.5296	431.49 441.30 451.11 460.91 470.72	44 45 46 47 48	4.4868 4.5887 4.6907 4.7927 4.8946	755.11 764.92 774.73 784.53 794.34	77 78 79 80 81	7.8518 7.9538 8.0558 8.1577 8.2597	4.990 5.443 5.897 6.350 6.804	11 12 13 14 15	24.251 26.455 28.660 30.865 33.069	19.958 20.412 20.865 21.319 21.772	44 45 46 47 48	97.003 99.208 101.41 103.62 105.82	34.927 35.380 35.834 36.287 36.741	77 78 79 80 81	169.76 171.96 174.17 176.37 178.57
156.91 166.71 176.52 186.33 196.13	16 17 18 19 20	1.6315 1.7335 1.8355 1.9375 2.0394	480.53 490.33 500.14 509.95 519.75	49 50 51 52 53	4.9966 5.0986 5.2006 5.3025 5.4045	804.15 813.95 823.76 833.57 843.37	82 83 84 85 86	8.3617 8.4636 8.5656 8.6676 8.7696	7.257 7.711 8.165 8.618 9.072	16 17 18 19 20	35.274 37.479 39.683 41.888 44.092	22.226 22.680 23.133 23.587 24.040	49 50 51 52 53	108.03 110.23 112.44 114.64 116.84	37.195 37.648 38.102 38.555 39.009	82 83 84 85 86	180.78 182.98 185.19 187.39 189.60
205.94 215.75 225.55 235.36 245.17	21 22 23 24 25	2.1414 2.2434 2.3453 2.4473 2.5493	529.56 539.37 549.17 558.98 568.79	54 55 56 57 58	5.5065 5.6084 5.7104 5.8124 5.9144	853.18 862.99 872.79 882.60 892.41	87 88 89 90 91	8.8715 8.9735 9.0755 9.1774 9.2794	9.525 9.979 10.433 10.886 11.340	21 22 23 24 25	46.297 48.502 50.706 52.911 55.116	24.494 24.948 25.401 25.855 26.308	54 55 56 57 58	119.05 121.25 123.46 125.66 127.87	39.463 39.916 40.370 40.823 41.277	87 88 89 90 91	191.80 194.01 196.21 198.42 200.62
254.97 264.78 274.59 284.39 294.20	26 27 28 29 30	2.6513 2.7532 2.8552 2.9572 3.0591	578.59 588.40 598.21 608.01 617.82	59 60 61 62 63	6.0163 6.1183 6.2203 6.3222 6.4242	902.21 912.02 921.83 931.63 941.44	92 93 94 95 96	9.3814 9.4834 9.5853 9.6873 9.7893	11.793 12.247 12.701 13.154 13.608	26 27 28 29 30	57.320 59.525 61.729 63.934 66.139	26.762 27.216 27.669 28.123 28.576	59 60 61 62 63	130.07 132.28 134.48 136.69 138.89	41.730 42.184 42.638 43.091 43.545	92 93 94 95 96	202.83 205.03 207.23 209.44 211.64
304.01 313.81 323.62	31 32 33	3.1611 3.2631 3.3651	627.63 637.43 647.24	64 65 66	6.5262 6.6282 6.7301	951.25 961.05 970.86	97 98 99	9.8912 9.9932 10.095	14.061 14.515 14.969	31 32 33	68.343 70.548 72.753	29.030 29.484 29.937	64 65 66	141.10 143.30 145.51	43.998 44.452 44.906	97 98 99	213.85 216.05 218.26

C 10 C 11



Appendix Table 4 $\,^{\circ}\text{C-}^{\circ}\text{F}$ Conversion Table

[Method of using this table] For example, to convert 38°C into $^{\circ}F$, read the figure in the right $^{\circ}F$ column adjacent to the 38 in the center column in the 2nd block. This means that 38°C is 100.4°F. To convert 38°F into °C, read the figure in the left °C column of the same row, which indicates that the answer is 3.3°C.

$$C = \frac{5}{9}(F - 32)$$

$$\mathbf{F} = 32 + \frac{9}{5}\mathbf{C}$$

°C		°F	°C		°F	°C		°F	°C		°F
-73.3 -62.2 -51.1 -40.0 -34.4	-100 - 80 - 60 - 40 - 30	-148.0 -112.0 - 76.0 - 40.0 - 22.0	0.0 0.6 1.1 1.7 2.2	32 33 34 35 36	89.6 91.4 93.2 95.0 96.8	21.7 22.2 22.8 23.3 23.9	71 72 73 74 75	159.8 161.6 163.4 165.2 167.0	43.3 46.1 48.9 51.7 54.4	110 115 120 125 130	230 239 248 257 266
-28.9 -23.3 -17.8 -17.2 -16.7	- 20 - 10 0 1 2	- 4.0 14.0 32.0 33.8 35.6	2.8 3.3 3.9 4.4 5.0	37 38 39 40 41	98.6 100.4 102.2 104.0 105.8	24.4 25.0 25.6 26.1 26.7	76 77 78 79 80	168.8 170.6 172.4 174.2 176.0	57.2 60.0 65.6 71.1 76.7	135 140 150 160 170	275 284 302 320 338
-16.1 -15.6 -15.0 -14.4 -13.9	3 4 5 6 7	37.4 39.2 41.0 42.8 44.6	5.6 6.1 6.7 7.2 7.8	42 43 44 45 46	107.6 109.4 111.2 113.0 114.8	27.2 27.8 28.3 28.9 29.4	81 82 83 84 85	177.8 179.6 181.4 183.2 185.0	82.2 87.8 93.3 98.9 104.4	180 190 200 210 220	356 374 392 410 428
-13.3 -12.8 -12.2 -11.7 -11.1	8 9 10 11 12	46.4 48.2 50.0 51.8 53.6	8.3 8.9 9.4 10.0 10.6	47 48 49 50 51	116.6 118.4 120.2 122.0 123.8	30.0 30.6 31.1 31.7 32.2	86 87 88 89 90	186.8 188.6 190.4 192.2 194.0	110.0 115.6 121.1 148.9 176.7	230 240 250 300 350	446 464 482 572 662
-10.6 -10.0 - 9.4 - 8.9 - 8.3	13 14 15 16 17	55.4 57.2 59.0 60.8 62.6	11.1 11.7 12.2 12.8 13.3	52 53 54 55 56	125.6 127.4 129.2 131.0 132.8	32.8 33.3 33.9 34.4 35.0	91 92 93 94 95	195.8 197.6 199.4 201.2 203.0	204 232 260 288 316	400 450 500 550 600	752 842 932 1022 1112
- 7.8 - 7.2 - 6.7 - 6.1 - 5.6	18 19 20 21 22	64.4 66.2 68.0 69.8 71.6	13.9 14.4 15.0 15.6 16.1	57 58 59 60 61	134.6 136.4 138.2 140.0 141.8	35.6 36.1 36.7 37.2 37.8	96 97 98 99 100	204.8 206.6 208.4 210.2 212.0	343 371 399 427 454	650 700 750 800 850	1202 1292 1382 1472 1562
- 5.0 - 4.4 - 3.9 - 3.3 - 2.8	23 24 25 26 27	73.4 75.2 77.0 78.8 80.6	16.7 17.2 17.8 18.3 18.9	62 63 64 65 66	143.6 145.4 147.2 149.0 150.8	38.3 38.9 39.4 40.0 40.6	101 102 103 104 105	213.8 215.6 217.4 219.2 221.0	482 510 538 593 649	900 950 1000 1100 1200	1652 1742 1832 2012 2192
- 2.2 - 1.7 - 1.1 - 0.6	28 29 30 31	82.4 84.2 86.0 87.8	19.4 20.0 20.6 21.1	67 68 69 70	152.6 154.4 156.2 158.0	41.1 41.7 42.2 42.8	106 107 108 109	222.8 224.6 226.4 228.2	704 760 816 871	1300 1400 1500 1600	2372 2552 2732 2912

Appendix Table	5 Viscosity	Conversion Table

Kinematic Viscosity mm ² /s		bolt ersal (sec)		Type wood sec)	Engler E (degree)	Kinematic Viscosity mm ² /s	Say Univ SUS	ersal	No.1 Redw R (s	rood	Engler E (degree)
mm²/s	100°F	210°F	50°C	100°C		mm²/s	100°F	210°F	50°C	100°C	
2	32.6	32.8	30.8	31.2	1.14	35	163	164	144	147	4.70
3	36.0	36.3	33.3	33.7	1.22	36	168	170	148	151	4.83
4	39.1	39.4	35.9	36.5	1.31	37	172	173	153	155	4.96
5	42.3	42.6	38.5	39.1	1.40	38	177	178	156	159	5.08
6	45.5	45.8	41.1	41.7	1.48	39	181	183	160	164	5.21
7	48.7	49.0	43.7	44.3	1.56	40	186	187	164	168	5.34
8	52.0	52.4	46.3	47.0	1.65	41	190	192	168	172	5.47
9	55.4	55.8	49.1	50.0	1.75	42	195	196	172	176	5.59
10	58.8	59.2	52.1	52.9	1.84	43	199	201	176	180	5.72
11	62.3	62.7	55.1	56.0	1.93	44	204	205	180	185	5.85
12	65.9	66.4	58.2	59.1	2.02	45	208	210	184	189	5.98
13	69.6	70.1	61.4	62.3	2.12	46	213	215	188	193	6.11
14	73.4	73.9	64.7	65.6	2.22	47	218	219	193	197	6.24
15	77.2	77.7	68.0	69.1	2.32	48	222	224	197	202	6.37
16	81.1	81.7	71.5	72.6	2.43	49	227	228	201	206	6.50
17	85.1	85.7	75.0	76.1	2.54	50	231	233	205	210	6.63
18	89.2	89.8	78.6	79.7	2.64	55	254	256	225	231	7.24
19	93.3	94.0	82.1	83.6	2.76	60	277	279	245	252	7.90
20	97.5	98.2	85.8	87.4	2.87	65	300	302	266	273	8.55
21	102	102	89.5	91.3	2.98	70	323	326	286	294	9.21
22	106	107	93.3	95.1	3.10	75	346	349	306	315	9.89
23	110	111	97.1	98.9	3.22	80	371	373	326	336	10.5
24	115	115	101	103	3.34	85	394	397	347	357	11.2
25	119	120	105	107	3.46	90	417	420	367	378	11.8
26	123	124	109	111	3.58	95	440	443	387	399	12.5
27	128	129	112	115	3.70	100	464	467	408	420	13.2
28	132	133	116	119	3.82	120	556	560	490	504	15.8
29	137	138	120	123	3.95	140	649	653	571	588	18.4
30	141	142	124	127	4.07	160	742	747	653	672	21.1
31	145	146	128	131	4.20	180	834	840	734	757	23.7
32	150	150	132	135	4.32	200	927	933	816	841	26.3
33	154	155	136	139	4.45	250	1 159	1 167	1 020	1 051	32.9
34	159	160	140	143	4.57	300	1 391	1 400	1 224	1 241	39.5

Remarks 1mm²/s=1cSt



Appendix Table 6 inch - mm Conversion Table

1" = 25.4 **mm**

inch	0	1	2	3	4	5	6	7	8	9	10
Fraction Decimal					l	mm			l	l	l
0 0.000000 1/64 0.015625 1/32 0.031250 3/64 0.046875	0.000 0.397 0.794 1.191	25.400 25.797 26.194 26.591	50.800 51.197 51.594 51.991	76.200 76.597 76.994 77.391	101.600 101.997 102.394 102.791	127.000 127.397 127.794 128.191	152.400 152.797 153.194 153.591	177.800 178.197 178.594 178.991	203.200 203.597 203.994 204.391	228.600 228.997 229.394 229.791	254.000 254.397 254.794 255.191
1/16 0.062500 5/64 0.078125 3/32 0.093750 7/64 0.109375	1.588 1.984 2.381 2.778	26.988 27.384 27.781 28.178	52.388 52.784 53.181 53.578	77.788 78.184 78.581 78.978	103.188 103.584 103.981 104.378	128.588 128.984 129.381 129.778	153.988 154.384 154.781 155.178	179.388 179.784 180.181 180.578	204.788 205.184 205.581 205.978	230.188 230.584 230.981 231.378	255.588 255.984 256.381 256.778
1/8 0.125000 9/64 0.140625 5/32 0.156250 11/64 0.171875	3.175 3.572 3.969 4.366	28.575 28.972 29.369 29.766	53.975 54.372 54.769 55.166	79.375 79.772 80.169 80.566	104.775 105.172 105.569 105.966	130.175 130.572 130.969 131.366	155.575 155.972 156.369 156.766	180.975 181.372 181.769 182.166	206.375 206.772 207.169 207.566	231.775 232.172 232.569 232.966	257.175 257.572 257.969 258.366
3/16 0.187500 13/64 0.203125 7/32 0.218750 15/64 0.234375	4.762 5.159 5.556 5.953	30.162 30.559 30.956 31.353	55.562 55.959 56.356 56.753	80.962 81.359 81.756 82.153	106.362 106.759 107.156 107.553	131.762 132.159 132.556 132.953	157.162 157.559 157.956 158.353	182.562 182.959 183.356 183.753	207.962 208.359 208.756 209.153	233.362 233.759 234.156 234.553	258.762 259.159 259.556 259.953
1/4 0.250000 17/64 0.265625 9/32 0.281250 19/64 0.296875	6.350 6.747 7.144 7.541	31.750 32.147 32.544 32.941	57.150 57.547 57.944 58.341	82.550 82.947 83.344 83.741	107.950 108.347 108.744 109.141	133.350 133.747 134.144 134.541	158.750 159.147 159.544 159.941	184.150 184.547 184.944 185.341	209.550 209.947 210.344 210.741	234.950 235.347 235.744 236.141	260.350 260.747 261.144 261.541
5/16 0.312500 21/64 0.328125 11/32 0.343750 23/64 0.359375	7.938 8.334 8.731 9.128	33.338 33.734 34.131 34.528	58.738 59.134 59.531 59.928	84.138 84.534 84.931 85.328	109.538 109.934 110.331 110.728	134.938 135.334 135.731 136.128	160.338 160.734 161.131 161.528	185.738 186.134 186.531 186.928	211.138 211.534 211.931 212.328	236.538 236.934 237.331 237.728	261.938 262.334 262.731 263.128
3/8 0.375000 25/64 0.390625 13/32 0.406250 27/64 0.421875	9.525 9.922 10.319 10.716	34.925 35.322 35.719 36.116	60.325 60.722 61.119 61.516	85.725 86.122 86.519 86.916	111.125 111.522 111.919 112.316	136.525 136.922 137.319 137.716	161.925 162.322 162.719 163.116	187.325 187.722 188.119 188.516	212.725 213.122 213.519 213.916	238.125 238.522 238.919 239.316	263.525 263.922 264.319 264.716
7/16 0.437500 29/64 0.453125 15/32 0.468750 31/64 0.484375	11.112 11.509 11.906 12.303	36.512 36.909 37.306 37.703	61.912 62.309 62.706 63.103	87.312 87.709 88.106 88.503	112.712 113.109 113.506 113.903	138.112 138.509 138.906 139.303	163.512 163.909 164.306 164.703	188.912 189.309 189.706 190.103	214.312 214.709 215.106 215.503	239.712 240.109 240.506 240.903	265.112 265.509 265.906 266.303
1/2 0.500000 33/64 0.515625 17/32 0.531250 35/64 0.546875	12.700 13.097 13.494 13.891	38.100 38.497 38.894 39.291	63.500 63.897 64.294 64.691	88.900 89.297 89.694 90.091	114.300 114.697 115.094 115.491	139.700 140.097 140.494 140.891	165.100 165.497 165.894 166.291	190.500 190.897 191.294 191.691	215.900 216.297 216.694 217.091	241.300 241.697 242.094 242.491	266.700 267.097 267.494 267.891
9/16 0.562500 37/64 0.578125 19/32 0.593750 39/64 0.609375	14.288 14.684 15.081 15.478	39.688 40.084 40.481 40.878	65.088 65.484 65.881 66.278	90.488 90.884 91.281 91.678	115.888 116.284 116.681 117.078	141.288 141.684 142.081 142.478	166.688 167.084 167.481 167.878	192.088 192.484 192.881 193.278	217.488 217.884 218.281 218.678	242.888 243.284 243.681 244.078	268.288 268.684 269.081 269.478
5/8 0.625000 41/64 0.640625 21/32 0.656250 43/64 0.671875	15.875 16.272 16.669 17.066	41.275 41.672 42.069 42.466	66.675 67.072 67.469 67.866	92.075 92.472 92.869 93.266	117.475 117.872 118.269 118.666	142.875 143.272 143.669 144.066	168.275 168.672 169.069 169.466	193.675 194.072 194.469 194.866	219.075 219.472 219.869 220.266	244.475 244.872 245.269 245.666	269.875 270.272 270.669 271.066
11/16 0.687500 45/64 0.703125 23/32 0.718750 47/64 0.734375	17.462 17.859 18.256 18.653	42.862 43.259 43.656 44.053	68.262 68.659 69.056 69.453	93.662 94.059 94.456 94.853	119.062 119.459 119.856 120.253	144.462 144.859 145.256 145.653	169.862 170.259 170.656 171.053	195.262 195.659 196.056 196.453	220.662 221.059 221.456 221.853	246.062 246.459 246.856 247.253	271.462 271.859 272.256 272.653
3/4 0.750000 49/64 0.765625 25/32 0.781250 51/64 0.796875	19.050 19.447 19.844 20.241	44.450 44.847 45.244 45.641	69.850 70.247 70.644 71.041	95.250 95.647 96.044 96.441	120.650 121.047 121.444 121.841	146.050 146.447 146.844 147.241	171.450 171.847 172.244 172.641	196.850 197.247 197.644 198.041	222.250 222.647 223.044 223.441	247.650 248.047 248.444 248.841	273.050 273.447 273.844 274.241
13/16 0.812500 53/64 0.828125 27/32 0.843750 55/64 0.859375	20.638 21.034 21.431 21.828	46.038 46.434 46.831 47.228	71.438 71.834 72.231 72.628	96.838 97.234 97.631 98.028	122.238 122.634 123.031 123.428	147.638 148.034 148.431 148.828	173.038 173.434 173.831 174.228	198.438 198.834 199.231 199.628	223.838 224.234 224.631 225.028	249.238 249.634 250.031 250.428	274.638 275.034 275.431 275.828
7/8 0.875000 57/64 0.890625 29/32 0.906250 59/64 0.921875	22.225 22.622 23.019 23.416	47.625 48.022 48.419 48.816	73.025 73.422 73.819 74.216	98.425 98.822 99.219 99.616	123.825 124.222 124.619 125.016	149.225 149.622 150.019 150.416	174.625 175.022 175.419 175.816	200.025 200.422 200.819 201.216	225.425 225.822 226.219 226.616	250.825 251.222 251.619 252.016	276.225 276.622 277.019 277.416
15/16 0.937500 61/64 0.953125 31/32 0.968750 63/64 0.984375	23.812 24.209 24.606 25.003	49.212 49.609 50.006 50.403	74.612 75.009 75.406 75.803	100.012 100.409 100.806 101.203	125.412 125.809 126.206 126.603	150.812 151.209 151.606 152.003	176.212 176.609 177.006 177.403	201.612 202.009 202.406 202.803	227.012 227.409 227.806 228.203	252.412 252.809 253.206 253.603	277.812 278.209 278.606 279.003

1	'' = 25.4	mn
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in	ıch	11	12	13	14	15	16	17	18	19	20	
Fraction	n Decimal		mm									
0	0.0000	279.400	304.800	330.200	355.600	381.000	406.400	431.800	457.200	482.600	508.000	
1/16	0.0625	280.988	306.388	331.788	357.188	382.588	407.988	433.388	458.788	484.188	509.588	
1/8	0.1250	282.575	307.975	333.375	358.775	384.175	409.575	434.975	460.375	485.775	511.175	
3/16	0.1875	284.162	309.562	334.962	360.362	385.762	411.162	436.562	461.962	487.362	512.762	
1/4	0.2500	285.750	311.150	336.550	361.950	387.350	412.750	438.150	463.550	488.950	514.350 515.938 517.525 519.112	
5/16	0.3125	287.338	312.738	338.138	363.538	388.938	414.338	439.738	465.138	490.538		
3/8	0.3750	288.925	314.325	339.725	365.125	390.525	415.925	441.325	466.725	492.125		
7/16	0.4375	290.512	315.912	341.312	366.712	392.112	417.512	442.912	468.312	493.712		
1/2 9/16 5/8 11/16	0.5000 0.5625 0.6250 0.6875	292.100 293.688 295.275 296.862	317.500 319.088 320.675 322.262	342.900 344.488 346.075 347.662	368.300 369.888 371.475 373.062	393.700 395.288 396.875 398.462	419.100 420.688 422.275 423.862	444.500 446.088 447.675 449.262	469.900 471.488 473.075 474.662	495.300 496.888 498.475 500.062	520.700 522.288 523.875 525.462	
3/4	0.7500	298.450	323.850	349.250	374.650	400.050	425.450	450.850	476.250	501.650	527.050 528.638 530.225 531.812	
13/16	0.8125	300.038	325.438	350.838	376.238	401.638	427.038	452.438	477.838	503.238		
7/8	0.8750	301.625	327.025	352.425	377.825	403.225	428.625	454.025	479.425	504.825		
15/16	0.9375	303.212	328.612	354.012	379.412	404.812	430.212	455.612	481.012	506.412		

1" = 25.4 **mm**

in	ich	21	22	23	24	25	26	27	28	29	30
Fraction	n Decimal					m	m				
0 1/16 1/8 3/16	0.0000 0.0625 0.1250 0.1875	533.400 534.988 536.575 538.162	558.800 560.388 561.975 563.562	584.200 585.788 587.375 588.962	609.600 611.188 612.775 614.362	635.000 636.588 638.175 639.762	660.400 661.988 663.575 665.162	685.800 687.388 688.975 690.562	711.200 712.788 714.375 715.962	736.600 738.188 739.775 741.362	762.000 763.588 765.175 766.762
1/4 5/16 3/8 7/16	0.2500 0.3125 0.3750 0.4375	539.750 541.338 542.925 544.512	565.150 566.738 568.325 569.912	590.550 592.138 593.725 595.312	615.950 617.538 619.125 620.712	641.350 642.938 644.525 646.112	666.750 668.338 669.925 671.512	692.150 693.738 695.325 696.912	717.550 719.138 720.725 722.312	742.950 744.538 746.125 747.712	768.350 769.938 771.525 773.112
1/2 9/16 5/8 11/16	0.5000 0.5625 0.6250 0.6875	546.100 547.688 549.275 550.862	571.500 573.088 574.675 576.262	596.900 598.488 600.075 601.662	622.300 623.888 625.475 627.062	647.700 649.288 650.875 652.462	673.100 674.688 676.275 677.862	698.500 700.088 701.675 703.262	723.900 725.488 727.075 728.662	749.300 750.888 752.475 754.062	774.700 776.288 777.875 779.462
3/4 13/16 7/8 15/16	0.7500 0.8125 0.8750 0.9375	552.450 554.038 555.625 557.212	577.850 579.438 581.025 582.612	603.250 604.838 606.425 608.012	628.650 630.238 631.825 633.412	654.050 655.638 657.225 658.812	679.450 681.038 682.625 684.212	704.850 706.438 708.025 709.612	730.250 731.838 733.425 735.012	755.650 757.238 758.825 760.412	781.050 782.638 784.225 785.812

1" = 25.4 **mm**

in	ıch	31	32	33	34	35	36	37	38	39	40
Fraction	n Decimal					m	m				
0	0.0000	787.400	812.800	838.200	863.600	889.000	914.400	939.800	965.200	990.600	1016.000
1/16	0.0625	788.988	814.388	839.788	865.188	890.588	915.988	941.388	966.788	992.188	1017.588
1/8	0.1250	790.575	815.975	841.375	866.775	892.175	917.575	942.975	968.375	993.775	1019.175
3/16	0.1875	792.162	817.562	842.962	868.362	893.762	919.162	944.562	969.962	995.362	1020.762
1/4	0.2500 0.3125 0.3750 0.4375	793.750	819.150	844.550	869.950	895.350	920.750	946.150	971.550	996.950	1022.350
5/16		795.338	820.738	846.138	871.538	896.938	922.338	947.738	973.138	998.538	1023.938
3/8		796.925	822.325	847.725	873.125	898.525	923.925	949.325	974.725	1000.125	1025.525
7/16		798.512	823.912	849.312	874.712	900.112	925.512	950.912	976.312	1001.712	1027.112
1/2	0.5000 0.5625 0.6250 0.6875	800.100	825.500	850.900	876.300	901.700	927.100	952.500	977.900	1003.300	1028.700
9/16		801.688	827.088	852.488	877.888	903.288	928.688	954.088	979.488	1004.888	1030.288
5/8		803.275	828.675	854.075	879.475	904.875	930.275	955.675	981.075	1006.475	1031.875
11/16		804.862	830.262	855.662	881.062	906.462	931.862	957.262	982.662	1008.062	1033.462
3/4	0.7500 0.8125 0.8750 0.9375	806.450	831.850	857.250	882.650	908.050	933.450	958.850	984.250	1009.650	1035.050
13/16		808.038	833.438	858.838	884.238	909.638	935.038	960.438	985.838	1011.238	1036.638
7/8		809.625	835.025	860.425	885.825	911.225	936.625	962.025	987.425	1012.825	1038.225
15/16		811.212	836.612	862.012	887.412	912.812	938.212	963.621	989.012	1014.412	1039.812



Appendix Table 7 Hardness Conversion Table (Reference)

Rockwell C Scale Hardness (1 471N) {150kgf}	Vickers Hardness	Brinell F Standard Ball	lardness Tungsten Carbide Ball	Rockwell A Scale Load ^{588.4} N (60kgf) Brale Indenter	Hardness B Scale Load 980.7N {100kgf} 1.588 mm (1/16in) Ball	Shore Hardness
68 67 66 65 64	940 900 865 832 800	_ _ _ _	— — — 739 722	85.6 85.0 84.5 83.9 83.4	_ _ _ _	97 95 92 91 88
63 62 61 60 59	772 746 720 697 674	_ _ _ _	705 688 670 654 634	82.8 82.3 81.8 81.2 80.7		87 85 83 81 80
58 57 56 55 54	653 633 613 595 577		615 595 577 560 543	80.1 79.6 79.0 78.5 78.0		78 76 75 74 72
53 52 51 50 49	560 544 528 513 498	500 487 475 464	525 512 496 481 469	77.4 76.8 76.3 75.9 75.2		71 69 68 67 66
48 47 46 45 44	484 471 458 446 434	451 442 432 421 409	455 443 432 421 409	74.7 74.1 73.6 73.1 72.5		64 63 62 60 58
43 42 41 40 39	423 412 402 392 382	400 390 381 371 362	400 390 381 371 362	72.0 71.5 70.9 70.4 69.9		57 56 55 54 52
38 37 36 35 34	372 363 354 345 336	353 344 336 327 319	353 344 336 327 319	69.4 68.9 68.4 67.9 67.4	(109.0) (108.5) (108.0)	51 50 49 48 47
33 32 31 30 29	327 318 310 302 294	311 301 294 286 279	311 301 294 286 279	66.8 66.3 65.8 65.3 64.7	(107.5) (107.0) (106.0) (105.5) (104.5)	46 44 43 42 41
28 27 26 25 24	286 279 272 266 260	271 264 258 253 247	271 264 258 253 247	64.3 63.8 63.3 62.8 62.4	(104.0) (103.0) (102.5) (101.5) (101.0)	41 40 38 38 37
23 22 21 20	254 248 243 238	243 237 231 226	243 237 231 226	62.0 61.5 61.0 60.5	100.0 99.0 98.5 97.8	36 35 35 34
(18) (16) (14) (12)	230 222 213 204	219 212 203 194	219 212 203 194	_ _ _ _	96.7 95.5 93.9 92.3	33 32 31 29
(10) (8) (6) (4) (2) (0)	196 188 180 173 166 160	187 179 171 165 158 152	187 179 171 165 158 152	_ _ _ _ _	90.7 89.5 87.1 85.5 83.5 81.7	28 27 26 25 24 24

Appendix Table 8 Physical and Mechanical Properties of Materials

Materials	Specific Gravity	Coefficient of Linear Expansion (0° to 100°C) (K ⁻¹)	Hardness (Brinell)	Young's modulus (MPa) {kgf/mm²}	Tensile Strength (MPa) {kgf/mm²}	Yield Point (MPa) {kgf/mm²}	Elongation (%)
Bearing Steel (hardened)	7.83	12.5×10 ⁻⁶	650 to 740	208 000 {21 200}	1 570 to 1 960 {160 to 200}	_	_
Martensitic Stainless Steel SUS 440C	7.68	10.1×10 ⁻⁶	580	200 000 {20 400}	1 960 {200}	1 860 {190}	_
Mild Steel (C=0.12~0.20%)	7.86	11.6×10 ⁻⁶	100 to 130	206 000 {21 000}	373 to 471 {38 to 48}	216 to 294 {22 to 30}	24 to 36
Hard Steel (C=0.3~0.5%)	7.84	11.3×10 ⁻⁶	160 to 200	206 000 {21 000}	539 to 686 {55 to 70}	333 to 451 {34 to 46}	14 to 26
Austenitic Stainless Steel SUS 304	8.03	16.3×10 ⁻⁶	150	193 000 {19 700}	588 {60}	245 {25}	60
Gray Iron FC200	7.3	10.4×10 ⁻⁶	223	98 100	More than 200 {20}	_	_
Spheroidal graphite Iron FCD400	7.0	11.7×10 ⁻⁶	Less than 201	{10 000}	More than 400 {41}	_	More than 12
Aluminum	2.69	23.7×10 ⁻⁶	15 to 26	70 600 {7 200}	78 {8}	34 {3.5}	35
Zinc	7.14	31×10 ⁻⁶	30 to 60	92 200 {9 400}	147 {15}	_	30 to 40
Copper	8.93	16.2×10 ⁻⁶	50	123 000 {12 500}	196 {20}	69 {7}	15 to 20
(Annealed) Brass	8.5	19.1×10 ⁻⁶	45	103 000	294 to 343 {30 to 35}	_	65 to 75
(Machined)			85 to 130	{10 500}	363 to 539 {37 to 55}		15 to 50

Remarks The hardness of hardened bearing steel and martensitic stainless steel is usually expressed using the Rockwell C Scale, but for comparison, it is converted into Brinell hardness.



Appendix Table 9 Tolerances

for Shaft	Diameters
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	meter ation (mm)	Single Plane Mean B.D. Deviation	d6	e6	f6	g5	g6	h5	h6	h7	h8	h9	h10	js5	js6
over	incl.	(Normal) Δ_{dmp}	do	CO	10	go	gu	113	110	117	110	113	1110	J30	J30
3	6	- 8 - 8	- 30 - 38	- 20 - 28	- 10 - 18		- 4 - 12	0 - 5	0 - 8	- 12	_ 0 _ 18	_ 0 _ 30	0 - 48	± 2.5	± 4
6	10	- 8	- 40 - 49	- 25 - 34	- 13 - 22	- 5 - 11	- 5 - 14	- 6	- 9	0 - 15	0 - 22	0 - 36	0 - 58	± 3	± 4.5
10	18	- 8	- 50 - 61	- 32 - 43	- 16 - 27	- 6 - 14	- 6 - 17	- 8	0 -11	0 - 18	0 - 27	0 - 43	0 - 70	± 4	± 5.5
18	30	0 - 10	- 65 - 78	- 40 - 53	- 20 - 33	- 7 - 16	- 7 - 20	_ 0 _ 9	0 -13	0 - 21	0 - 33	0 - 52	0 - 84	± 4.5	± 6.5
30	50	0 - 12	- 80 - 96	- 50 - 66	- 25 - 41	- 9 - 20	- 9 - 25	0 -11	0 -16	0 - 25	0 39	0 - 62	0 -100	± 5.5	± 8
50	80	0 - 15	-100 -119	- 60 - 79	- 30 - 49	- 10 - 23	- 10 - 29	0 -13	0 - 19	- 30	- 46	- 74	0 -120	± 6.5	± 9.5
80	120	- ⁰	-120 -142	- 72 - 94	- 36 - 58	- 12 - 27	- 12 - 34	0 -15	0 - 22	0 - 35	0 - 54	- 87	0 -140	± 7.5	± 11
120	180	0 - 25	-145 -170	- 85 -110	- 43 - 68	- 14 - 32	- 14 - 39	0 -18	0 -25	- ⁰	- 63	0 100	0 -160	± 9	± 12.5
180	250	- 30	-170 -199	- 100 - 129	- 50 - 79	- 15 - 35	- 15 - 44	0 -20	0 -29	- ⁰	- ⁰ 72	0 -115	0 -185	±10	± 14.5
250	315	0 - 35	-190 -222	-110 -142	- 56 - 88	- 17 - 40	- 17 - 49	0 -23	0 -32	0 - 52	0 - 81	0 -130	0 -210	± 11.5	± 16
315	400	- 40	-210 -246	- 125 - 161	- 62 - 98	- 18 - 43	- 18 - 54	0 -25	0 -36	0 - 57	0 - 89	0 -140	0 -230	± 12.5	± 18
400	500	0 - 45	-230 -270	135 175	- 68 - 108	- 20 - 47	- 20 - 60	0 -27	0 - 40	- 63	- 97	0 155	0 -250	± 13.5	± 20
500	630	0 - 50	-260 -304	- 145 - 189	- 76 -120	_	- 22 - 66	_	0 - 44	- ⁰	0 -110	0 175	0 -280	_	± 22
630	800	0 - 75	-290 -340	-160 -210	- 80 -130	_	- 24 - 74	_	0 -50	- 80	0 125	0 -200	0 -320	_	± 25
800	1 000	0 -100	-320 -376	-170 -226	- 86 -142	_	- 26 - 82	_	0 - 56	- ⁰	0 -140	0 -230	0 -360	_	± 28
1 000	1 250	0 -125	-350 -416	- 195 - 261	- 98 -164	_	- 28 - 94	_	0 -66	0 -105	0 165	0 -260	0 -420	_	± 33
1 250	1 600	0 -160	-390 -468	-220 -298	-110 -188	_	- 30 -108	_	0 - 78	0 -125	0 195	-310	0 -500	_	± 39
1 600	2 000	0 -200	-430 -522	-240 -332	120 212	_	- 32 -124	_	0 - 92	0 150	0 -230	0 -370	0 -600	_	± 46

for Shai	it Diaiii	eter 3										U	nits : μ m
j5	j6	j7	k5	k6	k7	m5	m6	n6	р6	r6	r7	Diameter Cl (m	
Jo	Jo	J'	KJ	KU	K/	шэ	1110	110	рo	10	17	over	incl.
+ 3 - 2	+ 6 - 2	+ 8 - 4	+ 6 + 1	+ 9 + 1	+ 13 + 1	+ 9 + 4	+ 12 + 4	+ 16 + 8	+ 20 + 12	+ 23 + 15	+ 27 + 15	3	6
+ 4 - 2	+ 7 - 2	+ 10 - 5	+ 7 + 1	+ 10 + 1	+ 16 + 1	+ 12 + 6	+ 15 + 6	+ 19 + 10	+ 24 + 15	+ 28 + 19	+ 34 + 19	6	10
+ 5 - 3	+ 8 - 3	+ 12	+ 9 + 1	+ 12 + 1	+ 19 + 1	+ 15 + 7	+ 18 + 7	+ 23 + 12	+ 29 + 18	+ 34 + 23	+ 41 + 23	10	18
+ 5 - 4	+ 9 - 4	+ 13 - 8	+ 11 + 2	+ 15 + 2	+ 23 + 2	+ 17 + 8	+ 21 + 8	+ 28 + 15	+ 35 + 22	+ 41 + 28	+ 49 + 28	18	30
+ 6 - 5	+ 11 - 5	+ 15 10	+ 13 + 2	+ 18 + 2	+ 27 + 2	+ 20 + 9	+ 25 + 9	+ 33 + 17	+ 42 + 26	+ 50 + 34	+ 59 + 34	30	50
+ 6	+ 12 - 7	+ 18	+ 15	+ 21	+ 32	+ 24	+ 30	+ 39	+ 51	+ 60 + 41	+ 71 + 41	50	65
- 7	- 7	-12	+ 2	+ 2	+ 2	+ 11	+ 11	+ 20	+ 32	+ 62 + 43	+ 73 + 43	65	80
+ 6	+ 13	+ 20	+ 18	+ 25	+ 38	+ 28	+ 35	+ 45	+ 59	+ 73 + 51	+ 86 + 51	80	100
- 9	- 9	– 15	+ 3	+ 3	+ 3	+ 13	+ 13	+ 23	+ 37	+ 76 + 54	+ 89 + 54	100	120
										+ 88 + 63	+ 103 + 63	120	140
+ 7 —11	+ 14 — 11	+ 22 18	+ 21 + 3	+ 28 + 3	+ 43 + 3	+ 33 + 15	+ 40 + 15	+ 52 + 27	+ 68 + 43	+ 90 + 65	+ 105 + 65	140	160
										+ 93 + 68	+ 108 + 68	160	180
										+ 106 + 77	+ 123 + 77	180	200
+ 7 -13	+ 16 13	+ 25 21	+ 24 + 4	+ 33 + 4	+ 50 + 4	+ 37 + 17	+ 46 + 17	+ 60 + 31	+ 79 + 50	+ 109 + 80	+ 126 + 80	200	225
										+ 113 + 84	+ 130 + 84	225	250
+ 7	± 16	± 26	+ 27	+ 36	+ 56	+ 43	+ 52	+ 66	+ 88	+ 126 + 94	+ 146 + 94	250	280
-16			+ 4	+ 4	+ 4	+ 20	+ 20	+ 34	+ 56	+ 130 + 98	+ 150 + 98	280	315
+ 7	± 18	+ 29	+ 29	+ 40	+ 61	+ 46	+ 57	+ 73	+ 98	+ 144 + 108	+ 165 + 108	315	355
-18	± 10	- 28	+ 4	+ 4	+ 4	+ 21	+ 21	+ 37	+ 62	+ 150 + 114	+ 171 + 114	355	400
+ 7	1.20	+ 31	+ 32	+ 45	+ 68	+ 50	+ 63	+ 80	+ 108	+ 166 + 126	+ 189 + 126	400	450
-20	± 20	-32	+ 5	+ 5	+ 5	+ 23	+ 23	+ 40	+ 68	+ 172 + 132	+ 195 + 132	450	500
				+ 44	+ 70		+ 70	+ 88	+ 122	+ 194 + 150	+ 220 + 150	500	560
_	_	_		0	0	_	+ 26	+ 44	+ 78	+ 199 + 155	+ 225 + 155	560	630
				+ 50	+ 80		+ 80	+ 100	+ 138	+ 225 + 175	+ 255 + 175	630	710
	_	_	1	0	0		+ 30	+ 50	+ 88	+ 235 + 185	+ 265 + 185	710	800
		_		+ 56	+ 90		+ 90	+ 112	+ 156	+ 266 + 210 + 276	+ 300 + 210 + 310	800	900
				0	0		+ 34	+ 56	+ 100	+ 220	+ 220	900	1 000
_	_	_	_	+ 66	+ 105	_	+ 106	+ 132	+ 186	+ 316 + 250 + 326	+ 355 + 250	1 000	1 120
				0	0		+ 40	+ 66	+ 120	+ 260	+ 365 + 260	1 120	1 250
_	_	_	_	+ 78	+ 125	_	+ 126	+ 156	+ 218	+ 378 + 300	+ 425 + 300	1 250	1 400
				0	0		+ 48	+ 78	+ 140	+ 408 + 330	+ 455 + 330	1 400	1 600
_	_	_	_	+ 92	+ 150	_	+ 150	+ 184	+ 262	+ 462 + 370	+ 520 + 370	1 600	1 800
				0	0		+ 58	+ 92	+ 170	+ 492 + 400	+ 550 + 400	1 800	2 000

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Appendix Table 10

	neter ition (mm) incl.	Single Plane Mean O.D. Deviation (Normal) Dmp	E6	F6	F7	G6	G7	Н6	H7	Н8	J6	J7	JS6	JS7
10	18	0 - 8	+ 43 + 32	+ 27 + 16	+ 34 + 16	+ 17 + 6	+ 24 + 6	+ 11	+ 18	+ 27	+ 6 - 5	+ 10 - 8	± 5.5	± 9
18	30	- ⁰	+ 53 + 40	+ 33 + 20	+ 41 + 20	+ 20 + 7	+ 28 + 7	+ 13	+ 21	+ 33	+ 8 - 5	+ 12 - 9	± 6.5	± 10.5
30	50	0 - 11	+ 66 + 50	+ 41 + 25	+ 50 + 25	+ 25 + 9	+ 34 + 9	+ 16	+ 25	+ 39	+ 10 — 6	+ 14 — 11	± 8	± 12.5
50	80	0 - 13	+ 79 + 60	+ 49 + 30	+ 60 + 30	+ 29 + 10	+ 40 + 10	+ 19	+ 30	+ 46	+ 13 - 6	+ 18 12	± 9.5	± 15
80	120	0 - 15	+ 94 + 72	+ 58 + 36	+ 71 + 36	+ 34 + 12	+ 47 + 12	+ 22	+ 35	+ 54	+ 16 — 6	+ 22 — 13	± 11	± 17.5
120 150	150 180	0 - 18 0 - 25	+ 110 + 85	+ 68 + 43	+ 83 + 43	+ 39 + 14	+ 54 + 14	+ 25 0	+ 40	+ 63	+ 18 — 7	+ 26 14	± 12.5	± 20
180	250	0 - 30	+ 129 + 100	+ 79 + 50	+ 96 + 50	+ 44 + 15	+ 61 + 15	+ 29 0	+ 46	+ 72	+ 22 — 7	+ 30 — 16	± 14.5	± 23
250	315	0 - 35	+ 142 + 110	+ 88 + 56	+ 108 + 56	+ 49 + 17	+ 69 + 17	+ 32	+ 52	+ 81	+ 25 — 7	+ 36 — 16	± 16	± 26
315	400	0 - 40	+ 161 + 125	+ 98 + 62	+ 119 + 62	+ 54 + 18	+ 75 + 18	+ 36	+ 57 0	+ 89	+ 29 — 7	+ 39 — 18	± 18	± 28.5
400	500	0 - 45	+ 175 + 135	+ 108 + 68	+ 131 + 68	+ 60 + 20	+ 83 + 20	+ 40	+ 63	+ 97	+ 33 — 7	+ 43 — 20	± 20	± 31.5
500	630	0 - 50	+ 189 + 145	+ 120 + 76	+ 146 + 76	+ 66 + 22	+ 92 + 22	+ 44	+ 70 0	+ 110	_	_	± 22	± 35
630	800	0 - 75	+ 210 + 160	+ 130 + 80	+ 160 + 80	+ 74 + 24	+ 104 + 24	+ 50	+ 80	+ 125 0	_	_	± 25	± 40
800	1 000	0 - 100	+ 226 + 170	+ 142 + 86	+ 176 + 86	+ 82 + 26	+ 116 + 26	+ 56	+ 90	+ 140	_	_	± 28	± 45
1 000	1 250	0 125	+ 261 + 195	+ 164 + 98	+ 203 + 98	+ 94 + 28	+ 133 + 28	+ 66	+ 105 0	+ 165 0	_	_	± 33	± 52.5
1 250	1 600	0 160	+ 298 + 220	+ 188 + 110	+ 235 + 110	+ 108 + 30	+ 155 + 30	+ 78	+ 125 0	+ 195 0			± 39	± 62.5
1 600	2 000	0 - 200	+ 332 + 240	+ 212 + 120	+ 270 + 120	+ 124 + 32	+ 182 + 32	+ 92 0	+ 150 0	+ 230 0	_	_	± 46	± 75
2 000	2 500	0 250	+ 370 + 260	+ 240 + 130	+ 305 + 130	+ 144 + 34	+ 209 + 34	+ 110 0	+ 175 0	+ 280 0	_	_	± 55	± 87.5

Tolerances for Housing Bore Diameters

ī	Inits	
U.	mus	ıım -

											Diameter CI (m	
K5	K6	K7	M5	M6	M7	N5	N6	N7	P6	P7	over	incl.
+ 2 - 6	+ 2 - 9	+ 6 - 12	- 4 -12	- 4 - 15	0 - 18	- 9 -17	- 9 - 20	- 5 - 23	- 15 - 26	- 11 - 29	10	18
+ 1 - 8	+ 2 - 11	+ 6 - 15	- 5 -14	- 4 - 17	0 - 21	- 12 - 21	- 11 - 24	- 7 - 28	- 18 - 31	- 14 - 35	18	30
+ 2	+ 3 - 13	+ 7 - 18	- 5 -16	- 4 - 20	0 - 25	-13 -24	- 12 - 28	- 8 - 33	- 21 - 37	- 17 - 42	30	50
+ 3 -10	+ 4 - 15	+ 9 - 21	- 6 -19	- 5 - 24	- 30	- 15 - 28	- 14 - 33	- 9 - 39	- 26 - 45	- 21 - 51	50	80
+ 2 -13	+ 4 - 18	+ 10 - 25	- 8 -23	- 6 - 28	0 - 35	-18 -33	- 16 - 38	- 10 - 45	- 30 - 52	- 24 - 59	80	120
+ 3 -15	+ 4 - 21	+ 12 - 28	- 9 -27	- 8 - 33	- 40	-21 -39	- 20 - 45	- 12 - 52	- 36 - 61	- 28 - 68	120	180
+ 2 -18	+ 5 - 24	+ 13 - 33	-11 -31	- 8 - 37	0 - 46	- 25 - 45	- 22 - 51	- 14 - 60	- 41 - 70	- 33 - 79	180	250
+ 3 -20	+ 5 - 27	+ 16 - 36	-13 -36	- 9 - 41	0 - 52	- 27 - 50	- 25 - 57	- 14 - 66	- 47 - 79	- 36 - 88	250	315
+ 3 -22	+ 7 - 29	+ 17 - 40	-14 -39	- 10 - 46	0 - 57	-30 -55	- 26 - 62	- 16 - 73	- 51 - 87	- 41 - 98	315	400
+ 2 -25	+ 8 - 32	+ 18 - 45	-16 -43	- 10 - 50	- 63	-33 -60	- 27 - 67	- 17 - 80	- 55 - 95	- 45 -108	400	500
_	0 - 44	- ⁰	_	- 26 - 70	- 26 - 96	_	- 44 - 88	- 44 -114	- 78 -122	- 78 -148	500	630
_	- 50	- 80	_	- 30 - 80	- 30 -110	_	- 50 -100	- 50 -130	- 88 -138	- 88 -168	630	800
_	0 - 56	- 90	_	- 34 - 90	- 34 -124	_	- 56 -112	- 56 -146	-100 -156	-100 -190	800	1 000
_	- 66	0 - 105	_	- 40 -106	- 40 -145	_	- 66 -132	- 66 -171	-120 -186	- 120 - 225	1 000	1 250
	0 - 78	0 125	_	- 48 -126	- 48 -173	_	- 78 -156	- 78 -203	-140 -218	-140 -265	1 250	1 600
	0 - 92	0 150	_	- 58 -150	- 58 -208	_	- 92 -184	- 92 -242	-170 -262	- 170 - 320	1 600	2 000
_	0 -110	0 175	_	- 68 -178	- 68 -243	_	- 110 - 220	-110 -285	- 195 - 305	- 195 - 370	2 000	2 500

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Appendix Table 11 Values of

Basic	Size	Stan										Standard
(m	m)	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11
over	incl.					Tol	erances (μ	m)				
_	3	0.8	1.2	2	3	4	6	10	14	25	40	60
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90
10	18	1.2	2	3	5	8	11	18	27	43	70	110
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160
50	80	2	3	5	8	13	19	30	46	74	120	190
80	120	2.5	4	6	10	15	22	35	54	87	140	220
120	180	3.5	5	8	12	18	25	40	63	100	160	250
180	250	4.5	7	10	14	20	29	46	72	115	185	290
250	315	6	8	12	16	23	32	52	81	130	210	320
315	400	7	9	13	18	25	36	57	89	140	230	360
400	500	8	10	15	20	27	40	63	97	155	250	400
500	630	9	11	16	22	32	44	70	110	175	280	440
630	800	10	13	18	25	36	50	80	125	200	320	500
800	1 000	11	15	21	28	40	56	90	140	230	360	560
1 000	1 250	13	18	24	33	47	66	105	165	260	420	660
1 250	1 600	15	21	29	39	55	78	125	195	310	500	780
1 600	2 000	18	25	35	46	65	92	150	230	370	600	920
2 000	2 500	22	30	41	55	78	110	175	280	440	700	1 100
2 500	3 150	26	36	50	68	96	135	210	330	540	860	1 350

Remarks 1. Standard tolerance grades IT14 to IT18 shall not be used for basic sizes less than or equal to 1 mm.

Standard Tolerance Grades IT

Grades			Basic Size					
IT12	IT13	IT14	IT15	IT16	IT17	IT18	(n	nm)
		Tole	erances (m	nm)			over	incl.
0.10	0.14	0.25	0.40	0.60	1.00	1.40	_	3
0.12	0.18	0.30	0.48	0.75	1.20	1.80	3	6
0.15	0.22	0.36	0.58	0.90	1.50	2.20	6	10
0.18	0.27	0.43	0.70	1.10	1.80	2.70	10	18
0.21	0.33	0.52	0.84	1.30	2.10	3.30	18	30
0.25	0.39	0.62	1.00	1.60	2.50	3.90	30	50
0.30	0.46	0.74	1.20	1.90	3.00	4.60	50	80
0.35	0.54	0.87	1.40	2.20	3.50	5.40	80	120
0.40	0.63	1.00	1.60	2.50	4.00	6.30	120	180
0.46	0.72	1.15	1.85	2.90	4.60	7.20	180	250
0.52	0.81	1.30	2.10	3.20	5.20	8.10	250	315
0.57	0.89	1.40	2.30	3.60	5.70	8.90	315	400
0.63	0.97	1.55	2.50	4.00	6.30	9.70	400	500
0.70	1.10	1.75	2.80	4.40	7.00	11.00	500	630
0.80	1.25	2.00	3.20	5.00	8.00	12.50	630	800
0.90	1.40	2.30	3.60	5.60	9.00	14.00	800	1 000
1.05	1.65	2.60	4.20	6.60	10.50	16.50	1 000	1 250
1.25	1.95	3.10	5.00	7.80	12.50	19.50	1 250	1 600
1.50	2.30	3.70	6.00	9.20	15.00	23.00	1 600	2 000
1.75	2.80	4.40	7.00	11.00	17.50	28.00	2 000	2 500
2.10	3.30	5.40	8.60	13.50	21.00	33.00	2 500	3 150

^{2.} Values for standard tolerance grades IT1 to IT5 for basic sizes over 500 mm are included for experimental use.



Appedix Table 12 Speed Factor $f_{\rm n}$

Appendix Table 13 Fatigue Life Factor f_{n} and Fatigue Life $L \cdot L_{\mathrm{h}}$

Ball Bearings $f_{\rm n}$ = (0.03 n) $^{-1/3}$ Roller Bearings $f_{\rm n}$ = (0.03 n) $^{-3/10}$

Ball Bearings $L=(C/P)^3$ $L_h=500$ f_h^3 Roller Bearings $L=(C/P)^{10/3}$ $L_h=500$ $f_h^{10/3}$

Speed	Speed F	actor $f_{ m n}$	Speed	Speed F	actor $f_{ m n}$		Speed	Speed F	actor $f_{ m n}$
<i>n</i> (min ⁻¹)	Ball Bearings	Roller Bearings	<i>n</i> (min ⁻¹)	Ball Bearings	Roller Bearings	•	<i>n</i> (min ⁻¹)	Ball Bearings	Roller Bearings
10	1.49	1.44	180	0.570	0.603	•	3 000	0.223	0.259
11	1.45	1.39	190	0.560	0.593		3 200	0.218	0.254
12	1.41	1.36	200	0.550	0.584		3 400	0.214	0.250
13	1.37	1.33	220	0.533	0.568		3 600	0.210	0.245
14	1.34	1.30	240	0.518	0.553		3 800	0.206	0.242
15	1.30	1.27	260	0.504	0.540		4 000	0.203	0.238
16	1.28	1.25	280	0.492	0.528		4 200	0.199	0.234
17	1.25	1.22	300	0.481	0.517		4 400	0.196	0.231
18	1.23	1.20	320	0.471	0.507		4 600	0.194	0.228
19	1.21	1.18	340	0.461	0.498		4 800	0.191	0.225
20	1.19	1.17	360	0.452	0.490		5 000	0.188	0.222
21	1.17	1.15	380	0.444	0.482		5 200	0.186	0.220
22	1.15	1.13	400	0.437	0.475		5 400	0.183	0.217
23	1.13	1.12	420	0.430	0.468		5 600	0.181	0.215
24	1.12	1.10	440	0.423	0.461		5 800	0.179	0.213
25 26 27 28 29	1.10 1.09 1.07 1.06 1.05	1.09 1.08 1.07 1.05 1.04	460 480 500 550 600	0.417 0.411 0.405 0.393 0.382	0.455 0.449 0.444 0.431 0.420		6 000 6 200 6 400 6 600 6 800	0.177 0.175 0.173 0.172 0.170	0.211 0.209 0.207 0.207 0.205 0.203
30	1.04	1.03	650	0.372	0.410		7 000	0.168	0.201
31	1.02	1.02	700	0.362	0.401		7 200	0.167	0.199
32	1.01	1.01	750	0.354	0.393		7 400	0.165	0.198
33.3	1.00	1.00	800	0.347	0.385		7 600	0.164	0.196
34	0.993	0.994	850	0.340	0.378		7 800	0.162	0.195
36	0.975	0.977	900	0.333	0.372		8 000	0.161	0.193
38	0.957	0.961	950	0.327	0.366		8 500	0.158	0.190
40	0.941	0.947	1 000	0.322	0.360		9 000	0.155	0.186
42	0.926	0.933	1 050	0.317	0.355		9 500	0.152	0.183
44	0.912	0.920	1 100	0.312	0.350		10 000	0.149	0.181
46	0.898	0.908	1 150	0.307	0.346		11 000	0.145	0.176
48	0.886	0.896	1 200	0.303	0.341		12 000	0.141	0.171
50	0.874	0.885	1 250	0.299	0.337		13 000	0.137	0.167
55	0.846	0.861	1 300	0.295	0.333		14 000	0.134	0.163
60	0.822	0.838	1 400	0.288	0.326		15 000	0.130	0.160
65	0.800	0.818	1 500	0.281	0.319		16 000	0.128	0.157
70	0.781	0.800	1 600	0.275	0.313		17 000	0.125	0.154
75	0.763	0.784	1 700	0.270	0.307		18 000	0.123	0.151
80	0.747	0.769	1 800	0.265	0.302		19 000	0.121	0.149
85	0.732	0.755	1 900	0.260	0.297		20 000	0.119	0.147
90	0.718	0.742	2 000	0.255	0.293		22 000	0.115	0.143
95	0.705	0.730	2 100	0.251	0.289		24 000	0.112	0.139
100	0.693	0.719	2 200	0.247	0.285		26 000	0.109	0.136
110	0.672	0.699	2 300	0.244	0.281		28 000	0.106	0.133
120	0.652	0.681	2 400	0.240	0.277		30 000	0.104	0.130
130	0.635	0.665	2 500	0.237	0.274		32 000	0.101	0.127
140	0.620	0.650	2 600	0.234	0.271		34 000	0.099	0.125
150	0.606	0.637	2 700	0.231	0.268		36 000	0.097	0.123
160	0.593	0.625	2 800	0.228	0.265		38 000	0.096	0.121
170	0.581	0.613	2 900	0.226	0.262		40 000	0.094	0.119

									=500 <i>I</i> h ^{10/3}
	Ball Bear	ing Life	Roller Bea	aring Life		Ball Bear	ing Life	Roller Be	aring Life
$\it C/P$ or $\it f_{\! h}$	L	$L_{ m h}$	L	$L_{ m h}$	$\it C/P$ or $\it f_{\rm h}$	L	$L_{ m h}$	L	$L_{ m h}$
	(10 ⁶ rev)	(h)	(10 ⁶ rev)	(h)		(10 ⁶ rev)	(h)	(10 ⁶ rev)	(h)
0.70	0.34	172	0.30	152	3.45	41.1	20 500	62.0	31 000
0.75	0.42	211	0.38	192	3.50	42.9	21 400	65.1	32 500
0.80	0.51	256	0.48	238	3.55	44.7	22 400	68.2	34 100
0.85	0.61	307	0.58	291	3.60	46.7	23 300	71.5	35 800
0.90	0.73	365	0.70	352	3.65	48.6	24 300	74.9	37 400
0.95	0.86	429	0.84	421	3.70	50.7	25 300	78.3	39 200
1.00	1.00	500	1.00	500	3.75	52.7	26 400	81.9	41 000
1.05	1.16	579	1.18	588	3.80	54.9	27 400	85.6	42 800
1.10	1.33	665	1.37	687	3.85	57.1	28 500	89.4	44 700
1.15	1.52	760	1.59	797	3.90	59.3	29 700	93.4	46 700
1.20	1.73	864	1.84	918	3.95	61.6	30 800	97.4	48 700
1.25	1.95	977	2.10	1 050	4.00	64.0	32 000	102	50 800
1.30	2.20	1 100	2.40	1 200	4.05	66.4	33 200	106	52 900
1.35	2.46	1 230	2.72	1 360	4.10	68.9	34 500	110	55 200
1.40	2.74	1 370	3.07	1 530	4.15	71.5	35 700	115	57 400
1.45	3.05	1 520	3.45	1 730	4.20	74.1	37 000	120	59 800
1.50	3.38	1 690	3.86	1 930	4.25	76.8	38 400	124	62 200
1.55	3.72	1 860	4.31	2 150	4.30	79.5	39 800	129	64 600
1.60	4.10	2 050	4.79	2 400	4.35	82.3	41 200	134	67 200
1.65	4.49	2 250	5.31	2 650	4.40	85.2	42 600	140	69 800
1.70	4.91	2 460	5.86	2 930	4.45	88.1	44 100	145	72 500
1.75	5.36	2 680	6.46	3 230	4.50	91.1	45 600	150	75 200
1.80	5.83	2 920	7.09	3 550	4.55	94.2	47 100	156	78 000
1.85	6.33	3 170	7.77	3 890	4.60	97.3	48 700	162	80 900
1.90	6.86	3 430	8.50	4 250	4.65	101	50 300	168	83 900
1.95	7.41	3 710	9.26	4 630	4.70	104	51 900	174	87 000
2.00	8.00	4 000	10.1	5 040	4.75	107	53 600	180	90 100
2.05	8.62	4 310	10.9	5 470	4.80	111	55 300	187	93 300
2.10	9.26	4 630	11.9	5 930	4.85	114	57 000	193	96 600
2.15	9.94	4 970	12.8	6 410	4.90	118	58 800	200	99 900
2.20	10.6	5 320	13.8	6 920	4.95	121	60 600	207	103 000
2.25	11.4	5 700	14.9	7 460	5.00	125	62 500	214	107 000
2.30	12.2	6 080	16.1	8 030	5.10	133	66 300	228	114 000
2.35	13.0	6 490	17.3	8 630	5.20	141	70 300	244	122 000
2.40	13.8	6 910	18.5	9 250	5.30	149	74 400	260	130 000
2.45	14.7	7 350	19.8	9 910	5.40	157	78 700	276	138 000
2.50	15.6	7 810	21.2	10 600	5.50	166	83 200	294	147 000
2.55	16.6	8 290	22.7	11 300	5.60	176	87 800	312	156 000
2.60	17.6	8 790	24.2	12 100	5.70	185	92 600	331	165 000
2.65	18.6	9 300	25.8	12 900	5.80	195	97 600	351	175 000
2.70	19.7	9 840	27.4	13 700	5.90	205	103 000	371	186 000
2.75	20.8	10 400	29.1	14 600	6.00	216	108 000	392	196 000
2.80	22.0	11 000	30.9	15 500	6.50	275	137 000	513	256 000
2.85	23.1	11 600	32.8	16 400	7.00	343	172 000	656	328 000
2.90	24.4	12 200	34.8	17 400	7.50	422	211 000	826	413 000
2.95 3.00 3.05 3.10 3.15	25.7 27.0 28.4 29.8 31.3	12 800 13 500 14 200 14 900 15 600	36.8 38.9 41.1 43.4 45.8	18 400 19 500 20 600 21 700 22 900	8.00 8.50 9.00 9.50 10.0	512 614 729 857 1 000	256 000 307 000 365 000 429 000	1 020 1 250 1 520 1 820 2 150	512 000 627 000 758 000 908 000
3.20 3.25 3.30 3.35 3.40	32.8 34.3 35.9 37.6 39.3	16 400 17 200 18 000 18 800 19 700	48.3 50.8 53.5 56.3 59.1	24 100 25 400 26 800 28 100 29 600	11.0 12.0 13.0 14.0 15.0	1 330 1 730 2 200 2 740 3 380	_ _ _ _	2 960 3 960 5 170 6 610 8 320	_ _ _ _ _

C 24 C 25



Appendix Table14 Index of Inch Design Tapered Roller Bearings

Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages
332	D 80.000	B140,B144,B146	497	d 85.725	B162	657	d 73.025	B158	1328	D 52.388	B136
336	d 41.275	B146	498	d 84.138	B162	658	d 74.612	B158	1329	D 53.975	B136
342	d 41.275	B146	522	D 101.600	B148,B150	659	d 76.200	B158	1380	d 22.225	B136
342 S	d 42.875	B146	528	d 47.625	B148	661	d 79.375	B160	1620	D 66.675	B142
344	d 40.000	B144	529	d 50.800	B150	663	d 82.550	B160	1680	d 33.338	B142
344 A	d 40.000	B144	529 X	d 50.800	B150	664	d 84.138	B162	1729	D 56.896	B136,B138
346	d 31.750	B140	532 X	D 107.950	B152	665	d 85.725	B162	1755	d 22.225	B136
354 A	D 85.000	B148	539	d 53.975	B152	665 A	d 85.725	B162	1779	d 23.812	B138
359 S	d 46.038	B148	552 A	D 123.825	B152,B154,B156	672	D 168.275	B162,B164,B166	1922	D 57.150	B138
362 A	D 88.900	B148,B150	553 X	<i>D</i> 122.238	B154,B156	677	d 85.725	B162	1988	d 28.575	B138
366	d 50.000	B150	555 S	<i>d</i> 57.150	B152	681	d 92.075	B164	1997 X	d 26.988	B138
368	d 50.800	B150	557 S	<i>d</i> 53.975	B152	683	d 95.250	B164	A2047	d 12.000	B136
368 A	d 50.800	B150	558	d 60.325	B154	685	d 98.425	B164	A2126	D 31.991	B136
369 A	d 47.625	B148	559	d 63.500	B154	687	d 101.600	B166	2523	D 69.850	B140,B142
372	D 100.000	B150	560	d 66.675	B156	742	D 150.089	B156,B160,B162	2558	d 30.162	B140
374	D 93.264	B148	560 S	d 68.262	B156	743	D 150.000	B160	2559	d 30.162	B140
376	d 45.000	B148	563	D 127.000	B154,B156,B158	745 A	d 69.850	B156	2580	d 31.750	B140
377	d 52.388	B150	563 X	D 127.000	B156	749	d 85.026	B162	2582	d 31.750	B140
382	D 98.425	B152	565	d 63.500	B154	749 A	d 82.550	B160	2585	d 33.338	B142
382 A	D 96.838	B152	566	d 69.850	B156	749 S	d 85.026	B162	2631	D 66.421	B140
382 S	D 96.838	B152	567	d 73.025	B158	750	d 79.375	B160	2690	d 29.367	B140
385	d 55.000	B152	567 A	 d 71.438 d 71.438 d 73.817 	B158	752	D 161.925	B160,B162	2720	D 76.200	B144
387	d 57.150	B152	567 S		B158	753	D 168.275	B160,B162	2729	D 76.200	B144
387 A	d 57.150	B152	568		B158	757	d 82.550	B160	2735 X	D 73.025	B144
388 A	d 57.531	B152	569	d 64.963	B154	758	d 85.725	B162	2788	d 38.100	B144
390 A	d 63.500	B154	570	d 68.262	B156	759	d 88.900	B162	2789	d 39.688	B144
394 A	D 110.000	B154,B156	572	D 139.992	B158,B160	760	d 90.488	B162	2820	D 73.025	B142
395	d 63.500	B154	572 X	<i>D</i> 139.700	B160	766	d 88.900	B162	2877	d 34.925	B142
395 A	d 66.675	B156	575	<i>d</i> 76.200	B158	772	D 180.975	B164,B166	2924	D 85.000	B148
395 S	d 66.675	B156	580	<i>d</i> 82.550	B160	776	d 95.250	B164	2984	d 46.038	B148
397	d 60.000	B154	581	d 80.962	B160	779	 d 98.425 d 101.600 d 104.775 	B164	3120	D 72.626	B140,B142
399 A	d 68.262	B156	582	d 82.550	B160	780		B166	3188	d 31.750	B140
414	D 88.501	B144	590 A	d 76.200	B158	782		B166	3197	d 33.338	B142
418	d 38.100	B144	592	<i>D</i> 152.400	B164	787	 d 104.775 D 206.375 d 120.650 	B166	3320	D 80.167	B144
432	D 95.250	B146	592 A	<i>D</i> 152.400	B158,B162,B164	792		B168	3386	d 39.688	B144
432 A	D 95.250	B148	593	<i>d</i> 88.900	B162	795		B168	3420	D 79.375	B142,B144
436	d 46.038	B148	594	d 95.250	B164	797	 d 130.000 d 128.588 d 130.175 	B168	3478	d 34.925	B142
438	d 44.450	B146	596	d 85.725	B162	799		B168	3479	d 36.512	B144
453 A	D 107.950	B148	597	d 93.662	B164	799 A		B168	3490	d 38.100	B144
453 X	D 104.775	B152	598	 d 92.075 d 92.075 D 115.000 	B164	832	D 168.275	B160,B162	3525	D 87.312	B146
460	d 44.450	B148	598 A		B164	837	d 76.200	B160	3576	d 41.275	B146
462	d 57.150	B152	614 X		B152	842	d 82.550	B160	3578	d 44.450	B146
469	d 57.150	B152	622 X	d 55.000	B152	843	d 76.200	B160	3720	D 93.264	B146
472	D 120.000	B156,B158	632	D 136.525	B154,B158	850	d 88.900	B162	3730	D 93.264	B150
472 A	D 120.000	B156	633	D 130.175	B154,B156,B158	854	D 190.500	B162,B164,B166	3775	d 50.800	B150
478	d 65.000	B156	637	d 60.325	B154	855	d 88.900	B162	3780	d 50.800	B150
480	d 68.262	B156	639	d 63.500	B154	857	d 92.075	B164	3782	d 44.450	B146
484	d 70.000	B158	643	d 69.850	B156	861	d 101.600	B166	3820	D 85.725	B146
492 A	D 133.350	B160,B162	644	 d 71.438 d 71.438 D 152.400 	B158	864	d 95.250	B164	3877	d 41.275	B146
493	D 136.525	B158,B160,B162	645		B158	866	d 98.425	B164	3920	D 112.712	B154,B156
495	d 82.550	B160	652		B158,B160	932	D 212.725	B166	3926	D 112.712	B152,B154
495 A	d 76.200	B158	653	<i>D</i> 146.050	B156,B158,B160,B162	938	 d 114.300 D 57.150 d 22.225 	B166	3981	d 58.738	B152
495 AX	d 76.200	B158	653 X	<i>D</i> 150.000	B158	1220		B136	3982	d 63.500	B154
496	d 80.962	B160	655	<i>d</i> 69.850	B156	1280		B136	3984	d 66.675	B156



Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mn d :CONE (Bore Dia.) D :CUP (Outside Dia	Pages	Bearing No. CONE, CUP	d :C0	nal Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages
3994 A4050 A4059	d 66.675 d 12.700 d 15.000	B156 B136 B136	02820 02872 02878	D 73.025 d 28.575 d 34.925	B138,B142 B138 B142	13685 13687 13830	d 38.100 d 38.100 D 63.500	B144 B144 B144	19150 19268 21075	d D d	38.100 68.262 19.050	B144 B142,B144 B136
A4138 4335 4388	D 34.988 D 90.488 d 41.275	B136 B146 B146	03062 03162 05062	<i>d</i> 15.875 <i>D</i> 41.275 <i>d</i> 15.875	B136 B136 B136	13889 14123 A 14125 A	 d 38.100 d 31.750 d 31.750 	B140	21212 L21511 L21549	D D d	53.975 34.988 15.875	B136 B136 B136
4535 4595 A 5069	D 104.775 d 53.975 d 17.455	B152 B152 B136	05068 05075 05079	<i>d</i> 17.462 <i>d</i> 19.050 <i>d</i> 19.990	B136 B136 B136	14130 14131 14137 A	 d 33.338 d 33.338 d 34.925 	B142	22168 22325 23100	d D d	42.862 82.550 25.400	B146 B146 B138
A5144 5335 5356	D 36.525 D 103.188 d 44.450	B136 B148 B148	05175 05185 07079	D 44.450 D 47.000 d 20.000	B136 B136 B136	14138 A 14139 14274	 d 34.925 d 34.976 D 69.012 	B142	23256 23621 23691	D D d	65.088 73.025 35.000	B138 B142 B142
5535 5566 5582	D 122.238 d 55.562 d 60.325	B152,B154 B152 B154	07087 07097 07098	 d 22.225 d 25.000 d 24.981 	B136 B138 B138	14276 14283 15100	D 69.012 D 72.085 d 25.400	B140,B142 B142 B138	24720 24721 24780	D D d	76.200 76.200 41.275	B146 B146 B146
5584 5735 5760	d 63.500 D 135.733 d 76.200	B154 B158,B160 B158	07100 07100SA 07196	d 25.400 d 25.400 D 50.005	B138 B138 B136,B138	15101 15106 15112	d 25.400 d 26.988 d 28.575	B138	25520 25521 25523	D D D	82.931 83.058 82.931	B146,B148 B146 B146,B148
5795 A6062 A6067	d 77.788 d 15.875 d 16.993	B160 B136 B136	07204 07205 08118	<i>D</i> 51.994 <i>D</i> 52.001 <i>d</i> 30.162	B136,B138 B138 B140	15113 15116 15117	 d 28.575 d 30.112 d 30.000 	B140	25577 25578 25580	d d d	42.875 42.862 44.450	B146 B146 B146
A6075 A6157 6220	<i>d</i> 19.050 <i>D</i> 39.992 <i>D</i> 127.000	B136 B136 B150,B152	08125 08231 09062	d 31.750 D 58.738 d 15.875	B140 B140 B136	15118 15119 15120	 d 30.213 d 30.213 d 30.213 	B140	25584 25590 25820	d d D	44.983 45.618 73.025	B148 B148 B142
6279 6280 6320	d 50.800 d 53.975 D 135.755	B150 B152 B154,B156	09067 09074 09078	<i>d</i> 19.050 <i>d</i> 19.050 <i>d</i> 19.050	B136 B136 B136	15123 15125 15126	 d 31.750 d 31.750 d 31.750 	B140	25821 25877 25878	D d d	73.025 34.925 34.925	B142,B144 B142 B142
6376 6379 6420	 d 60.325 d 65.088 D 149.225 	B154 B156 B152,B156,B158	09081 09194 09195	d 20.625 D 49.225 D 49.225	B136 B136 B136	15245 15250 15250 X	D 62.000 D 63.500 D 63.500	B140	25880 26118 26131	d d d	36.487 30.000 33.338	B144 B140 B142
6454 6455 6460	d 69.850 d 57.150 d 73.025	B156 B152 B158	09196 11162 11300	D 49.225 d 41.275 D 76.200	B136 B146 B146	15520 15523 15578	D 57.150 D 60.325 d 25.400	B138	26283 26820 26822	D D D	72.000 80.167 79.375	B140,B142 B146 B146
6461 6535 6536	d 76.200 D 161.925 D 161.925	B158 B158,B160,B162 B158	11520 11590 LM11710	D 42.862 d 15.875 D 39.878	B136 B136 B136	15580 16150 16284	d 26.988 d 38.100 D 72.238	B144	26823 26882 26884	D d d	76.200 41.275 42.875	B146 B146 B146
6559 6575 6576	d 82.550 d 76.200 d 76.200	B160 B158 B158	LM11749 LM11910 LM11949	<i>d</i> 17.462 <i>D</i> 45.237 <i>d</i> 19.050	B136 B136 B136	16929 16986 17098	<i>D</i> 74.988 <i>d</i> 43.000 <i>d</i> 24.981	B146	27620 27687 27689	D d d	125.412 82.550 83.345	B160 B160 B160
6580 9121 9180	d 88.900 D 152.400 d 61.912	B162 B154,B156 B154	12168 12303 12520	d 42.862 D 76.992 D 49.225	B146 B146 B136	17118 17244 17520	d 30.000 D 62.000 D 42.862	B138,B140	27690 27820 27880	d D d	83.345 80.035 38.100	B160 B144 B144
9185 9220 9285	d 68.262 D 161.925 d 76.200	B156 B158 B158	12580 M12610 M12648	d 20.638 D 50.005 d 22.225	B136 B136 B136	17580 17831 17887	 d 15.875 D 79.985 d 45.230 	B148	28138 28315 28521	d D D	34.976 80.000 92.075	B142 B142 B150
9320 9321 9378	D 177.800 D 171.450 d 76.200	B160 B160,B162 B160	M12649 LM12710 LM12711	d 21.430 D 45.237 D 45.975	B136 B136 B136	18200 18337 18520	d 50.800 D 85.725 D 73.025	B150	28580 28584 28622	d d D	50.800 52.388 97.630	B150 B150 B152
9380 9385 02420	d 76.200 d 84.138 D 68.262	B160 B162 B138,B140	LM12749 13175 13181	d 22.000 d 44.450 d 46.038	B136 B146 B148	18590 18620 18690	d 41.275 D 79.375 d 46.038	B148	28680 28920 28921	d D D	55.562 101.600 100.000	B152 B154 B154
02473 02474 02475	d 25.400 d 28.575 d 31.750	B138 B138 B140	13318 13620 13621	D 80.962 D 69.012 D 69.012	B146,B148 B144 B144	18720 18790 19138	D 85.000 d 50.800 d 34.976	B150	28985 29520 29586	d D d	60.325 107.950 63.500	B154 B154 B154



Bearing No.	Nominal Dimension (mm) d:CONE (Bore Dia.)	Pages	Bearing No.	Nominal Dimension (mm) d:CONE (Bore Dia.)	Pages
CONE, CUP	D:CUP (Outside Dia.)		CONE, CUP	D:CUP (Outside Dia.)	. 3
29620 29630 29675	D 120.650 B	8156,B158 8156 8156	42690 43118 43131	 d 77.788 d 30.162 d 33.338 	B160 B140 B142
29685 LM29710 LM29711	D 65.088 B	8158 8144 8144	43300 43312 44143	<i>D D T T T T T T T T T T</i>	B140 B142 B144
LM29748 LM29749 31520	d 38.100 B	8144 8144 8142	44150 44157 44162	 d 38.100 d 40.000 d 41.275 	B144 B144 B146
31594	d 66.675 B	3142	44348	<i>D</i> 88.501	B144,B146
33262		3156	L44610	<i>D</i> 50.292	B138
33275		3156	L44640	<i>d</i> 23.812	B138
33281	d 73.025 B	8158	L44643	d 25.400	B138
33287		8158	L44649	d 26.988	B138
JHM33410		8138	45220	D 104.775	B152
JHM33449 33462 33821	<i>D</i> 117.475 B	3138 3156,B158 3150	45221 45289 L45410	<i>D</i> 104.775 <i>d</i> 57.150 <i>D</i> 50.292	B152 B152 B140
33889	d 76.200 B	3150	L45449	d 29.000	B140
34300		3158	46143	d 36.512	B144
34306		3160	46162	d 41.275	B146
34478	D 193.675 B	3158,B160	46176	d 44.450	B146
36620		3168	46368	D 93.662	B144,B146
36690		3168	46720	D 225.425	B168
36920 36990 37425	d 177.800 B	8170 8170 8166	46780 47420 47487	 d 158.750 D 120.000 d 69.850 	B168 B156,B158 B156
37625 M38510 M38511	D 66.675 B	8166 8142 8142	47490 47620 47680	 d 71.438 D 133.350 d 76.200 	B158 B158,B160 B158
M38547	d 34.925 B	8142	47685	d 82.550	B160
M38549		8142	47686	d 82.550	B160
39236		8154	47687	d 82.550	B160
39250	D 104.775 B	8154	47820	<i>D</i> 146.050	B164
39412		8154	47890	<i>d</i> 92.075	B164
39520		8154,B156	47896	<i>d</i> 95.250	B164
39521	D 112.712 B d 63.500 B d 66.675 B	8156	48120	<i>D</i> 161.925	B166
39585		8154	48190	<i>d</i> 107.950	B166
39590		8156	48220	<i>D</i> 182.562	B168
41100 41125 41126	d 28.575 B	8138 8138 8138	48282 48286 48290	 d 120.650 d 123.825 d 127.000 	B168 B168 B168
41286	d 88.900 B	3138	48320	D 190.500	B168
42350		3162	48385	d 133.350	B168
42362		3164	48393	d 136.525	B168
42368	d 95.250 B	3164	LM48510	D 65.088	B142
42375		3164	LM48511	D 65.088	B142
42376		3164	LM48548	d 34.925	B142
42381	D 148.430 B	8164	48620	D 200.025	B168
42584		8164	48685	d 142.875	B168
42587		8162,B164	49175	d 44.450	B146
42620	d 76.200 B	8158,B160	49176	d 44.450	B146
42687		8158	49368	D 93.662	B146
42688		8158	49520	D 101.600	B150

Bearing No. CONE, CUP	Nominal Dimension (mm) d :CONE (Bore Dia.) D :CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages
49585	 d 50.800 d 98.425 d 100.012 	B150	67920	D 282.575	B170
52387		B164	67983	d 203.200	B170
52393		B164	67985	d 206.375	B170
52400	d 101.600D 157.162D 161.925	B166	L68110	<i>D</i> 59.131	B142
52618		B164,B166	L68111	<i>D</i> 59.975	B142
52637		B164,B166	L68149	<i>d</i> 35.000	B142
53150	d 38.100	B144	68450	d 114.300d 117.475D 180.000	B166
53162	d 41.275	B146	68462		B166
53176	d 44.450	B148	68709		B166
53177	d 44.450	B148	68712	<i>D</i> 180.975	B166
53178	d 44.450	B148	JL69310	<i>D</i> 63.000	B144
53375	D 95.250	B144,B148	JL69349	<i>d</i> 38.000	B144
53387	D 98.425	B146,B148	71412	 d 104.775 d 107.950 d 111.125 	B166
55175	d 44.450	B148	71425		B166
55187	d 47.625	B148	71437		B166
55200 55200 C 55206	 d 50.800 d 50.800 d 52.388 	B150 B150 B150	71450 71453 71750	d 114.300d 115.087D 190.500	B166 B166 B166
55437	 D 111.125 D 112.712 d 106.362 	B148,B150	72187	d 47.625	B148
55443		B148	72200	d 50.800	B150
56418		B166	72200 C	d 50.800	B150
56425	<i>d</i> 107.950	B166	72212	d 53.975	B152
56650	<i>D</i> 165.100	B166	72212C	d 53.975	B152
59200	<i>d</i> 50.800	B150	72218	d 55.562	B152
59429	<i>D</i> 108.966	B150	72218C	 d 55.562 d 57.150 D 123.825 	B152
64433	<i>d</i> 109.992	B166	72225C		B152
64450	<i>d</i> 114.300	B166	72487		B148,B150,B152
64700	<i>D</i> 177.800	B166	LM72810	<i>D</i> 47.000	B138
65200	<i>d</i> 50.800	B150	LM72849	<i>d</i> 22.606	B138
65212	<i>d</i> 53.975	B152	74500	<i>d</i> 127.000	B168
65237 65320 65385	 d 60.325 D 114.300 d 44.450 	B154 B148 B148	74525 74537 74550	 d 133.350 d 136.525 d 139.700 	B168 B168 B168
65500	<i>D</i> 127.000	B150,B152,B154	74850	<i>D</i> 215.900	B168
66187	<i>d</i> 47.625	B148	74856	<i>D</i> 217.488	B168
66462	<i>D</i> 117.475	B148	77375	<i>d</i> 95.250	B164
66520	<i>D</i> 122.238	B152,B154	77675	<i>D</i> 171.450	B164
66584	<i>d</i> 53.975	B152	78225	<i>d</i> 57.150	B152
66585	<i>d</i> 60.000	B154	78250	<i>d</i> 63.500	B154
66587	d 57.150	B152	LM78310	<i>D</i> 62.000	B142
LM67010	D 59.131	B138,B140	LM78310 A	<i>D</i> 62.000	B142
LM67043	d 28.575	B138	LM78349	<i>d</i> 35.000	B142
LM67048	d 31.750D 203.200D 196.850	B140	78537	D 136.525	B154
67320		B168	78551	D 140.030	B152,B154
67322		B168	78571	D 144.983	B152
67388	 d 127.000 d 130.175 d 133.350 	B168	HM81610	D 47.000	B136
67389		B168	HM81649	d 16.000	B136
67390		B168	M84210	D 59.530	B138
67720 67780 67787	<i>D</i> 247.650 <i>d</i> 165.100 <i>d</i> 174.625	B168,B170 B168 B170	M84249 M84510 M84548	 d 25.400 D 57.150 d 25.400 	B138 B138 B138
67790	 d 177.800 D 266.700 d 190.500 	B170	M86610	D 64.292	B138,B140
67820		B170	M86643	d 25.400	B138
67885		B170	M86647	d 28.575	B138



Bearing No. CONE, CUP	d :C	nal Dimension (mm) ONE (Bore Dia.) UP (Outside Dia.)	Pages	Bearing No. CONE, CUP	d :C0	al Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages
M86648 A	d	30.955	B140	HH221432	d	87.312	B162
M86649	d	30.162	B140	HH221434	d	88.900	B162
M88010	D	68.262	B140,B142	HH221440	d	95.250	B164
M88043	d	30.162	B140	HH221442	d	98.425	B164
M88046	d	31.750	B140	HH221447	d	99.982	B164
M88048	d	33.338	B142	HH221449	d	101.600	B166
HM88510	D	73.025	B140,B142	HH224310	D	212.725	B166
HM88542	d	31.750	B140	HH224335	d	101.600	B166
HM88547	d	33.338	B142	HH224340	d	107.950	B166
HM88610	D	72.233	B138,B140,B142,B144	HH224346	d	114.300	B166
HM88630	d	25.400	B138	M224710	D	174.625	B168
HM88638	d	32.000	B140	M224748	d	120.000	B168
HM88648	d	35.717	B144	LL225710	D	165.895	B168
HM88649	d	34.925	B142	LL225749	d	127.000	B168
HM89410	D	76.200	B142,B144	HM231110	D	236.538	B168
HM89411	D	76.200	B142	HM231140	d	146.050	B168
HM89443	d	33.338	B142	M236810	D	260.350	B170
HM89444	d	33.338	B142	M236849	d	177.800	B170
HM89446	d	34.925	B142	LM300811	D	68.000	B144
HM89446 A	d	34.925	B142	LM300849	d	41.000	B144
HM89449	d	36.512	B144	L305610	D	80.962	B150
99100	D	254.000	B168	L305649	d	50.800	B150
99550	d	139.700	B168	JH307710	D	110.000	B152
99575	d	146.050	B168	JH307749	d	55.000	B152
99587	d	149.225	B168	JHM318410	D	155.000	B162
99600	d	152.400	B168	JHM318448	d	90.000	B162
LM102910	D	73.431	B148	L327210	D	177.008	B168
LM102949	d	45.242	B148	L327249	d	133.350	B168
JLM104910	D	82.000	B150	LM328410	D	187.325	B168
LM104911	D	82.550	B150	LM328448	d	139.700	B168
LM104911A	D	82.550	B150	H414210	D	136.525	B156,B158
LM104912	D	82.931	B150	H414245	d	68.262	B156
LM104947A	d	50.000	B150	H414249	d	71.438	B158
JLM104948	d	50.000	B150	JH415610	D	145.000	B158
LM104949	d	50.800	B150	JH415647	d	75.000	B158
M201011	D	73.025	B144	LM501310	D	73.431	B144
M201047	d	39.688	B144	LM501314	D	73.431	B144
JM205110	D	90.000	B150	LM501349	d	41.275	B144
JM205149	d	50.000	B150	LM503310	D	75.000	B148
JM207010	D	95.000	B152	LM503349	d	46.000	B148
JM207049	d	55.000	B152	HH506310	D	114.300	B150
JH211710	D	120.000	B156	HH506348	d	49.212	B150
JH211749	d	65.000	B156	JLM506810	D	90.000	B152
HM212010	D	122.238	B154,B156	JLM506849	d	55.000	B152
HM212011	D	122.238	B154,B156	JLM508710	D	95.000	B154
HM212044	d	60.325	B154	JLM508748	d	60.000	B154
HM212046	d	63.500	B154	JM511910	D	110.000	B156
HM212047	d	63.500	B154	JM511946	d	65.000	B156
HM212049	d	66.675	B156	JM515610	D	130.000	B160
JH217210	D	150.000	B162	JM515649	d	80.000	B160
JH217249	d	85.000	B162	HM516410	D	133.350	B160
HM218210	D	147.000	B162	HM516448	d	82.550	B160
HM218248	d	90.000	B162	JHM516810	D	140.000	B162
HH221410	D	190.500	B162,B164,B166	JHM516849	d	85.000	B162

	None	I.D'	
Bearing No. CONE, CUP	d :C0	nal Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages
HM518410	D	152.400	B162
HM518445	d	88.900	B162
LM522510	D	159.987	B166
LM522546	d	107.950	B166
LM522548	d	109.987	B166
LM522549	d	109.987	B166
JHM522610	D	180.000	B166
JHM522649	d	110.000	B166
JHM534110	D	230.000	B170
JHM534149	d	170.000	B170
LM603011	D	77.788	B148
LM603012	D	77.788	B148
LM603049	d	45.242	B148
L610510	D	94.458	B154
L610549	d	63.500	B154
JM612910	D	115.000	B158
JM612949	d	70.000	B158
LM613410	D	112.712	B156
LM613449	d	69.850	B156
HM617010	D	142.138	B162
HM617049	d	85.725	B162
L623110	D	152.400	B166
L623149	d	114.300	B166
JLM710910	D	105.000	B156
JLM710949	d	65.000	B156
JLM714110	D	115.000	B158
JLM714149	d	75.000	B158
JM714210	D	120.000	B158
JM714249	d	75.000	B158
H715311	D	136.525	B154,B156,B158
H715334	d	61.912	B154
H715340	d	65.088	B156
H715341	d	66.675	B156
H715343	d	68.262	B156
H715345	d	71.438	B158
JM716610	D	130.000	B162
JM716648	d	85.000	B162
JM716649	d	85.000	B162
JM718110	D	145.000	B162
JM718149	d	90.000	B162
JM719113	D	150.000	B164
JM719149	d	95.000	B164
JM720210	D	155.000	B164
JHM720210	D	160.000	B164
JM720249	d	100.000	B164
JHM720249	d	100.000	B164
JL724314	D	170.000	B168
JL724348	d	120.000	B168
JL725316	D	175.000	B168
JL725346	d	125.000	B168
JM734410	D	240.000	B170
JM734449	d	170.000	B170
JM738210	D	260.000	B170
JM738249	d	190.000	B170

Bearing No. CONE, CUP	d :C0	al Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages
HM801310	D	82.550	B144
HM801346	d	38.100	B144
M802011	D	82.550	B146
M802048	d	41.275	B146
HM803110	D	88.900	B146
HM803145	d	41.275	B146
HM803146	d	41.275	B146
HM803149	d	44.450	B146
M804010	D	88.900	B148
M804049	d	47.625	B148
HM804810	D	95.250	B146,B148,B150
HM804840	d	41.275	B146
HM804843	d	44.450	B148
HM804846	d	47.625	B148
HM804848	d	48.412	B150
HM804849	d	48.412	B150
HM807010	D	104.775	B148,B150
HM807011	D	104.775	B150
JHM807012	D	105.000	B150
HM807040	d	44.450	B148
HM807044	d	49.212	B150
JHM807045	d	50.000	B150
HM807046	d	50.800	B150
JLM813010	D	110.000	B158
JLM813049	d	70.000	B158
JLM820012	D	150.000	B164
JLM820048	d	100.000	B164
JM822010	D	165.000	B166
JM822049	d	110.000	B166
JHM840410	D	300.000	B170
JHM840449	d	200.000	B170
HM903210	D	95.250	B148
HM903247	d	44.450	B148
HM903249	d	44.450	B148
HM911210	D	130.175	B152
HM911242	d	53.975	B152
H913810	D	146.050	B154,B156
H913842	d	61.912	B154
H913849	d	69.850	B156



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