

Rolling Bearings



Technical Informati	on A7	Tech. Info.
Deep Groove Ball Br	gs. B4	
Angular Contact Ball Br	gs. B46	
Self-Aligning Ball Br	gs. B76	
Cylindrical Roller Br	gs. B84	
Tapered Roller Br	gs. B110	F
Spherical Roller Br	gs. B182	
Thrust Br	gs. B206	Thrust Brgs.
Needle Roller Br	gs. B244	
Ball Brg. Un	its B280	
Plummer Bloc	ks B304	
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NSK Products and Appendic	es C1	Appendices



Rolling Bearings

CAT. No. E1102k

Introduction to Revised NSK Rolling Bearing Catalog (CAT.No.E1102k)

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, audiovisual equipment, medical equipment, and many others. These striking innovations present a challenge to bearing manufacturers since there are ever increasing demand to offer bearings with higher performance, accuracy, and reliability. Manufacturers of diverse equipment have many different bearing requirements including higher speeds, less torque, less noise and vibration, zero maintenance, survival in harsh environments, integration into units, and many more.

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.

NSK

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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:

 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).

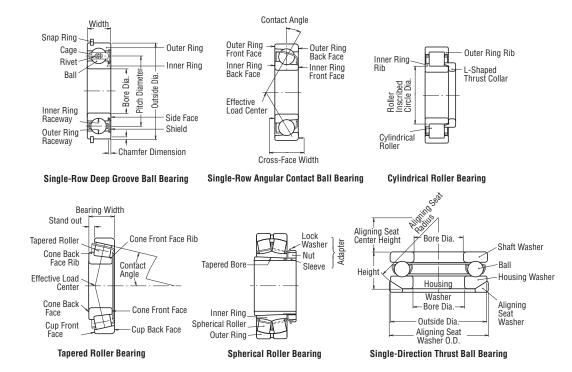
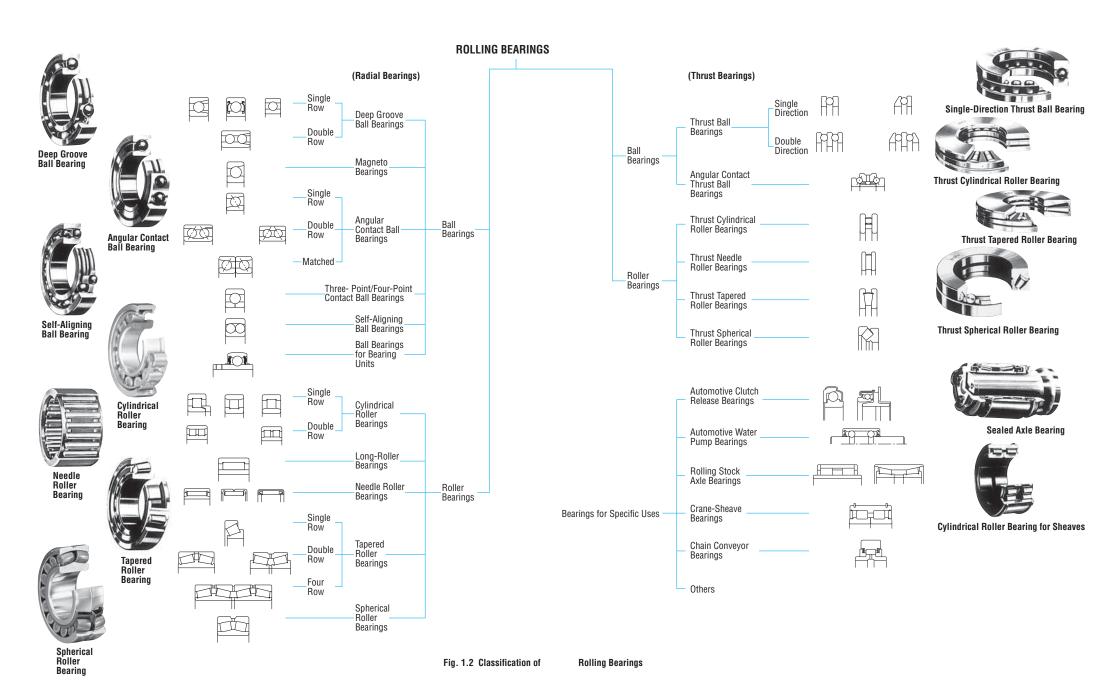


Fig. 1.1 Nomenclature for Bearing Parts







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.

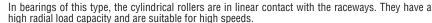
Self-Aligning Ball Bearings



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 13 A 12



Table 1. 1 Types and Characteristics

Fe	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
- 10			M								
sity	Radial Loads	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	0	\bigcirc	\bigcirc	0	\bigcirc
Load Capacity	Axial Loads		0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0	×	×	\bigcirc
Loi	Combined Loads	\bigcirc	0	0	0	0		0	×	×	
ŀ	High Speeds		\odot	0		0	0	\odot	0	0	0
ŀ	High Accuracy	0		0		0	0		(0	
	ow Noise and Torque	0							0		
F	Rigidity					0			0	0	0
ļ	Angular Misalignment	0	0	0	0	0	0	0	\bigcirc	0	
(Self-Aligning Capability							☆			
ļ	Ring Separability		☆				☆		☆	☆	☆
F	Fixed-End Bearing	☆			☆	☆	☆	☆			
F	Free-End Bearing	*			*	*	*	*	☆	☆	
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
	© Excellent	⊙ G	ood	◯ Fair	0	Poor ×	Impossible	←— Or	ne direction nly	←→ Tw	o directions

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.
\odot	0	0	0	0	×	×	×	×	×	0	_
$\overline{\bigcirc}$	×	\bigcirc	\bigcirc	\bigcirc	\bigcirc	$\overline{\bigcirc}$	\odot	(i)	(i)	(i)	_
	×	0	0	\odot	×	×	×	×	×	0	_
\odot	0	\bigcirc	\bigcirc	\bigcirc	×	×	\bigcirc	0	0	0	A18 A37
		0			0		0				A19 A58 A81
											A19
\odot	0	0	0				0	0	0		A19 A96
	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.

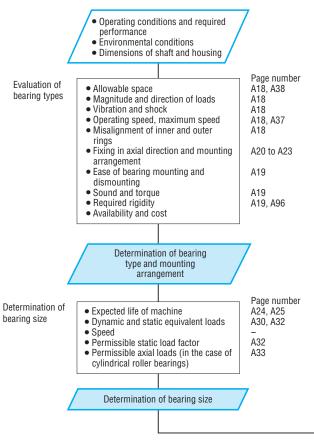
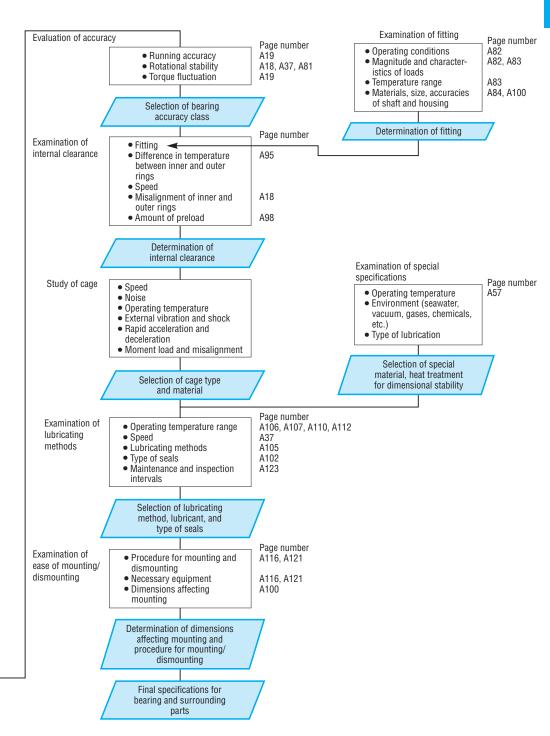


Fig. 2.1 Flow Chart for Selection of Rolling Bearings



A 16 A 17

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).

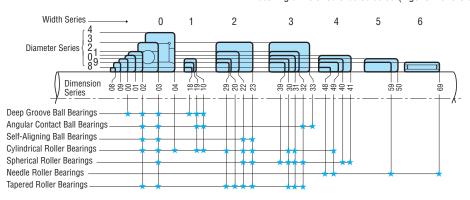


Fig. 3.1 Dimension Series of Radial Bearings

Bearing Types

Deep Groove

Ball Bearings

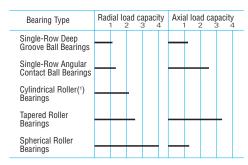
Needle Roller

Tapered Roller

Bearings

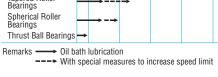
Angular Contact

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.

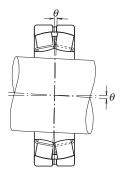


Fig. 3.4 Permissible Misalignment of Spherical Roller Bearings

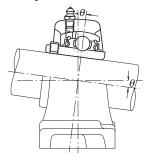


Fig. 3.5 Permissible Misalignment of Ball Bearing Units

Bearing Types	Highest accuracy specified	Tolerance comparison of inner ring radial runout		
Deep Groove Ball		1 2 3 4 5		
Bearings	Class 2			
Angular Contact Ball Bearings	Class 2			
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

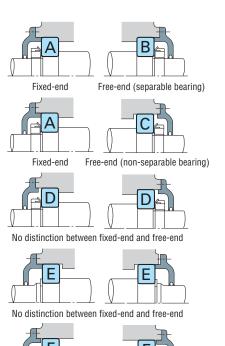
Among the bearings on a shaft, only one can be a "fixed-end" bearing that is used to fix the shaft axially. For this fixed-end bearing, a type which can carry both radial and axial loads must be selected.

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. 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.



No distinction between fixed-end and free-end

BEARING A

Deep Groove Ball Bearing
Matched Angular Contact
Ball Bearing
Double-Row Angular
Contact Ball Bearing

· Self-Aligning Ball Bearing · Cylindrical Roller Bearing with Ribs (NH, NUP types)

Double-Row Tapered Roller Bearing Spherical Roller Bearing

BEARING D,E(2)

Angular Contact Ball Bearing Tapered Roller Bearing Magneto Bearing Cylindrical Roller Bearing (NJ. NF types)

BEARING B

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

BEARING C(1)

Deep Groove Ball Bearing
Matched Angular Contact
Ball Bearing (back-toback)
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

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 Fig. 4.1.

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 Arrangements		Remarks	Application Examples
Fixed-end Free	-end		
		 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
		 This 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	Remarks	Application Examples
Fixed-end Free-end		
	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 fatique 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 fatique 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 fatique 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 Life 5.2.1 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 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_r for radial bearings and C_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

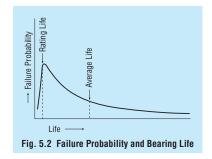


Table 5. 1 Fatigue Life Factor f_h for Various Bearing Applications

	_	-	_		
Operating Periods			Fatigue Life Factor $f_{ m h}$	ı	
Operating Perious	~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 important		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 important					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 (10 6 rev)

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

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 $L_{\rm h}$ (h), bearing speed as n (min⁻¹), fatigue life factor as $f_{\rm h}$, and speed factor as $f_{\rm n}$, the relations shown in Table 5.2 are obtained:

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

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

 $n,\ f_{\rm n}$Fig. 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)



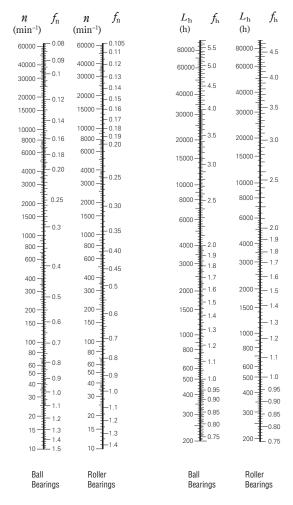


Fig. 5.3 Bearing Speed and Speed Factor

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 tables.

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_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 $f_{ m t}$	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 fatigue life, the basic rating life is adjusted using the following adjustment factors:

$$L_{\text{na}} = a_1 a_2 a_3 L_{10}$$
(5.7)

where $L_{\rm na}$: 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

*a*₃: 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 $C_{\rm r}$ and $C_{\rm a}$ 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
a_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_h 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 $P_{\rm a}$ exceeds 0.5 $C_{\rm a}$ for thrust bearings, please consult NSK to establish the applicablity 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:

$$F_{\rm r} = f_{\rm w} \cdot F_{\rm rc} F_{\rm a} = f_{\rm w} \cdot F_{\rm ac}$$
 \ (5.8)

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

 $F_{\rm rc}$, $F_{\rm ac}$: Theoretically calculated load (N), {kgf}

 $f_{\rm w}$: 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 000H / n(kgf·mm)}......(5.9)

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

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

> $P_{\rm b}$: 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, 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 $f_{\rm w}$

Operating Conditions	Typical Applications	$f_{ m w}$
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_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:

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

= 974 000H / n \...\{kgf\cdot mm\}\\ P_k = M / r \....(5.13)

$$S_{\mathbf{k}} = P_{\mathbf{k}} \tan \theta$$
(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_{ν} : Radial force on gear (N), {kgf}

 K_{\circ} : 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_g by multiplying the theoretically calculated load by this factor.

The values of f_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_{α}

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)

$$F_{\text{CII}} = \frac{a}{c}K \qquad (5.17)$$

where $F_{\rm CI}$: 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.

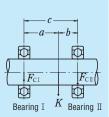




Fig. 5.5 Radial Load Distribution (1)

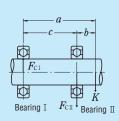


Fig. 5.6 Radial Load Distribution (2)

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)

Load F_1 : Speed n_1 ; Operating time t_1 Load F_2 : Speed n_2 ; Operating time t_2 Load F_n : Speed n_n : Operating time t_n

Then, the average load F_m may be calculated using the following equation:

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

$$n_{\rm m} = \frac{n_1 t_1 + n_2 t_2 + \dots + n_n t_n}{t_1 + t_2 + \dots + t_n}$$
....(5.19)

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

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

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

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

(3) When the load fluctuation is similar to a sine wave (Fig. 5.9), an approximate value for the average load F_m may be calculated from the following equation:

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)

$$F_{\rm m} = 0.75 \; F_{\rm max} \;$$
 (5.22)

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

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

 $F_{\rm s}$: 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
$$F_{\rm R} < F_{\rm S}$$

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

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.

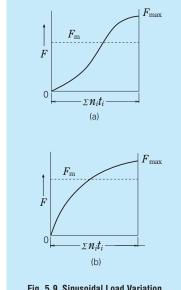


Fig. 5.9 Sinusoidal Load Variation

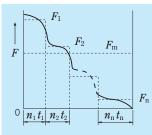


Fig. 5.7 Incremental Load Variation

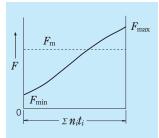
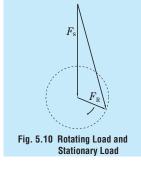


Fig. 5.8 Simple Load Fluctuation



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_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:

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

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 $F_{r\mathbb{I}}$ and $F_{r\mathbb{I}}$ 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 $P_{\scriptscriptstyle \rm T}$, $P_{\scriptscriptstyle \rm II}$ may be calculated as

$$\begin{split} \text{where} \quad & F_{\mathrm{ae}} + \frac{0.6}{Y_{\mathrm{II}}} \; F_{r_{\,\mathrm{II}}} \geqq \frac{0.6}{Y_{\,\mathrm{I}}} \; F_{r_{\,\mathrm{I}}} \\ & P_{_{\mathrm{I}}} = \mathrm{X} F_{r_{\,\mathrm{I}}} + Y_{_{\mathrm{I}}} \left(F_{\mathrm{ae}} + \frac{0.6}{Y_{\,\mathrm{II}}} \; F_{r_{\,\mathrm{II}}} \right) \right\}(5.28) \\ & P_{_{\mathrm{II}}} = F_{r_{\,\mathrm{II}}} \end{split}$$

where
$$F_{\mathrm{ae}} + \frac{0.6}{Y_{\mathrm{II}}} F_{\mathrm{rII}} < \frac{0.6}{Y_{\mathrm{I}}} F_{\mathrm{rI}}$$

$$P_{\text{I}} = F_{\text{rI}}$$

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

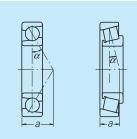


Fig. 5.11 Effective Load Centers

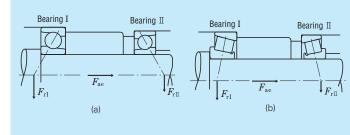


Fig. 5.12 Loads in Opposed Duplex Arrangement



5.5 Static Load Ratings and Static Equivalent

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.

 $\begin{array}{lll} \mbox{For self-aligning ball bearings} & 4\,600\mbox{MPa} \\ & \{469\mbox{kgf/mm}^2\} \\ \mbox{For other ball bearings} & 4\,200\mbox{MPa} \\ & \{428\mbox{kgf/mm}^2\} \\ \mbox{For roller bearings} & 4\,000\mbox{MPa} \\ & \{408\mbox{kgf/mm}^2\} \\ \end{array}$

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 axial 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.

$$P_0 = X_0 F_r + Y_0 F_a$$
(5.30)
 $P_0 = F_r$ (5.31)

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

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

$$f_{\rm S} = \frac{C_{\rm o}}{P_{\rm o}}$$
....(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 $f_{\rm s}$ should be greater than 4.

Table 5. 8 Values of Permissible Static Load Factor $f_{\rm S}$

Operating Conditions		imit of $f_{ m s}$ 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)

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

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

Oil lubrication (Empirical equation)

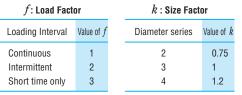
$$C_{A} = 9.8f \left\{ \frac{490 (k \cdot d)^{2}}{n + 1000} - 0.000135 \times (k \cdot d)^{3.4} \right\} ...(N)$$

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

where C_A : 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.

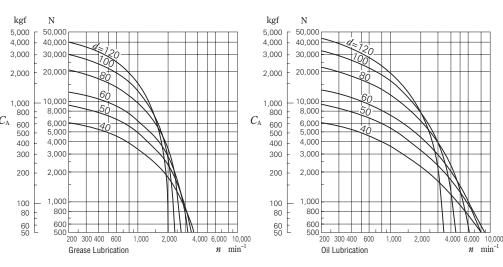


Fig. 5.13 Permissible Axial Load for Cylindrical Roller Bearings

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, 12 970kgfl (Bearing Table, Page B10). Since only a radial load is applied, the equivalent load P may be obtained as follows:

$$P = F_r = 2500N$$
, (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 $f_{\rm h}$, under these conditions, can be calculated as follows:

$$f_h = f_n \frac{C_r}{P} = 0.333 \times \frac{29100}{2500} = 3.88$$

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 $F_r = 3000$ N, (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)

$$f_h = f_n \frac{C_r}{P} = 0.26 \times \frac{C_r}{3.000} \ge 2.72$$

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 $f_0F_a/C_{\rm or}$, from the table above the single-row deep groove ball bearing table.

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

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

 $e = 0.26$

and
$$F_a / F_r = 1000/2500 = 0.4 > e$$

$$X = 0.56$$

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

Therefore, the dynamic equivalent load P is

$$P = XF_r + YF_a$$

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

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

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

$$f_h = f_n \frac{C_r}{P} = 0.333 \times \frac{29100}{3070} = 3.16$$

This value of f_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 $F_r = 45\,000$ N, (4 950kgf)

Axial load $F_a = 8000$ N, (816kgf)

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

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

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
$$F_a / F_r \leq e$$

$$P = XF_r + YX_a = F_r + Y_3F_a$$

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 380kef)

From the fatigue life factor f_h , 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 0000kgf) Among spherical roller bearings of series 231 satisfying this value of C_r , the smallest is **23126CE4** ($C_r = 505\,000N$, (51 500kgf))

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}

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

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

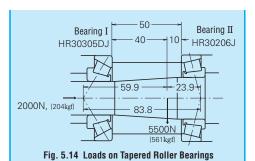
$$= 500 \times 3.49^{\frac{10}{3}} \stackrel{\text{3}}{=} 32\ 000\ \text{h}$$

(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 $F_r = 5500N$, (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:

$$F_{rI} = 5.500 \times \frac{23.9}{83.8} = 1.569$$
N, (160kgf)

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

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

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

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

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

For bearing I

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

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

since
$$F_{\rm aI} / F_{\rm rI} = 2.2 > e = 0.83$$

the dynamic equivalent load $P_{I} = XF_{rI} + Y_{I}F_{aI}$

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

= 3 164N, (323kgf) The fatigue life factor $f_h = f_n \frac{C_r}{D_r}$

$$= \frac{0.42 \times 38\ 000}{3\ 164} = 5.04$$

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

For bearing II

since $F_{r_{\, {\rm II}}}=3~931{
m N},~$ (401kgf), $F_{a_{\, {\rm II}}}=0$

the dynamic equivalent load

$$P_{\Pi} = F_{r\Pi} = 3\,931\,\text{N}, \,\,\,\text{(401kgf)}$$

the fatigue life factor

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

and the rating fatigue life $L_{\rm h} = 500 \times 4.59^{\frac{10}{3}} = 80~400 h$ 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 $F_r = 245~000N$, (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
	500 500		23160 CAE4 24160 CAE4		273 000 315 000	0.31 0.38	2.2 1.8

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

$$P = F_r + Y_3 F_2$$

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.

$$f_h = f_n \frac{C_r}{P} = \frac{0.444 \ C_r}{F_r + Y_3 F_a} = 3 \text{ to } 5$$

Assuming that $Y_3 =$ 2.1, then the necessary basic load rating $C_{\rm r}$ can be obtained

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

$$= \frac{(245\ 000 + 2.1 \times 49\ 000) \times (3\ to\ 5)}{0.444}$$

 $= 2\ 350\ 000\ to\ 3\ 900\ 000\ N,$ {240 000 to 400 000 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. $C/P \ge 12$ 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

(Refer to)

characteristics.

Table 12.2 Grease Properties (Pages A110 and 111)

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

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

6.1 Correction of Limiting Speed

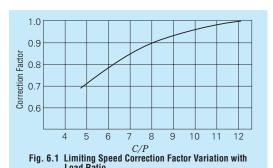
When the bearing load P exceeds 8 % of the basic load rating C, or when the axial load F_a exceeds 20 % of the radial load F_r , the limiting speed must be corrected by multiplying the limiting speed found in the bearing tables by the correction factor shown in Figs. 6.1 and 6.2.

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, forced-circulation 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.



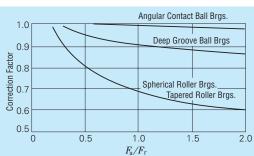


Fig. 6.2 Limiting Speed Correction Factor for Combined Radial and Axial Loads

Table 6.1 Limiting Speed Correction Factor for High-Speed Applications

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).

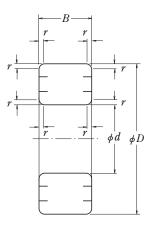


Fig. 7.1 Boundary Dimensions of Radial Ball and Roller Bearings

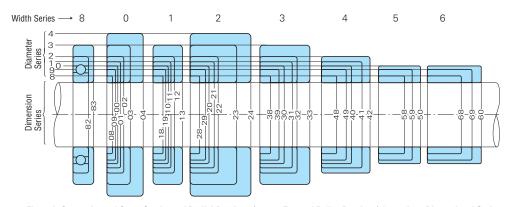


Fig. 7.6 Comparison of Cross Sections of Radial Bearings (except Tapered Roller Bearings) for various Dimensional Series

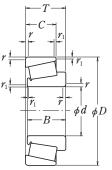


Fig. 7.2 Tapered Roller Bearings

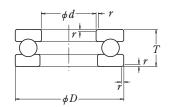


Fig. 7.3 Single-Direction Thrust Ball Bearings

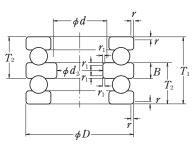


Fig. 7.4 Double-Direction Thrust Ball Bearings

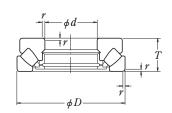


Fig. 7.5 Spherical Thrust Roller Bearings

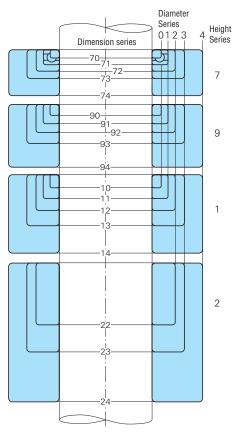


Fig. 7.7 Comparison of Cross Sections of Thrust Bearings (except Diameter Series 5) for Various Dimension Series

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Single-Row Ball Brgs.	Double-Row Ball Brgs. Cylindrical Roller Brgs.	Needle Brg	Spherica Brg	1		re Nu <i>a</i>		0 -	3 2		L 8 6	0000						15 7 16 8 17 8	
3rgs.	Row Ball JS. al Roller	Roller 1S.	al Roller IS.			q		0.6 1 2.5 1.5 3	352	4 7 5 8 6 10	7 8 112 9 14	10 15 12 18 15 21	23 27 - 23	25 32 28 — 30 37	1	₹ 6 iè	888	75 80 85	929
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19 23 30 30 30	888	888	33,33	52 45	888	60 75 70 75 100	9833	90 00 118 118 118 118 118 118 118 118 118	90 118 98 128 112 150	112 150 118 160 128 170	136 136 140 140	150 200 165 218 165 218	180 243 180 243 185 250	206 280 224 300 243 315	265 345 272 355 290 375	300 400 325 425
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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	900 950 1000	1060 1120 1180	1250 1320 1400	1460 1540 1630	1720 1820 1950	2060 2180 2300	2430 _
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444	922	999	888	800	2 2 2 3 8 8 8	118 140 140	140 160 160	021 180 180	190 200 218	230 243 250	258 272 280	300 315 335	335 355 375	400 425 450	462 475 500	230
6 5 5 5	67 67 80	888	96 109 109	136 136	091 091	09E 06E	190 218 218	230 230 243	258 272 300	308 325 335	355 365 375	400 438 462	462 488 515	545	111	1.1
177	886	109 125	125 145 145	180 180 180 180	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	710	1.1.1	11
9.0			<u> </u>	1.5	2.1	3 3	ω44	444	വവവ	യവവ	999	6 7.5	7.5 7.5 7.5	7.5	111	1.1
222	1.5	222	2.1 2.1	2.1	ოოო	w44	444	വവവ	യവവ	999	999	7.5 7.5 7.5	7.5 7.5 7.5	7.5 9.5 9.5	9.5 9.5	12 —
222	2 1 15	222	2.1 2.1	2.1	ოოო	w44	444	വവവ	ഉവവ	999	999	7.5 7.5 7.5	7.5 7.5 7.5	7.5 9.5 9.5	9.5 9.5	12
160 170 180	200 210 225	240 260 280	290 310 340	360 400 420	460 480 520	540 560 600	620 650 680	700 720 780	820 870 920	980 1030 1090	1150 1220 1280	1360 1420 1500	1580 1660 1750	1850 1950 2120	2240 2360 2500	1.1
855	22 24	25 28 31	334	7844	50	57 63	63	171	82 85 92	103	112 118 122	132 136 140	145	111	111	1.1
888	888	8438	22 29 29 29 29 29 29 29 29 29 29 29 29 2	888	844	888	825	100	118	129	155	888	200 212 218	230 243 272	280 308 308	11
38 33	45 45	848	60 66 72	72 82 82	92	106	118 122 128	128 128 145	150 155 170	185	200 212 218	236 243 250	265 272 290	300	365 375 400	1.1
14 4 46	22 22 29 29 20 20 20 20 20 20 20 20 20 20 20 20 20	60 67 74	75 82 90	104	118	134 148	150	165	195 200 212	220	258 272 280	308 325 325	345 355 375	400 412 462	475 500 530	1.1
989	69	886	109	140 140 140 140	668	200 200 200 200 200	200 212 218	218 218 250	258 272 290	308 315 335	345 365 375	412 412 438	462 475 500	530 545 615	690	1.1
75 80 80	95 100	109 122 136	136 150	9616	218 218 243	243 243 272	272 280 300	335	355 365 388 388	425 438 462	475 500 515	560 560 600	615	1.1.1	1.1.1	11
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	====	1.5	2 2 2.1	3 3 3.1	444	446	വവവ	യവവ	999	6 7.5	7.5	7.5 7.5 9.5	9.5	1.1.1	1.1.1	1.1
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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.

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

Units: mm

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					s 4	Dimension Series	04~24	(min.)	11				9:0	1.1	==	7: 1 5:			2.2.2	ωω4	444
					r Serie	Dimension Series	24	В	11		1 1 1	111	141	16 19 24	33	36	143	53	944	77 88 86	888
74	104	N 4			Diameter Series 4	Dim	8		П	I	1 1 1	111	161	122	19	21 23	25 27	33 33	35 37 42	45 48 52	52 22 28
					Ī		D		1.1	I	1.1.1	111	32 3	37 42 52	62 72 —	80 06	100	120 130 140	150 160 180	190 200 210	225 240 250
						Dimension Series	03~33	in.)	П	I	0.2	0.3	0.3	1.06	-55	222	- 	1.5	2.1	2.1	ოოო
						Dimer	83	* (min.)	11	ı	111	111	111	0.3	9.0 9.0 0.6	9.0 9.0 0.6	0.6		<u> </u>	1.5	227
633	3323	N 33			_		33		1.1	l	_	e 5 E	5 5 9	£ £ £	22.2 22.2 25	25.4 30 30.2	32 34.9 36.5	39.7 44.4 49.2	54 58.7 63.5	68.3 73	73 77.8 82.6
623	43	N 23		223	Series 3	ries	23		11	ı	1 1 1	=	554	777	19	222	8338	848	248	883	45°E
					Diameter Series	Dimension Series	13	В	11	ı	1 1 1	111	111	111	111	111	111	111	111	111	1 2
32	13	N 3		213	ä	Dimer	83		11	ı	۱ ا	7 6 5	o o 0	122	4 5 9	<u>19 8 6</u>	828	3272	883	4833	844
							88		11	ı	1.1.1	111	111	000	199	225	4 4 9	13	22 24 25	27 28 30	3833
							D		1.1	I	5	16 13 22	28 30	35 37 42	47 52 56	62 68 72	75 80 90	120	130 150	160 170 180	190 200 215
						sion	02~42	n.)	1.1	ı	0.15	000	0000	9:0	0.0				<u> </u>	2 2 2	2.1
						Dimension Series	82 (r (min.)	11	ı	1 1.0	0.15 0.15 0.2	0000	0000	0000	0.0	9.0	9.0			1.1.1.
							42		11		1 1 1	111	111	1 1 8	22.22	3823	888	888	22 22 22	888	8 7 8
632	52	N 32		232	3s 2		32		11	ı	ا ا م	7 8 OI	125	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 55.6 60.3
622	42	N 22		222	Diameter Series 2	Dimension Series	22		11	ı	1 1 1	111	111	222	£ € €	8568	222	222	338	883	848
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25	12	N 2				D.	02		11		4	യവവ	~ ∞ ∞	601	2 4 4	19 9 9	12 12 12	19 20 21	23 24	25 26 28	34 33 33
							82		11		2.5	6 8 4 5 5	0 2 2	~ ~ 8		555	12 2 2	554	9 8 8	12 13	25 4 22
							D		1.1	ı	1 2	13	22 24 26	30 35 35	40 50	52 58 62	65 72 80	100	110 120 125	130 150	160 170 180
						sion	11~41	(.	1.1	ı	111	111	111	111	111	111	111	111	111	111	222
						Dimension Series	1 10	r (min.)	11	ı	111	111	111	111	111	111	111	111	111	111	=
				241			41		11	ı	1.1.1	111	4 5 9 9 1	8 8 8	848	227 28	888	888	844	2222	888
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		_			Diameter S	sion Se	21	В	1.1	ı	111	[∞]	e55	222	5179	9178	19 22	27 57 54 54 54 54 54 54 54 54 54 54 54 54 54	24 27 27	885	8888
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							10		11	ı	111	111	111	111	111	111	111	111	111	111	21
			_	- L			D		1.1	I	1.1.1	111	111	111	111	111	111	111	111	111	150 160 165
Ile-Row I Brgs.	Double-Row Ball Brgs.	ndrical er Brgs.	le Roller rgs.	Spherical Roller Brgs.			q		0.6	0	2.5	4 12 9	7 8 9	121	20 27	25 28 30	32 40 40	45 50 55	992	75 80 85	90 100
Sing Bal	Doul	Roll	Need	Spheri	1	əqwr	те Иг	og	-	ı	3 5	4 5 9	8 6	010	03	02 08 06)32 07 08	110	13 13	15	18 20

4 4 0	വവവ	യവവ	999	6 7.5 7.5	7.5 9.5 9.5	9.5 9.5	12 12	15 15	12 12 12	1 12	111	111	111	1.1
108	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	88 92 95	98 102 115	122 132 140	150 155 165	180	206 212 218	230 236 250	258 272 280	290	111	111	111	1.1
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	1.1.1	1.1.1	111	1.1
ოოო	444	444	വവവ	002	7.5 7.5 7.5	7.5 7.5 7.5	9.5	9.5 12 12	12 51 2	555	500	€ E	111	1.1
33.1	ω4	111	111	111	111	111	111	111	111	111	111	111	111	1.1
87.3 92.1 106	112 118 128	130 140 150	155 180 180	195 206 224	236 258 272	290 300 308	315 345 365	375 388 412	438 462 488	515 530 560	630 630 650	670 710	111	1.1
1288	88 102 108	114 120 126	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	1.1
53 62	66 70 75	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	1.1
22 69	58 65 65	98 72 75	888	102	109 112 118	125 128 136	136 145 155	160	190 200 206	218 224 236	258 272 280	290 300	111	1.1
37 44	48 50 —	111	111	1.1.1	111	1.1.1	1.1.1	111	111	111	1.1.1	111	111	1.1
260 260 260 260	320 320 320	380 380 380	420 460 460	240 240 280	620 670 710	750 780 820	850 950 950	1030 1090	1150 1220 1280	1360 1420 1500	1600 1700 1780	1850 1950 —	111	1.1
22.1	ოოო	w44	444	400	0 2 2	999	7.5	7.5 7.5 9.5	9.5 12.9	12 12	5 5 5	15	111	1.1
<u> </u>	111	111	111	111	111	111	111	111	111	111	111	111	111	11
888	100	21 14 14 17 18	021 198 188	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	1.1
65.1 69.8 76	888	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	230	111	11
2222	2882	888	28.89	21 13 13 13 13 13 13 13 13 13 13 13 14 14 15 16 16 16 16 16 16 16 16 16 16 16 16 16	140 165 165	170 175 185	195 200 212	224 243 258	272 280 300	315 325 345	355 375 388	412 425 —	111	1.1
42	46 50 54	58 62 62	65 70 78	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	1.1
9889	40 42 45	48 52 52	228	72 80 80	95 92	98 103	109 112 118	125 136 145	150 155 165	175 180 195	200 206 218	230 243	111	1.1
1 88 7	111	111	111	111	111	111	111	111	111	111	111	111	111	1.1
190 200 215	230 250 270	290 310 320	340 400	440 500	540 580 620	650 680 720	760 790 830	870 920 980	1030 1090 1150	1220 1280 1360	1420 1500 1580	1660 1750 —	111	1.1
222	2.1	3.11	ωω 4	440	വവവ	യവവ	6 7.5	7.5 7.5 7.5	7.5 7.5 7.5	9.5 9.5 9.5	9.5	525	रुरु	500
<u></u> 5	1.5	22.1	ოოო	444	വവവ	യവവ	999	6 7.5 7.5	7.5 7.5 7.5	7.5 9.5 9.5	9.5 12 12	122	111	11
888	885	80 81 81	24 12 13 13 13 13 13 13 13 13 13 13 13 13 13	888	200 218 243	243 243 250	288 300 300	308 325 335	355 375 400	412 438 475	475 500 515	545 580 600	630 670 710	750
888	288	888	4 1 1 2 1 2 1 2 1	2 4 4 8	091 178 190	20 197 200 200	224 226 240	248 264 272	280 300 315	336 345 365	375 400 412	438 475	475 500 530	280
442	48 60 60	66 66 72	78 82 88	95 106 106	118 128 140	140 145 145	165 165 175	180 190 195	206 218 230	243 250 272	272 290 300	315 335 345	365 388 400	425
8833	38 40 46	51 56	65 69	74 82 82	90 100 100	106 106 112	122 122 132	136 145 150	160 170 175	185 195 206	212 224 230	243 258 265	280 290 308	325
													111	
													1750 1850 1950	
													1120 1180 1250	
25 24	26 30	32 34 36	38 44 44	48 52 56	64 68	72 76 80	88 92	96 /500 /530	/560 /600 /630	/670 /710 /750	/820	/950 /1000 /1060	/1120 /1180 /1250	/1320

/1500 1500 2300

Table 7. 2 Boundary Dimensions of

Tap Ro Br	ller					329						32	0 X				330					33	31		
					Diam	eter Se	ries 9							Diam	eter Se	ries 0					Di	ameter	Serie	s 1	
per				Dim	nensio	n Serie	s 29		Cha Dime	mfer		Dime	nsion S	Series	Dime	nsion S	Series	Cha	mfer		Dime	nsion S	Series	Cha Dime	mfer
Bore Number	d			Ι			II		Cone	l .			20			30		Cone				31		Cone	
Bor		D	В	С	T	В	С	T	r (1	min.)	D	В	С	Т	В	С	T	<i>r</i> (1	min.)	D	В	С	T	r (1	min.)
00 01 02	10 12 15	=	Ξ	_ _ _	_ _	_ _ _	_ _ _	=	_ _ _	_ _ _	 28 32	— 11 12	_ _ _	 11 12	— 13 14	_ _ _	— 13 14		0.3 0.3	<u>-</u>	Ξ	_ _ _	_ _ _	_ _ _	_ _
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	_ _ _	Ξ	_ _ _	_ _ _	_ _ _	_ _ _
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	_ _ _	Ξ	_ _ _	=	_ _ _	_ _ _
/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	_ _ _	Ξ	_ _ _	 - -	_ _ _	_ _ _
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	_ _ _	Ξ	_ _ _	=	_ _ _	_ _ _
38 40 44	190 200 220	260 280 300	42 48 48	<u>-</u> <u>-</u>	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	_ _ _	=	_ _ _	_ _ _	_ _ _	_ _ _
60 64 68 72	300 320 340 360	420 440 460 480	=======================================	_ _ _	_ _ _	76 76 76 76	57 57 57 57	76 76 76 76	4 4 4 4	3 3 3	460 480 —	100 100 —	74 74 —	100 100 —	_ _ _	_ _ _ _		5 5 —	4 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 31)3D			313				323			Tapi Ro Br	
				Di	amete	r Serie	s 2										Diam	eter Se	eries 3							
	Di	mensi	on	Di	imensi	ion	Di	imensi	on	Cha	mfer		Di	mensi	on Ser	ies	Di	mensi	on	Di	imensi	on	Cha	mfer)er
	s	eries (12	S	eries 2	22	9	eries 3	12	Cone				0	3		S	eries 1	13	S	eries 2	23		Cup	d	Bore Number
D						Ī	Ť	11100	_			D			Ĭ			01100							и	ore [
D	В	С	T	В	С	T	В	С	Т	% (1	min.)	D	В	С	C (1)	Т	В	С	Т	В	С	T	r (min.)		ā
30 32 35	9 10 11	9 10	9.7 10.75 11.75	14 14 14	_ _ _	14.7 14.75 14.75	 - -	_ _ _	_ _ _	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	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	1.5	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 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	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		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		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	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 Se	ries 2			
per			Dime	ension S	Series			Dime	ension S	Series				[Dimensi	on Serie	S			
Bore Number	d	n	70	90	10	A6 (:)	D	71	91	11	46 ()	n	72	92	12	22	2	2	M (!)	26 (i)
Bor		D		T		γ (min.)	D		T		∦ (min.)	D		,	Γ		Central	Washer	(min.)	\mathcal{V}_1 (min.)
				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	21 21	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	

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 bearing tables for Thrust Bearings).

Thrust Bearings (Flat Seats) — 1 —

																					Un	its: mm	l
				513		523							514		524							Thrus Br	st Ball as.
			293									294											al Thrust
				Diam	neter Se	ries 3							Diam	eter Se	ries 4				Diam	neter Se	ries 5	1101101	Digo.
			D	imensi	on Seri	es						С	imensi	on Serie	es					Dimension			ja
		73	93	13	23		3	1			74	94	14	24	2	и И	-			Series 95			Bore Number
	D	75	00	10	20			* (min.)	γ_1 (min.)	D	74	54	14	24			∤ (min.)	γ_1 (min.)	D	- 55	∤ (min.)	d	ore N
				Т		-	Washer	-					Т		Central					T			ω.
						d_2	В								d_2	В							
	20 24 26	7 8 8	_ _ _	11 12 12		- -	=	0.6 0.6 0.6	_ _ _	_ _ _	=	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	Ξ	_ _ _	4 6 8	4 6 8
	30 32 37	9 9 10	_ _ _	14 14 15		_ _ _	=	0.6 0.6 0.6	_ _ _	_ _ _	=	_	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	=	_ _ _	10 12 15	00 01 02
	40 47 52	10 12 12	=	16 18 18	_ _ 34	_ _ 20	_ _ 8	0.6 1 1	_ _ _ 0.3	— — 60	_ _ 16	_ _ 21	_ _ 24	— — 45	_ _ 15	_ _ 11	_ _ 1	_ _ 0.6	52 60 73	21 24 29	1 1 1.1	17 20 25	03 04 05
	60 68 78	14 15 17	_ _ 22	21 24 26	38 44 49	25 30 30	9 10 12	1 1 1	0.3 0.3 0.6	70 80 90	18 20 23	24 27 30	28 32 36	52 59 65	20 25 30	12 14 15	1 1.1 1.1	0.6 0.6 0.6	85 100 110	34 39 42	1.1 1.1 1.5	30 35 40	06 07 08
	85 95 05	18 20 23	24 27 30	28 31 35	52 58 64	35 40 45	12 14 15	1 1.1 1.1	0.6 0.6 0.6	100 110 120	25 27 29	34 36 39	39 43 48	72 78 87	35 40 45	17 18 20	1.1 1.5 1.5	0.6 0.6 0.6	120 135 150	45 51 58	2 2 2.1	45 50 55	09 10 11
1	10 15 25	23 23 25	30 30 34	35 36 40	64 65 72	50 55 55	15 15 16	1.1 1.1 1.1	0.6 0.6 1	130 140 150	32 34 36	42 45 48	51 56 60	93 101 107	50 50 55	21 23 24	1.5 2 2	0.6 1 1	160 170 180	60 63 67	2.1 2.1 3	60 65 70	12 13 14
1	35 40 50	27 27 29	36 36 39	44 44 49	79 79 87	60 65 70	18 18 19	1.5 1.5 1.5	1 1 1	160 170 180	38 41 42	51 54 58	65 68 72	115 120 128	60 65 65	26 27 29	2 2.1 2.1	1 1 1.1	190 200 215	69 73 78	3 3 4	75 80 85	15 16 17
1	55 70 90	29 32 36	39 42 48	50 55 63	88 97 110	75 85 95	19 21 24	1.5 1.5 2	1 1 1	190 210 230	45 50 54	60 67 73	77 85 95	135 150 166	70 80 90	30 33 37	2.1 3 3	1.1 1.1 1.1	225 250 270	82 90 95	4 4 5	90 100 110	18 20 22
2	110 225 240	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
2	50 70 80	45 50 50	60 67 67	80 87 87	140 153 153	130 140 150	31 33 33	2.1 3 3	1.1 1.1 1.1	300 320 340	67 73 78	90 95 103	120 130 135	209 226 236	120 130 135	46 50 50	4 5 5	2 2 2.1	360 380 400	125 132 140	6 6 6	150 160 170	30 32 34
3	00 20 40	54 58 63	73 78 85	95 105 110	165 183 192	150 160 170	37 40 42	3 4 4	2 2 2	360 380 400	82 85 90	109 115 122	140 150 155	245 —	140 —	52 —	5 5 5	3 —	420 440 460	145 150 155	6 6 7.5	180 190 200	36 38 40
3	60 80 20	63 63 73	85 85 95	112 112 130	_ _ _	_ _ _	_ _ _	4 4 5	_ _ _	420 440 480	90 90 100	122 122 132	160 160 175	=	_ _ _	_ _ _	6 6 6	_ _ _	500 540 580	170 180 190	7.5 7.5 9.5	220 240 260	44 48 52
4	40 80 00	73 82 82	95 109 109	130 140 140	_ _ _	_ _ _	_ _ _	5 5 5	_ _ _	520 540 580	109 109 118	145 145 155	190 190 205	_ _ _	_ _ _	_ _ _	6 6 7.5	_ _ _	620 670 710	206 224 236	9.5 9.5 9.5	280 300 320	56 60 64

A 46 A 47



Table 7. 3 Boundary Dimensions of

Thrust B	all Brgs.									511					512		522			
Spherica Roller	al Thrust Brgs.													292						
			Diam	neter Sei	ries 0			Diam	neter Se	ries 1					Diam	eter Se	ries 2			
iber			Dime	ension S	eries			Dime	ension S	Series				[Dimensio	on Serie	S			
Bore Number	d	D^{-1}	70	90	10	46 (!)	D	71	91	11	M (!)	D	72	92	12	22	2	2	00 (!)	26 (!)
Bor		D		T		γ (min.)	D		T		火 (min.)	D		,	Г		Central	Washer	/ (min.)	\mathcal{V}_1 (min.)
									,								d_2	В		
68	340	380	18	24	30	1	420	36	48	64	2	460	54	73	96	_		-	3	_
72	360	400	18	24	30	1	440	36	48	65	2	500	63	85	110	_		-	4	_
76	380	420	18	24	30	1	460	36	48	65	2	520	63	85	112	_		-	4	_
80	400	440	18	24	30	1	480	36	48	65	2	540	63	85	112	_	_	_	4	
84	420	460	18	24	30	1	500	36	48	65	2	580	73	95	130	_	_	_	5	
88	440	480	18	24	30	1	540	45	60	80	2.1	600	73	95	130	_	_	_	5	
92	460	500	18	24	30	1	560	45	60	80	2.1	620	73	95	130	_	_	_	5	
96	480	520	18	24	30	1	580	45	60	80	2.1	650	78	103	135	_	_	_	5	
/500	500	540	18	24	30	1	600	45	60	80	2.1	670	78	103	135	_	_	_	5	
/530	530	580	23	30	38	1.1	640	50	67	85	3 3 3	710	82	109	140	_	_	_	5	_
/560	560	610	23	30	38	1.1	670	50	67	85		750	85	115	150	_	_	_	5	_
/600	600	650	23	30	38	1.1	710	50	67	85		800	90	122	160	_	_	_	5	_
/630	630	680	23	30	38	1.1	750	54	73	95	3	850	100	132	175	_	_	_	6	_
/670	670	730	27	36	45	1.5	800	58	78	105	4	900	103	140	180	_	_	_	6	_
/710	710	780	32	42	53	1.5	850	63	85	112	4	950	109	145	190	_	_	_	6	_
/750	750	820	32	42	53	1.5	900	67	90	120	4	1000	112	150	195	_	_	_	6	
/800	800	870	32	42	53	1.5	950	67	90	120	4	1060	118	155	205	_	_	_	7.5	
/850	850	920	32	42	53	1.5	1000	67	90	120	4	1120	122	160	212	_	_	_	7.5	
/900	900	980	36	48	63	2	1060	73	95	130	5	1180	125	170	220	_	_	_	7.5	
/950	950	1030	36	48	63	2	1120	78	103	135	5	1250	136	180	236	_	_	_	7.5	
/1000	1000	1090	41	54	70	2.1	1180	82	109	140	5	1320	145	190	250	_	_	_	9.5	
/1060	1060	1150	41	54	70	2.1	1250	85	115	150	5	1400	155	206	265	_	_	_	9.5	
/1120	1120	1220	45	60	80	2.1	1320	90	122	160	5	1460	—	206	—	_	_	_	9.5	
/1180	1180	1280	45	60	80	2.1	1400	100	132	175	6	1520	—	206	—	_	_	_	9.5	
/1250	1250	1360	50	67	85	3	1460	_	_	175	6	1610	_	216	_	_	_	_	9.5	_
/1320	1320	1440	—	—	95	3	1540	_	_	175	6	1700	_	228	_	_	_	_	9.5	_
/1400	1400	1520	—	—	95	3	1630	_	_	180	6	1790	_	234	_	_	_	_	12	_
/1500	1500	1630		_	105	4	1750	_	_	195	6	1920	_	252	_	_	_	_	12	_
/1600	1600	1730		_	105	4	1850	_	_	195	6	2040	_	264	_	_	_	_	15	_
/1700	1700	1840		_	112	4	1970	_	_	212	7.5	2160	_	276	_	_	_	_	15	_
/1800	1800	1950		_	120	4	2080	_	_	220	7.5	2280	_	288	_	_	_	_	15	_
/1900	1900	2060		_	130	5	2180	_	_	220	7.5	—	_	—	_	_	_	_	—	_
/2000	2000	2160		_	130	5	2300	_	_	236	7.5	—	_	—	_	_	_	_	—	_
/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).

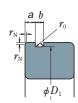
Thrust Bearings (Flat Seats) — 2 —

			`		,															Un	its: mm	1
			513		523							514		524								st Ball gs.
		293									294										Spheric Roller	al Thrust Brgs.
			Diam	eter Se	ries 3							Diam	eter Se	ries 4				Diam	neter Se	ries 5		
		D	imensi	on Serie	es							imensi	on Serie	es					Dimension Series)er
	73	93	13	23	2	:3				74	94	14	24	2	4				95		d	Bore Number
D					Central	Washe	* (min.)	r_1 (min.)	D					Central	Washe	* (min.)	r_1 (min.)	D		1 (min.)		Bore
			T		d_2	В						T		d_2	В				T			
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				6		710	140	185	243				7.5		850	272	12	400	80
650 680	100 103 109	140 145	180 190	_		_	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 /800
1180 1250	170 180	230 243	300 315	_	_	=	9.5 12	_	1360 1440	250 —	335 354	438	_	_	_	15 15	_	_	=	_	800 850	/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					10					1250	/1250
1900 2000	_	348 360	_	_	_	_	19 19 19	_	2160 2280	Ξ	505 530	_	_	_	=	19 19 19	=	Ξ	Ξ	=	1320 1400	/1320
									2200		300					13						
2140 2270	_	384 402	_	_	_	_	19 19	_	_	=	_	_	_	_	=	_	_	_	=	_	1500 1600	/1500
_	_	_	_	_	_	_	_	_	_	-	_	_	_	_	-	_	_	_	_	_	1700	/1700
_	_	_	_	_	_	=	_	_	_	=	_	_	_	_	=	_	_	_	_	_	1800 1900	/1800 /1900
_	_	_	_	_	_	_	-	-	_	-	_	_	_	_	-	_	_	_	-	_	2000	/2000
Ξ	=	_	_	_	=	_	_	_	_	=	_	_	_	_	=	_	_	=	=	_	2120 2240	/2120 /2240
_	_	_	_	_	_	_	_	_	_	=	_	_	_	_	=	_	_	Ξ	Ξ	=	2360 2500	/2360 /2500

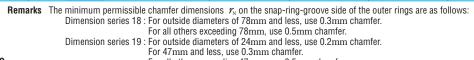
A 48 A 49



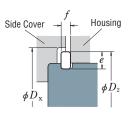
Table 7. 4 Dimensions of Snap Ring Grooves and Locating Snap Rings — (1) Bearings of Dimension Series 18 and 19

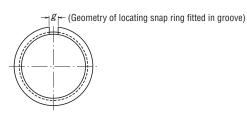


Арр	licable Bear	ings				Snap F	Ring Groove				
	J		Snap Rin	g Groove	5	Snap Ring Gr	oove Positio	on	Snap Rin	g Groove	Radius of
(d	D		neter		Bearing Dim		es		dth	Bottom Corners
Dimensi	on Series	D	I	O_1		18	1	9	'	b	r_0
18	19		max.	min.	max.	min.	max.	min.	max.	min.	max.
_	10 12 15	22 24 28	20.8 22.8 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
20 22	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	2.3 3.1	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



For all others exceeding 47mm, use 0.5mm chamfer.



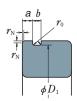


Units: mm

		Locati	ng Snap Rin	g			Side Cover
Locating Snap Ring Number	Hei	Sectional ight e		kness	fitted	by of snap ring I in groove eference) Snap Ring Outside Diameter D_2	Stepped Bore Diameter (Reference) $D_{\rm X}$
	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

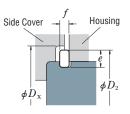


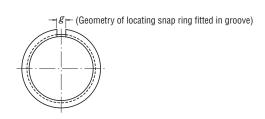
Table 7. 4 Dimensions of Snap Ring Grooves and Locating Snap Rings — (2) Bearing of Diameter Series 0, 2, 3, and 4



	Appli	cable Bea	rings					Snap Ri	ng Groove				
	(d			Dia	ng Groove meter		ap Ring Gr a Bearing Dia	3		. Wi	ng Groove idth	Radius of Bottom Corners
	Diamete	er Series		D		D_1		0	2, 3	3, 4	1	b	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 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 — 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 	17 —	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		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	Не	Sectional eight	Thio	ckness	fitted	ry of snap ring d in groove eference) Snap Ring Outside Diameter D_2	Stepped Bore Diameter (Reference)
	max.	min.	max.	min.			min.
NR 26(1)	2.06	1.91	0.84	0.74	3	28.7	29.4
NR 28(1)	2.06	1.91	0.84	0.74	3	30.7	31.4
NR 30	3.25	3.1	1.12	1.02	3	34.7	35.5
NR 32	3.25	3.1	1.12	1.02	3	36.7	37.5
NR 35	3.25	3.1	1.12	1.02	3	39.7	40.5
NR 37	3.25	3.1	1.12	1.02	3	41.3	42
NR 40	3.25	3.1	1.12	1.02	3	44.6	45.5
NR 42	3.25	3.1	1.12	1.02	3	46.3	47
NR 44	3.25	3.1	1.12	1.02	3	48.3	49
NR 47	4.04	3.89	1.12	1.02	4	52.7	53.5
NR 50	4.04	3.89	1.12	1.02	4	55.7	56.5
NR 52	4.04	3.89	1.12	1.02	4	57.9	58.5
NR 55	4.04	3.89	1.12	1.02	4	60.7	61.5
NR 56	4.04	3.89	1.12	1.02	4	61.7	62.5
NR 58	4.04	3.89	1.12	1.02	4 4 4	63.7	64.5
NR 62	4.04	3.89	1.7	1.6		67.7	68.5
NR 65	4.04	3.89	1.7	1.6		70.7	71.5
NR 68	4.85	4.7	1.7	1.6	5	74.6	76
NR 72	4.85	4.7	1.7	1.6	5	78.6	80
NR 75	4.85	4.7	1.7	1.6	5	81.6	83
NR 80	4.85	4.7	1.7	1.6	5	86.6	88
NR 85	4.85	4.7	1.7	1.6	5	91.6	93
NR 90	4.85	4.7	2.46	2.36	5	96.5	98
NR 95	4.85	4.7	2.46	2.36	5	101.6	103
NR 100	4.85	4.7	2.46	2.36	5	106.5	108
NR 110	4.85	4.7	2.46	2.36	5	116.6	118
NR 115	4.85	4.7	2.46	2.36	5	121.6	123
NR 120	7.21	7.06	2.82	2.72	7	129.7	131.5
NR 125	7.21	7.06	2.82	2.72	7	134.7	136.5
NR 130	7.21	7.06	2.82	2.72	7	139.7	141.5
NR 140	7.21	7.06	2.82	2.72	7	149.7	152
NR 145	7.21	7.06	2.82	2.72	7	154.7	157
NR 150	7.21	7.06	2.82	2.72	7	159.7	162
NR 160	7.21	7.06	2.82	2.72	7	169.7	172
NR 170	9.6	9.45	3.1	3	10	182.9	185
NR 180	9.6	9.45	3.1	3	10	192.9	195
NR 190	9.6	9.45	3.1	3	10	202.9	205
NR 200	9.6	9.45	3.1	3	10	212.9	215

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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

NU Type Cylindrical

Accuracy of ISO Class 4

Radial Clearance in Non-Interchangeable Cylindrical Roller Bearings **CC1**

Diameter Series 3

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 IIS B 1513 (Bearing Numbers for Rolling Bearings). Due to a need for more detailed classification, NSK uses auxiliary symbols other than those specified by IIS.

Bearing numbers consist of a basic number and supplementary symbols. The basic number indicates the bearing series(type) and the width and diameter series as shown in Table 7.5. Basic numbers,

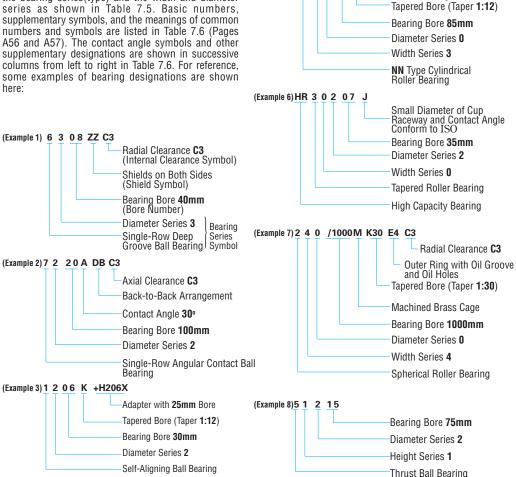


Table 7. 5 Bearing Series Symbols

					ing control cymbolc				
			Dimension	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	141400	1414		
Ball Bearings	62	6	(0)	2		NA48	NA	4	0
	63	6	(0)	3	Needle Roller	NA49	NA NA	4	8
	70	7	(1)		Bearings	NA59	NA	5	9
Single-Row	79 70	7 7	(1) (1)	9	Dearings	NA69	NA	6	9
Angular Contact	70 72	7	(0)	2					
Ball Bearings	72	7	(0)	3		329	3	2	9
		,	(0)			329	3	2	0
	12	1	(0)	2		330	3	3	0
Self-Aligning	13	1	(0)	3		331	3	3	1
Ball Bearings	22	(1)	2	2	Tapered Roller	302	3	0	2
	23	(1)	2	3	Bearings	302			
	NU10	NU	1	0		322	3	2	2 2
	NU2	NU	(0)	2		332	3	3	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		231	2	3	1
	NJ22	NJ	2	2	Spherical	222	2	2	2
	NJ3	NJ	(0)	3	Roller				
	NJ23	NJ	2	3	Bearings	232	2	3	2
Single-Row	NJ4	NJ	(0)	4		213 (1)	2	0	3
Cylindrical			. ,			223	2	2	3
Roller	NUP2	NUP	(0)	2		511	5	1	1
Bearings	NUP22	NUP	2	2		512	5	1	2
ŭ	NUP3	NUP	(0)	3		513	5	1 1	3
	NUP23	NUP	2	3	Thrust Ball	514	5	1	4
	NUP4	NUP	(0)	4	Bearings with	514	J	'	+
	N10	N	1	0	Flat Seats	522	5	2	2
	N2	N	(0)	2		523	5	2	3
	N3	N	(0)	3		524	5	2	4
	N4	N	(0)	4					
	NF2	NF	(0)	2	Spherical	292	2	9	2
	NF3	NF NF	(0) (0)	3	Thrust Roller	293	2	9	3
	NF4	NF NF	(0)	4	Bearings	294	2	9	4
Note (1) Bea	arına Series Sı	vmhol 213	should lo	nically he 2	03. but customarily it is r	numbered 213			

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.

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Table 7. 6 Formulation of

			Bas	ic Numbers	3									
•		ing Series nbols (1)	Bore	e Number		ntact Angle Symbol	Interr	nal Design Symbol	Ma	terial Symbol	Cag	e Symbol	Sea	nal Features Is, Shields Symbol
	Symbol	Meaning	Symbol	Meaning	Symbo	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	Meaning	Symbol	
	68 69 60	Single- Row Deep Groove Ball Bearings	1 2 3	Bearing 1mm 2 3		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	М	Machined Brass Cage	Z ZS	Shield on One Side Only
	: 70 72 73 :	Single-Row Angular Contact Ball Bearings	9	: : 9 10	A5	of 30° Standard Contact Angle of 25°	J	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
	12 13 22 :	Self- Aligning Ball Bearings Cylindrical	01 02 03	12 15 17	В	Standard Contact Angle of 40°				Troiling Elomonia	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			v	Without	DDU	Contact Rubber Seals on Both Sides
	NA48 NA49 NA69 : 320 322 323 :	Needle Roller Bearings Tapered Roller Bearings (2)	04(3) 05 06 	20 25 30 : : 440		Tapered Roller Bearings Contact Angle Less than 17° Contact Angle	CA CD EA	Spherical Roller Bearings				Cage	v	Non- Contact Rubber Seal on One Side Only Non- Contact
	230 222 223 : 511 512 513	Spherical Roller Bearings Thrust Ball Bearing with Flat Seats	92 96 /500 /530 /560	460 480 500 530 560	D	Contact Angle about 28°	E	Béarings Spherical Thrust Roller Bearings						Rubber Seals on Both Sides
	: 292 293 294 :	Thrust Spherical Roller Bearings	/2 360 /2 500	2 360 2 500										
	HR(4)	High Capacity Tapered Rolle Bearings, and	er											
		Symbols	and Nu	mbers Conf	orm to	JIS(5)			NSK	Symbol			NS	K Symbol
						Marked on Bea	ırings					t Marked Bearings		
		. ()		0 1 0							, 0.1			

- 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	ıxiliary Syn	nbols													
	ol for Design		ngement /mbol	Inter		Clearance Symbol load Symbol		rance Class Symbol	Sį	рe	Special cification symbol		er or Sleeve Symbol	Grea	se Symbol
	f Rings Meaning	Symbol	Meaning	Symbol	Mea	aning (radial clearance)	Symbol	Meaning	Symb	nl	Meaning	Symbol	Meaning	Symbol	Meaning
K	Tapered Bore of Inner Ring	DB				Clearance Less than C2 Clearance Less	,	ISO Normal	/B	ea rea	arings ated for nensional	+ K	Bearings with Outer Ring	AS2	SHELL ALVANIA GREASE S2
	, . ,	DF	Face-to- Face Arrangement	Omitted C3	Radial	CN Clearance Clearance Greater than CN	P6	ISO Class 6		ta	bilization / Working	+L	Spacers Bearings with Inner Ring	ENS	ENS GREASE
K30	Tapered Bore of Inner Ring (Taper 1:12) DF Face-to-Face Arrangement Dinner Ring (Taper 1:30) Tapered Bore of Inner Ring (Taper 1:30) DF Face-to-Face Arrangement Dinner Ring (Taper 1:30) DT Tandem Arrangement CC CC Dinner Ring (Taper 1:30) Notch or Lubricating Groove in Ring United Bulleting CC CC CC Dinner Ring Croove in Outside Surface and Holes in Outer Ring Groove in Outer Ring Courter Ring Courte	Clearance Greater than C3 Clearance Greater	P6X P5	ISO Class 6X	X28		Temperature Lower than 150 °C Working	+KL	Spacers Bearings with Both		NS HI-LUBE MULTEMP PS				
E	Notch or			CC2	geab	than CC2 Clearance Less	P4	ISO Class 4	Λ20		Temperature Lower than 200 °C		Inner and Outer Ring Spacers	132	No. 2
	Groove in			CC3	n-Interchan rical Roller	Normal Clearance Clearance Greater	P2	ISO Class 2	X29		Working Temperature Lower than 250 °C	H AH	Adapter Designation Withdrawal		
E4	Groove in				. =	than CC3 Clearance Greater	Tap	MA(7) pered ler bearing			pherical \	HJ	Sleeve Designation Thrust		
	Holes in				all Brgs.	Clearance Less than		Class 4	S11	\E	doller Bearings Dimensional Stabilizing		Collar Designation		
N	Groove in			MC3 MC4	Extra	Normal Clearance Clearance Greater	PN2	Class 2			Treatment Working Temperature Lower than 200°C				
NR	Groove with Snap Ring				Fo and Mi	than MC4 Clearance Greater	PN3	Class 3			200 C				
				СМ		rance in Deep Groove Bearings for Electric ors	PN0	Class 0							
				CT CM	Clea Roll Mot	rance in Cylindrical er Bearings for Electric ors									
					Ball Be	d of Angular Contact) aring ra light Preload									
				L M H	Med	nt Preload dium Preload vy Preload									
S	rtially the ame as JIS(5)		ame as IIS(5)	NSK S	Symbo	Partially the same as JIS(5)/ BAS(6)	San	ne as JIS(5)			NSK Sym	nbol, Pai	rtially the same	as JIS(5)
	ntae (5)	IIC. I	ananaa-			ple, Marked on Bearing	IS			_			Not Marked	on Bear	ings

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

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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.

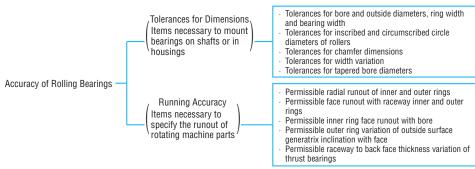


Table 8. 1 Bearing Types and Tolerance Classes

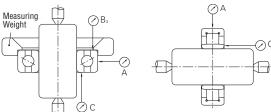
	Bearing	Types		Applica	able Tolerance (Classes		Applicable Tables	Reference Pages
	Deep Groove Ba	all Bearings	Normal	Class 6	Class 5	Class 4	Class 2		
	Angular Contac	t Ball Bearings	Normal	Class 6	Class 5	Class 4	Class 2		
	Self-Aligning Ba	all Bearings	Normal	Class 6 equivalent	Class 5 equivalent	_	_	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	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 Bearin	gs	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	l Roller Bearings	Normal	_	_	_	_	Table 8.7	A75
S	JIS	(1)	Class 0	Class 6	Class 5	Class 4	Class 2	_	_
ndard	DIN	[(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)

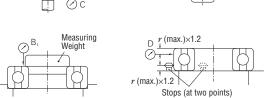
Notes (1) JIS: Japanese Industrial Standards (2) DIN: Deutsch Industrie Norm

(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	А
K_{ea}	Stationary	Rotating	Α
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 wash rotated.	or housing ner is to be	E

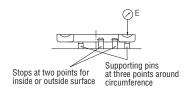


Fig. 8.1 Measuring Methods for Running Accuracy (summarized)

Symbols for Boundary Dimensions and Running Accuracy

d	Brg	pore	aia.,	non	nınaı	

Deviation of a single bore dia.

Single plane mean bore dia. deviation

Bore dia. Variation in a single radial plane

Mean bore dia. Variation

BInner ring width, nominal

Deviation of a single inner ring width Δ_{Bs}

Inner ring width variation

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_i , S_e Raceway to backface thickness variation of thrust brg

TBrg width, nominal

Deviation of the actual brg width

Brg outside dia., nominal

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 Δ_{Cs}

Outer ring width variation

 $K_{\rm ea}$ 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





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

Nominal	Bore Diameter					4	dmp (2)						Δ	ds (2)	
	d (mm)	N	ormal	C	lass 6	С	lass 5	C	lass 4	C	Class 2	Dia S	ass 4 ameter eries 2, 3, 4	С	lass 2
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low
0.6(1) 2.5 10	2.5 10 18	0 0 0	- 8 - 8 - 8	0 0 0	- 7 - 7 - 7	0 0 0	- 5 - 5 - 5	0 0 0	- 4 - 4 - 4	0 0 0	-2.5 -2.5 -2.5	0 0 0	- 4 - 4 - 4	0 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	-15 -18 -18 -22	0 0 0 0	-10 -13 -13 -15	0 0 0	- 8 -10 -10 -12	0 0 0	-5 -7 -7 -8	0 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	-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	_ _ _	- - -	 - -	<u>-</u> -	_ _ _	- - -	_ _ _	_ 	_ _ _	<u>-</u> -	_ _ _	_ _ _

				Δ_{E}	$_{ m Bs}$ (or $arDelta$	Cs)(3)							V_{\perp}	$_{B\mathrm{s}}$ (or ${\it V}$	_{Cs})	
		Single	Bearing				Co	mbine	d Bearing:	S (4)		Inner Ri Outer Ri	ing (or ing) (3)		Inner Rin	g
	Jormal Class 6		lass 5 lass 4	C	lass 2		ormal lass 6		lass 5 lass 4	C	lass 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.	ma
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. 1. 1.
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. 1. 1.
0 0 0 0	- 200 - 250 - 250 - 300	0 0 0 0	-200 -250 -250 -300	0 0 0 0	-200 -250 -250 -300	0 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 -	<u>-</u>	_ _ _	35 40 50	35 40 45	13 15 —	_ _ _	- -
0 0 0	- 500 - 750 -1 000	_ _ _		_ _ _		=		=		-		60 70 80	50 - -	- -	_ _ _	- -
0 0	-1 250 -1 600 -2 000	_ _ _		_ _ _	_	_	_	=	_	=	_	100 120 140	- - -	=	_ _ _	- -

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

- (2) Applicable to bearings with cylindrical bores.
 (3) 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.
 (4) Applicable to individual rings manufactured for combined bearings.
 (5) Applicable to ball bearings such as deep groove ball bearings, angular contact ball bearings, etc.

(excluding Tapered Roller Bearings) Widths of Outer Rings

					$V_{d\mathrm{p}}$ (2)								V_{dr}	_{np} (2)		
	Norma	1		Class 6	;	Cla	ss 5	Cla	ss 4	Class 2						
Dia	meter Se	eries	Dia	meter Se	eries		neter 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

O11110 1 pt111											
Nominal Bore Diameter		S _{ia} (5)			S_d				K_{ia}		
d (mm)	Class 2	Class 4	Class 5	Class 2	Class 4	Class 5	Class 2	Class 4	Class 5	Class 6	Normal
over incl.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.
0.6(1) 2.5 2.5 10 10 18	1.5 1.5 1.5	3 3 3	7 7 7	1.5 1.5 1.5	3 3 3	7 7 7	1.5 1.5 1.5	2.5 2.5 2.5	4 4 4	5 6 7	10 10 10
18 30 30 50 50 80	2.5 2.5 2.5	4 4 5	8 8 8	1.5 1.5 1.5	4 4 5	8 8 8	2.5 2.5 2.5	3 4 4	4 5 5	8 10 10	13 15 20
80 120 120 150 150 180 180 250	2.5 2.5 5	5 7 7 8	9 10 10 13	2.5 2.5 4 5	5 6 6 7	9 10 10 11	2.5 2.5 5 5	5 6 6 8	6 8 8 10	13 18 18 20	25 30 30 40
250 315 315 400 400 500	_ _ _	_ _ _	15 20 —	_ _ _	_ _ _	13 15 —		_ 	13 15 —	25 30 35	50 60 65
500 630 630 800 800 1 000	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ 	_ _ _	_ 	_ _ _	40 _ _	70 80 90
1 000 1 250 1 250 1 600 1 600 2 000	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	100 120 140

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

Nominal Ou	tside					Δ	<i>D</i> mp						Δ	l_{Ds}	
Diamete D (mm)	er	N	ormal	Cl	ass 6	Cl	ass 5	Cl	ass 4	С	lass 2	Dia S	ass 4 meter eries 2, 3, 4	C	lass 2
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low
2.5(¹) 6 18	6 18 30	0 0 0	- 8 - 8 - 9	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
120 150 180	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
250 315 400	315 400 500			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 -
500 630 800	630 800 1 000	0 0 0	- 50 - 75 -100	0 0 0	-38 -45 -60	0 0	-28 -35 -	_ _ _	_ _ _	- - -		_	_ _ _	_ _ _	=
1 000 1 250 1 600 2 000	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

					V_{Dp} ([2]								V	Dmp (2)			
	Nori	nal			Cla	ss 6		Cla	ss 5	Cla	ss 4	Class 2						
C	Dpen Type	9	Shielded Sealed	С	pen Typ	ре	Shielded Sealed	Open	Туре	Open	Туре	Open Type	N	Class	Class	Class	Class	ı
	Diameter	Series	,		Diamete			Diar Se	neter ries	Dian Se	neter ries	Diameter Series	Normal	6	5	4	2	ı
9	0, 1	2, 3, 4	2, 3, 4	9	0, 1	2, 3, 4	0,1,2,3,4	9	0,1,2,3,4	9	0,1,2,3,4	0,1,2,3,4						ı
	ma	х.			m	ax.		m	ax.	m	ax.	max.	max.	max.	max.	max.	max.	
10 10 12	8 8 9	6 6 7	10 10 12	9 9 10	7 7 8	5 5 6	9 9 10	5 5 6	4 4 5	4 4 5	3 3 4	2.5 2.5 4	6 6 7	5 5 6	3 3 3	2 2 2.5	1.5 1.5 2	
14 16 19	11 13 19	8 10 11	16 20 26				7 9 10	5 7 8	6 7 8	5 5 6	4 4 5	8 10 11	7 8 10	4 5 5	3 3.5 4	2 2 2.5		
23 31 38	23 31 38	14 19 23	30 38 -	19 23 25	19 23 25	11 14 15	25 30 —	11 13 15	8 10 11	9 10 11	7 8 8	5 7 8	14 19 23	11 14 15	6 7 8	5 5 6	2.5 3.5 4	
44 50 56	44 50 56	26 30 34	- - -	31 35 41	31 35 41	19 21 25	_ _ _	18 20 23	14 15 17	13 15 —	10 11 —	8 10 —	26 30 34	19 21 25	9 10 12	7 8 —	4 5 —	
63 94 125	63 94 125	38 55 75	- - -	48 56 75	48 56 75	29 34 45	_	28 35 —	21 26 —	_ _ _	=	_ _ _	38 55 75	29 34 45	14 18 —	_ _ _	- - -	
_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	ı
=		-	-	=	-	=	_	_				_	=	=	=		_	ı
_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	

Units : $\mu\,m$

			K_{ea}				S_D			S ea (3)			V_{Cs} (4)		. Nominal (Nutside
rn	nal	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
ax	۲.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	over	incl.
15 15 15	5	8 8 9	5 5 6	3 3 4	1.5 1.5 2.5	8 8 8	4 4 4	1.5 1.5 1.5	8 8 8	5 5 5	1.5 1.5 2.5	5 5 5	2.5 2.5 2.5	1.5 1.5 1.5	2.5 (¹) 6 18	6 18 30
20 25 35	5	10 13 18	7 8 10	5 5 6	2.5 4 5	8 8 9	4 4 5	1.5 1.5 2.5	8 10 11	5 5 6	2.5 4 5	5 6 8	2.5 3 4	1.5 1.5 2.5	30 50 80	50 80 120
40 45 50	5	20 23 25	11 13 15	7 8 10	5 5 7	10 10 11	5 5 7	2.5 2.5 4	13 14 15	7 8 10	5 5 7	8 8 10	5 5 7	2.5 2.5 4	120 150 180	150 180 250
60 70 80		30 35 40	18 20 23	11 13 —	7 8 —	13 13 15	8 10 –	5 7 —	18 20 23	10 13 —	7 8 —	11 13 15	7 8 —	5 7 —	250 315 400	315 400 500
00 20 40		50 60 75	25 30 —	_	_ _ _	18 20 —	=	_ _ _	25 30 —	_ _ _	_ _ _	18 20 —	_ _ _	_ _ _	500 630 800	630 800 1 000
60 90 20 50		_ _ _	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	1 000 1 250 1 600 2 000	1 250 1 600 2 000 2 500

A 62 A 63



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	dmp			4	$\mathcal{L}_{d\mathrm{s}}$		V	dp			V_a	<i>l</i> mp	
(mi			rmal ss 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
over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	max.	max.
10 18 30	18 30 50	0 0 0	- 8 -10 -12	0 0 0	- 7 - 8 -10	0 0 0	- 5 - 6 - 8	0 0 0	- 5 - 6 - 8	8 10 12	7 8 10	5 6 8	4 5 6	6 8 9	5 6 8	5 5 5	4 4 5
50 80 120	80 120 180	0 0 0	-15 -20 -25	0 0 0	-12 -15 -18	0 0 0	- 9 -10 -13	0 0 0	- 9 -10 -13	15 20 25	12 15 18	9 11 14	7 8 10	11 15 19	9 11 14	6 8 9	5 5 7
180 250 315	250 315 400	0 0 0	-30 -35 -40	0 0 0	-22 -25 -30	0 0 0	-15 -18 -23	0 0 0	-15 -18 -23	30 35 40	22 - -	17 - -	11 - -	23 26 30	16 - -	11 - -	8 - -
400 500 630	500 630 800	0 0 0	-45 -50 -75	0 0 0	-35 -40 -60	0 _ _	-27 - -	0 - -	-27 - -	_ _ _		_ _ _	_ _ _	_ _ _	_ _ _	- - -	

		ma		
п	G	ш	111	19

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

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

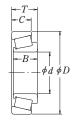
No		l Outside neter			Δ	Dmp			4	$1_{D m s}$		V	<i>D</i> p			V_{I}	Этр	
	_	D nm)		ormal ass 6X		ass 6 ass 5	Class 4		Cl	ass 4	Normal Class 6X	Class 6	Class 5	Class 4	Normal Class 6X	Class 6	Class 5	Class 4
0	ver	incl.	high	low	high	0 0			high	low	max.	max.	max.	max.	max.	max.	max.	max.
	18	30	0	- 9	0	- 8	0	- 6	0	- 6	9	8	6	5	7	6	5	4
	30	50	0	- 11	0	- 9	0	- 7	0	- 7	11	9	7	5	8	7	5	5
	50	80	0	- 13	0	-11	0	- 9	0	- 9	13	11	8	7	10	8	6	5
	80	120	0	- 15	0	-13	0	-10	0	-10	15	13	10	8	11	10	7	5
	120	150	0	- 18	0	-15	0	-11	0	-11	18	15	11	8	14	11	8	6
	150	180	0	- 25	0	-18	0	-13	0	-13	25	18	14	10	19	14	9	7
2	180	250	0	- 30	0	-20	0	-15	0	-15	30	20	15	11	23	15	10	8
	250	315	0	- 35	0	-25	0	-18	0	-18	35	25	19	14	26	19	13	9
	315	400	0	- 40	0	-28	0	-20	0	-20	40	28	22	15	30	21	14	10
5	100	500	0	- 45	0	-33	0	-23	0	-23	45	_	_	_	34	_	_	_
	500	630	0	- 50	0	-38	0	-28	0	-28	50	_	_	_	38	_	_	_
	530	800	0	- 75	0	-45	—	-	—	-	—	_	_	_	-	_	_	_
8	300	1 000	0	-100	0	-60	-	-	_	-	_	-	_	-	_	-	_	_

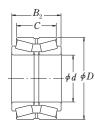
- Remarks 1. The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension *r* (max.) from the ring face.
 2. Some of these tolerances conform to the NSK Standard.

					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	-	—



	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	_	_





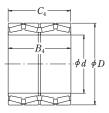
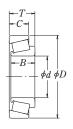


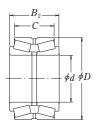


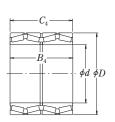
Table 8. 3 Tolerances for Metric Design Table 8. 3. 3 Tolerances for Width, Overall Bearing Width,

N	omina Diam	al Bore ieter			4	1 _{Bs}					4	∆ _{C s}					Δ_T	s		
	(mi			ormal ass 6	Cla	ss 6X		ass 5 ass 4		ormal lass 6	Cl	ass 6X		lass 5 lass 4		rmal ıss 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

Units : $\mu\,m$

R		with Roller	s	Outer Ri		ve Width D	eviation		Combined Bea B 2s	aring Width $\mathcal{L}_{B\mathrm{4s}}$,	4		nal Bore meter
Nor	mal	Class	s 6X	Nor	mal	Clas	s 6X		of double- earings	All classes bear			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

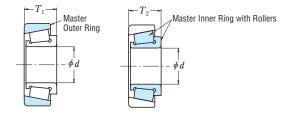




Table 8. 4 Tolerances for Inch Design Tapered Roller Bearings

(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 : $\mu\,m$

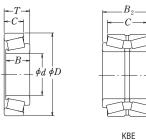
	Nominal Bo	re Diameter \emph{l}				Δ	ds		
over		incl.		CLAS	S 4, 2	CLAS	S 3, 0	CLAS	SS 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low
_ 76.200 266.700	3.0000 10.5000	76.200 266.700 304.800	3.0000 10.5000 12.0000	+ 13 + 25 + 25	0 0 0	+13 +13 +13	0 0 0	+8 +8 -	0 0 —
304.800 609.600 914.400 1 219.200	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 0	_ _ _ _	_ _ _

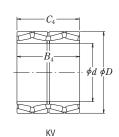


	Nominal Outs $\it I$	``				Δ	Ds		
over		incl.		CLAS	S 4, 2	CLAS	S 3, 0	CLAS	SS 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low
	_ 10.5000 12.0000	266.700 304.800 609.600	10.5000 12.0000 24.0000	+ 25 + 25 + 51	0 0 0	+13 +13 +25	0 0 0	+8 +8 -	0 0 —
609.600 914.400 1 219.200	24.0000 36.0000 48.0000	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 d						Δ	Ts .				
OV	er	in	cl.	CL	ASS 4	CLA	SS 2	<i>D</i> ≦508.		SS 3 D>508	.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 : $\mu\,m$

		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

			Dou		arings (KBE T	ype)				(KV	v Bearings Type) Δ_{C4s}
CLA	SS 4	CLAS	SS 2	D≦508.0	CLA 000 (mm)	SS 3 D>508.	000 (mm)	CLAS	SS 0,00	CLAS	SS 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	_	=	+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	dmp				V_{dp}			$V_{d\mathrm{mp}}$			$\it \Delta_{\it Bs}$ (or	⊿ _{Cs}) (1)
(mm)		No	rmal	Cla	ass 6	Cla	ass 5	Normal	Class 6	Class 5	Normal	Class 6	Class 5		rmal ass 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	eries E		Δι	Omp	E	Bearing S	eries EN	I		_	$V_{D\mathrm{p}}$	
	D (mm)	Norr	nal	Clas	s 6	Clas	ss 5	Nor	mal	Clas	s 6	Clas	s 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 : μm
	$V_{B{ m s}}$ (or	V _{Cs}) (1)	Δ	Ts		K_{ia}		S_d	$S_{\it ia}$
	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.
Ī	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

10	n oute	i iiiigs					Units : μ	ım
		$V_{D{ m mp}}$			K_{ea}		S _{ea}	S_D
N	Vormal	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 d or d_2 (mm)		$\Delta_{d ext{mp}}$ 0	r ⊿ _{d2mp}			r ${V_d}_{ m 2p}$		$S_{\it i}$ or	S _e (1)	
(mm)		Cla	rmal ss 6 ss 5	Cla	ss 4	Normal Class 6 Class 5	Class 4	Normal	Class 6	Class 5	Class 4
over	incl.	high	high low high low		max.	max.	max.	max.	max.	max.	
_	18	0	- 8	0	- 7	6	5	10	5	3	2
18	30	0	- 10	0	- 8	8	6	10	5	3	2
30	50	0	- 12	0	-10	9	8	10	6	3	2
50	80	0	- 15	0	-12	11	9	10	7	4	3
80	120	0	- 20	0	-15	15	11	15	8	4	3
120	180	0	- 25	0	-18	19	14	15	9	5	4
180	250	0	- 30	0	-22	23	17	20	10	5	4
250	315	0	- 35	0	-25	26	19	25	13	7	5
315	400	0	- 40	0	-30	30	23	30	15	7	5
400	500	0	- 45	0	-35	34	26	30	18	9	6
500	630	0	- 50	0	-40	38	30	35	21	11	7
630	800	0	- 75	0	-50	-	—	40	25	13	8
800 1 000	1 000 1 250	0 0	-100 -125	<u>-</u>	=	_	<u>-</u>	45 50	30 35	15 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, $S_{\rm e}$, applies only to flat-seat thrust bearings.



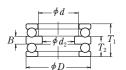
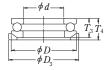


Table 8. 6. 2 Tolerances for Outside Diameter of Housing Washers and Aligning Seat Washers

Units : μm

Nominal Outside D Bearing or Ali Seat Wash	gning er		Flat Se	⊿ at Type	Dmp	Aligni Wash	ng Seat er Type	V	Dр	Outside Dev	Geat Washer Diameter iation D 3s
D or D_3 (mm)	3	Cla	rmal ıss 6 ıss 5	Cla	iss 4		rmal ss 6	Normal Class 6 Class 5	Class 4		rmal ss 6
over	incl.	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
180	250	0	- 30	0	-20	0	- 45	23	15	0	- 90
250	315	0	- 35	0	-25	0	- 53	26	19	0	-105
315	400	0	- 40	0	-28	0	- 60	30	21	0	-120
400	500	0	- 45	0	-33	0	- 68	34	25	0	-135
500	630	0	- 50	0	-38	0	- 75	38	29	0	-180
630	800	0	- 75	0	-45	0	-113	55	34	0	-225
800 1 000 1 250	1 000 1 250 1 600	0 0 0	-100 -125 -160	_ _ _	_ _ _	_ _ _	=	75 — —	_ _ _	_ _ _	Ξ



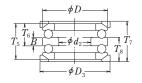




Table 8. 6. 3 Tolerances for Thrust Ball Bearing Height and Central Washer Height

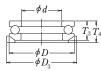
Units: um

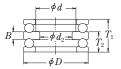
																μΠ
ı	Nomin	al Bore		Flat Se	at Type		Ali	gning Seat	Washer	Туре	Wit	h Aligning	Seat Wa	sher		Deviation
		neter	ΔI_{Ts} (or Δ $_{T2s}$	Δ	T1s	Δ_{T3s}	or Δ $_{T6s}$	Δ	T5s	$\Delta_{T_{48}}$	or Δ $_{T88}$	Δ	T7s		al Washer I _{Bs}
	<i>d</i> (m	(1) m)		l, Class 6 , Class 4		,		rmal ass 6		rmal ss 6		rmal ss 6	Noi Cla	rmal ss 6		l, Class 6 , Class 4
	over	incl.	high	low	high	low	high	high low		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	-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.







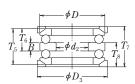


Table 8. 7 Tolerances for Thrust Spherical Roller Bearings

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

Units: µm

	Nominal Bore Diameter					Reference		
Diameter $d \pmod{mm}$		Δ	<i>I</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)

		Ur	iits : μm			
Nominal Outs I (m		$\it \Delta_{\it Dmp}$				
over	incl.	high	low			
120	180	0	- 25			
180	250	0	- 30			
250	315	0	- 35			
315	400	0	- 40			
400	500	0	- 45			
500	630	0	- 50			
630	800	0	- 75			
800	1 000		-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 r (max.) from the ring face.

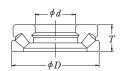




Table 8. 8 Tolerances of

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

(1) Tolerances for Inner Rings

	Nominal Bore Diameter d (mm)		Δ_{dmp}			$\it \Delta_{ds}$			V_{dp}		V_{dmp}		_	$1_{B\mathrm{s}}$		
			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	LSS 5P LSS 7P LSS 9P
	over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	high	low
	-	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 (1) 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 Outside		$\it \Delta_{Dmp}$			$\it \Delta_{Ds}$				V_{Dp}			$V_{D\mathrm{mp}}$				
Outside Diameter D		CLASS 5P				CLASS 5P CLASS 7P CLASS			SS 9P	CLASS 5P CLASS 7P		CLASS 9P		SS 5P SS 7P	CLASS 9P		
(mm	(mm) CLASS 7P			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 (1) 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

ш	n	ite	•	11	-1

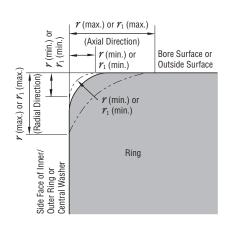
(or	(or Δ_{C_S}) V_{B_S}		$K_{i\mathrm{a}}$			S_{ia}			S_{d}				
CL	ASS 5P ASS 7P ASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P
high	low	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.
0	-400	5.1	2.5	1.3	3.8	2.5	1.3	7.6	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: μm

	V _{Cs} (1)			S_D			$K_{ m ea}$		S ea			Deviation of Flange Outside		Flange Outside		Flange Outside Diameter $\Delta_{D 18}$		Flange Outside						Flange Outside		Flange Outside		Deviation of Flange Width		Flange Backface Runout
CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS	CLASS		i	with Raceway (2) S _{ea1}																
5P	7P	9P	5P	7P	9P	5P	7P	9P	5P	7P	9P		ASS 5P ASS 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														





 ${m r}$: 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			Darmiccih	le Chamfer	Reference
Chamfer Dimension for Inner/ Outer Rings **(min.) or	Nomin Dian	neter	Dimens Inner/Ou r (max.) o	sion for ter Rings r \mathcal{Y}_1 (max.)	Corner Radius of Shaft or Housing γ_a
\mathcal{Y}_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

Reference

Permissible	Momina	Bore or	Parmiccih	le Chamfer	Reference						
Chamfer Dimension for Inner/ Outer Rings	Nominal	Outside eter (1)	Dimensior Outer \$\mathcal{\mathcal{P}}(n)\$	n for Inner/ Rings nax.)	Corner Radius of Shaft or Housing r_a						
	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	(1) Inner Rings are classified by d and Outer Rings									

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

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

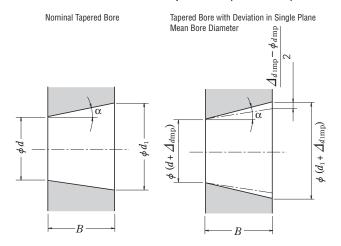
Units: mm

		Omto : mm				
Permissible Chamfer	Permissible Chamfer Dimension for Shaft	Reference				
Dimension for Shaft (or Central)/Housing	(or Central)/Housing	Corner Radius of Shaft or Housing				
Washers	Washers γ (max.) or γ (max.)	$\gamma_{\rm a}$				
${m \gamma}$ (min.) or ${m \gamma}_1$ (min.)	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 $\Delta_{
m dimp}$: Single Plane Mean Bore Diameter Deviation in Theoretical Diameter of Larger End of Bore

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

 \hat{B} : Nominal Inner Ring width

 α : Half of Taper Angle of Tapered Bore

Taper 1 : 12

Units : $\mu\,m$

Nominal Bore Diameter $d \pmod{mm}$		Δ_d	mp	Δ_{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	1 250 1 600	+165 +195	0	+105 +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: µn	1
-----------	---

Nominal Bore Diameter $d \pmod {\mathrm{mm}}$		$\it \Delta_{dmp}$		Δ_{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_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 Diagram of the control of the contro	Stationary	Rotating	Stationary Outer Ring Load	Tight Fit	Loose Fit	
Load Stationary	Stationary	Rotating	Rotating Outer Ring Load	Loose Fit	Tight Fit	
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 $\varDelta d$ 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):

$$\Delta d \ge 0.02 \frac{F_{\rm r}}{B} \times 10^{-3} \dots (N)$$

 $\Delta d \ge 0.2 \frac{F_{\rm r}}{B} \times 10^{-3} \dots {\rm \{kgf\}}$ (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 $(0.1 \text{--} 0.15) \Delta T$ 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):

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

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

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

 Δ 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

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
$$\Delta d = \frac{d}{d+3} \Delta d_a \dots (9.5)$$

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

			S	haft Diameter (mm	n)					
Load	Conditions	Examples	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 Gliatt Diameters		h6	bearings, f6 can be used to allow easy axial movement.			
	Light Loads	Electrical Home	<18	_	_	js5				
	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 _r ())	Machine Tools	_	140 to 200	_	m6				
	Normal Loads (0.06 to 0.13 $C_{ m r}(^1)$)	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 bearings and single-row angular contact ball bearings instead of k5 and m5.			
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				
Load			200 to 280	140 to 200	100 to 140	n6				
Indeterminate				200 to 400	140 to 280	р6				
			_	_	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	р6	bearing internal			
	$(>0.13C_{\rm r}(^1))$	Construction Equipment,	_	over 200	140 to 200	r6	clearance is necessary.			
		Crushers	_	_	200 to 500	r7				
Axial Loads Only				All Shaft Diameters	i	js6 (j6)	_			
	Radial Bearings with Tapered Bores and Sleeves									
All Types of Loading		General bearing Applications, Railway Axleboxes		All Shaft Diameters		h9/IT5(²)	IT5 and IT7 mean that the deviation of the shaft from its true geometric			
Makes (Transmission Shafts, Woodworking Spindles		All Gliait Diameters		h10/IT7(²)	form, e. g. roundness and 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

Load	Conditions	Examples	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	<200	k6	_
(Spherical Thrust Roller	Load or Direction of Load	Refiners, Plastic	200 to 400	m6	
Bearings)	Indeterminate	Extruders	over 400	n6	

Table 9.4 Fits of Radial Bearings with Housings

	Load Co		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	IIIIpussible	_
		Heavy Shock Loads	Traction Motors			
	Direction of Load Indeterminate	Normal or Heavy Loads	Pumps Crankshaft Main Bearings	K7	Generally Impossible	If axial displacement of the outer ring is not required.
	muotommato	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	Н8	Easily possible	_
	Rotating Inner Ring Load	High Temperature Rise of Inner Ring Through Shaft	Paper Dryers	G7		
	Luau	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 : u.m

(-)	Bouringo or r	outuron orac		Units : µ m							
One	rating Conditions		Nominal Bore	e Diameters d		Bore Diameter Tolerances Δ_{ds}		Shaft Diameter Tolerances		- Remarks	
Ope	rating conditions	OV	er	inc	il.					Hemans	
		(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 $d \le 152.4$ mm,	
s s	Normai Loaus	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	Heavy Loads	_		76.200	3.0000	+13	0	+ 64	+ 38	In general, bearings with a clear-	
3ot	Shock Loads	76.200	3.0000	304.800	12.0000	+25	0	*		ance larger than CN are used.	
	High Speeds	304.800	12.0000	609.600	24.0000	+51	0	*			
	riigii opoodo	609.600	24.0000	914.400	36.0000	+76	0	+381	+305	interference is about 0.0005 d .	
		_	_	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	
ute		304.800	12.0000	609.600	24.0000	+51	0	+ 51	0	figures in the above (Rotating inner ring	
g O	Normal Loads	609.600	24.0000	914.400	36.0000	+76	0	+ 76	0	loads, heavy or shock loads) apply.	
Rotating Outer Ring Loads	틸립 without Shocks	_	_	76.200	3.0000	+13	0	0	- 13		
3 d		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 : μm

One	rating Conditions		Nominal Bore Diameters $oldsymbol{d}$					Shaft Diameter Tolerances		- Remarks	
Ope	rating conditions	OV	er	in	incl.					Heiliaiks	
		(mm)	1/25.4	(mm)	1/25.4	high	low	high	low		
	Duratalan	_	_	76.200	3.0000	+13	0	+ 30	+18		
_	Precision Machine-Tool	76.200	3.0000	304.800	12.0000	+13	0	+ 30	+18		
s ne	Main Spindles	304.800	12.0000	609.600	24.0000	+25	0	+ 64	+38	_	
g Ir	wan opinaloo	609.600	24.0000	914.400	36.0000	+38	0	+102	+64		
Rotating Inner Ring Loads	Hannel anda	_		76.200	3.0000	+13	0	_			
30tg	Heavy Loads Shock Loads	76.200	3.0000	304.800	12.0000	+13	0	_	_	A minimum interference of about	
	High Speeds	304.800	12.0000	609.600	24.0000	+25	0	_	_	0.00025 d is used.	
	"	609.600	24.0000	914.400	36.0000	+38	0	_			
Rotating Outer Ring Loads	Precision	_	-	76.200	3.0000	+13	0	+ 30	+18		
g O	Machine-Tool	76.200	3.0000	304.800	12.0000	+13	0	+ 30	+18		
tatio	Main Spindles	304.800	12.0000	609.600	24.0000	+25	0	+ 64	+38		
8.5	a Spiridioo	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

One	rating Conditions	Nominal Outside Diameters D					Outside Diameter Tolerances Δ_{Ds}		ng Bore neter ances	- Remarks	
Оро	rating conditions	ove	r	in	ol.					Homano	
		(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	displaced axially.	
g	fixed-end	304.800	12.0000	609.600	24.0000	+51	0	+152	+102	diopidood dataily.	
Rotating Inner Ring Loads		609.600	24.0000	914.400	36.0000	+76	0	+229	+152		
- Bi		_		76.200	3.0000	+25	0	+ 25	0		
₩	The outer ring position can be adjusted axially.	76.200	3.0000	127.000	5.0000	+25	0	+ 25	0	The outer ring can be displaced	
ner		127.000	5.0000	304.800	12.0000	+25	0	+ 51	0	axially.	
드		304.800	12.0000	609.600	24.0000	+51	0	+ 76	+ 25	waarj.	
ţį		609.600	24.0000	914.400	36.0000	+76	0	+127	+ 51		
ota	The euter ring	_		76.200	3.0000	+25	0	- 13	- 38		
<u>~</u>	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	undiny.	
		609.600	24.0000	914.400	36.0000	+76	0	- 25	-102		
ıter	Normal Loads	_		76.200	3.0000	+25	0	- 13	- 38		
Rotating Outer Ring Loads	The outer ring	76.200	3.0000	127.000	5.0000	+25	0	- 25	- 51		
Eig Log	position cannot	127.000	5.0000	304.800	12.0000	+25	0	- 25	- 51	The outer ring is fixed axially.	
otat	be adjusted	304.800	12.0000	609.600	24.0000	+51	0	- 25	- 76		
88	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 D					Outside Diameter Tolerances ΔI_{Ds}		g Bore neter ances	- Remarks	
Opc	rating conditions	OV	er	ind	cl.					Homarko	
		(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 C	Used on fixed-	152.400	6.0000	304.800	12.0000	+13	0	+25	+13	The outer ring can be displaced	
ing.	end	304.800	12.0000	609.600	24.0000	+25	0	+51	+25	axially.	
P.		609.600	24.0000	914.400	36.0000	+38	0	+76	+38		
Ĕ	The outer ring	_		152.400	6.0000	+13	0	+13	0		
пg	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.	
B	,,	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 cutof ring to those 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		
350	The outer ring	76.200	3.0000	152.400	6.0000	+13	0	-13	-25		
Rotating Outer Ring Loads	position cannot	152.400	6.0000	304.800	12.0000	+13	0	-13	-38	The outer ring is fixed axially.	
ota	be adjusted	304.800	12.0000	609.600	24.0000	+25	0	-13	-38		
<u></u>	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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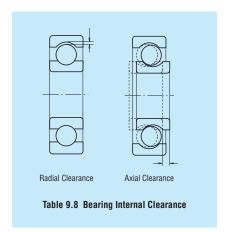


9.2 Bearing Internal Clearances

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 small.

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

Вє	earing Types	Table Number	Page Number
Deep Groove Ba	ıll 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	- W.	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 and Roller Bearings	d Combined Tapered	9.15	A93
Combined Angu Bearings (1)	lar 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						Ultai	ance				
d (mm		С	2	С	N	С	3	С	4	С	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 ob	ain th	e mea	sured	l value	s, use	e the o	clearar	nce co	rrecti	

Nominal Bore

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 I Dia. d (n		Meas Lo			lial Cle ount	arance	Correc	tion
over	incl.	(N)	au {kgf}	C2	CN	СЗ	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

Unite : um

									UIIII	ιο . μ	1111	
Clear- ance Symbol		C1	M	C2	М	СЗ	М	C4	M	C5	M	C6
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	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	МС5	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 d (n	neter	Bearing Series	Clea	rance
over	incl.		min.	max.
2.5	20	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: $\mu\,m$

Nomina			CI	earanc	e in Be	arings	with C	ylindri	cal Bo	es			C	learan	ce in B	earing	s with	Tapere	d Bore	S	
Dia. <i>d</i> ((mm)	(22	C	N	C	23	C	4	C	5	(2	C	N	C	3	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 B		Clea	rance	Rem	narks
Dia. d (m	m)	С	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 Electric Motors

Units: um

						0	ιιο . μ π
Nomina			Clear	rance		F	Remarks
Dia. d	(mm)	Interchan	geable CT	Non-Intercha	angeable CM	Reco	nmended 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		

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

	omi ore l						ances Cylind									Cleara		Non-I			ole Bea	rings		
d	(m	m)	C	2	С	N	C	3	C	4	C	5	C	C1	С	C2	CC	(1)	C	C3	C	C4	C	C5
OV	er	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.								
	0	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
4	0	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
14	0	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
20	0 2	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
28	0 :	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
40	0 4	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		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 wit	h Tapere	d Bores				
	mm)	CC	9 (1)	C	C0	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

Non	ninal Dia.		(Cleara	nce in	Beari	ngs wit	th Cylin	drical B	ores				Cle	arance i	in Beari	ngs wit	h Taper	ed Bore	S	
d (r		C	2	С	N	(C3	C	4	C	5	C	2	(CN	C	3	C	4	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	140	260	260	410	410	550	550	720	720	900	260	370	370	490	490	630	630	790	790	1 000
500	560	150	280	280	440	440	600	600	780	780	1 000	290	410	410	540	540	680	680	870	870	1 100
560	630	170	310	310	480	480	650	650	850	850	1 100	320	460	460	600	600	760	760	980	980	1 230
630	710	190	350	350	530	530	700	700	920	920	1 190	350	510	510	670	670	850	850	1 090	1 090	1 360
710	800	210	390	390	580	580	770	770	1 010	1 010	1 300	390	570	570	750	750	960	960	1 220	1 220	1 500
800	900	230	430	430	650	650	860	860	1 120	1 120	1 440	440	640	640	840	840	1 070	1 070	1 370	1 370	1 690
900	1 000	260	480	480	710	710	930	930	1 220	1 220	1 570	490	710	710	930	930	1 190	1 190	1 520	1 520	1 860
1 000	1 120	290	530	530	780	780	1 020	1 020	1 330	—	—	530	770	770	1 030	1 030	1 300	1 300	1 670	—	—
1 120	1 250	320	580	580	860	860	1 120	1 120	1 460	—	—	570	830	830	1 120	1 120	1 420	1 420	1 830	—	—
1 250	1 400	350	640	640	950	950	1 240	1 240	1 620	—	—	620	910	910	1 230	1 230	1 560	1 560	2 000	—	—

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

Units : $\mu\,m$

	ndrical						CI	earance					
	red Bore	C	21	C	2	С	^C N	C	3	C	24	С	5
Nominal Bo Dia. d (mn		_	_	C	1	C	22	C	N	C	23	C	24
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	130	190	200	260	400	460	600	700	_	=	_	_
1 120	1 250	150	210	220	280	450	510	670	770	_		_	_
1 250	1 400	170	240	250	320	500	570	750	870	_		_	_

Remarks Axial internal clearance $\Delta_a = \Delta_r \cot \alpha = \frac{1.5}{e} \Delta_r$

where Δ_r : Radial internal clearance α : Contact angle e: Constant (Listed in bearing tables)

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

Units: u.m.

Nomin	al Bore		Axial Intern					al Clearance					
Diam	eter.			Contact /	Angle 30°			Contact Angle 40°					
d (r	nm)	C	N	C	3	C	24	C	N	C	3	(24
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

	Units : µm				n					
Nomin	al Bore		Axial Internal Clearance							
Dia. d	(mm)	C	2	CN		C3		C4		
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 9.13.2)

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:

$$\delta_t = \alpha \Delta_t D_0$$
 (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 $= 12.5 \times 10^{-6} (1/°\dot{C})$
- Δ_t : Temperature difference between inner and outer rings (°C)
- D_e : Outer ring raceway diameter (mm)

For ball bearings

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

For roller bearings

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

The clearance after substracting this δ_t from the residual clearance. Δ_f is called the effective clearance. △. 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.

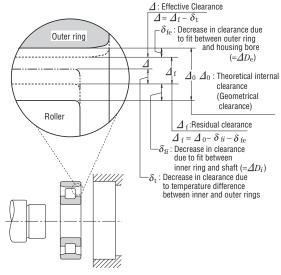


Fig. 9.2 Changes in Radial Internal Clearance of Bearings

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 loads and	Traction motors for railways	C4
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 bearings
- (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

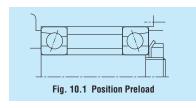
A position preload is achieved by fixing two axially opposed bearings in such a way that a preload is imposed on them. Their position, once fixed, remain unchanged while in operation.

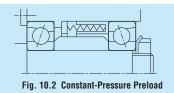
In practice, the following three methods are generally used to obtain a position preload.

- (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. 10.1)
- (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)

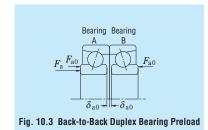




10.3 Preload and Rigidity

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.



 δ_{aB}^{aA} : Displacement of Bearing B

 $F_{\rm a\,A}$: Axial load imposed on Bearing A $F_{\rm a\,B}$: Axial load imposed on Bearing B

10.3.2 Constant-Pressure Preload and Rigidity

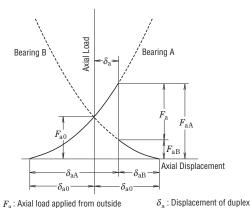
A preload diagram for duplex bearings under a constant-pressure preload is shown in Fig. 10.5. The deflection curve of the spring is nearly parallel to the horizontal axis because the rigidity of springs is lower than that of the bearing. As a result, the rigidity under a constant-pressure preload is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



 δ_a : Displacement of duplex bearing set δ_a : Displacement of Bearing A

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.

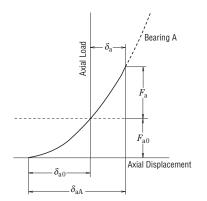


Fig. 10.5 Axial Displacement with Constant-Pressure Preload

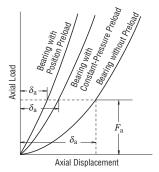


Fig. 10.6 Comparison of Rigidities and Preloading Methods

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 bearings.

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 rigidity

When speeds result in a value of $D_{\mathrm{pw}} \times n$ ($d_{\mathrm{m}} n$ 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

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

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

Units . μ III						
Nominal Bore Dia. d (mm)		Target Shaft	Nominal Outside Dia. D (mm)		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

Table 10. 2. 2 Duplex

Unite: um

Extra light	Light
Preload EL	Preload L
12	25
12	25
14	29
14	29
24	49
29	59
39	78
60	120
60	120
75	150
75	150
100	200
100	200
125	250
145	290
145	290
195	390
195	390
245	490
270	540
270	540

(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)

where $F_{\rm a\,min}$: Minimum axial load (N), {kgf} n : Speed (min⁻¹)

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

Angular Contact Ball Bearings

Bearings of Series 70

Units	7
UIIIIO	1

Preloads					
Medium Preload M	Heavy Preload H				
49 59 69	100 120 150				
69 120 150	150 250 290				
200 250 290	390 490 590				
340 390 490	690 780 980				
540 540 740	1 080 1 080 1 470				
780 930 980	1 570 1 860 1 960				
1 180 1 180 1 270	2 350 2 350 2 550				

(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:

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

Table 10. 2. 3 Duplex Bearings of Series 72

10. 2. 3 Duplex Bearings of Series 72

				UIIILS . IN
		Preli	oads	
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
7220 C	490	980	2 350	4 710

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	Item Class of Bearings		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 Ra	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 .

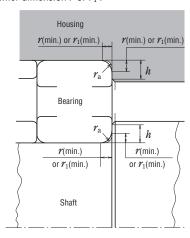


Fig. 11.1 Chamfer Dimensions. Fillet Radius of Shaft and Housing, and Shoulder Height

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 h and 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

			UIIII . IIIIII
Nominal		Shaft or Housir	ng
Chamfer	Fillet	Minimun Sho	ulder Heights
Dimensions		h (n	nin.)
$ rac{r}{(\text{min.})}$ or $ rac{r}{(\text{min.})}$	Radius γ_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.



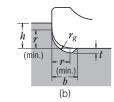


Fig. 11. 2 Chamfer Dimensions, Fillet Radius, and Shoulder Height

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	$\gamma_{ m g}$	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		

A 100



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 $D_{\rm a}$ should be less than the pitch circle diameter of the balls, and the shaft shoulder diameter $d_{\rm a}$ 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.

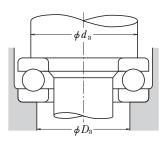


Fig. 11.3 Face Supporting Diameters for Thrust Ball Bearings

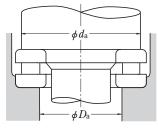


Fig. 11.4 Face Supporting Diameters for Thrust Roller Bearings

(a)

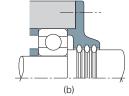


Fig. 11.5 Examples of Oil Grooves

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 grooves.

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

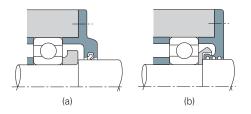
(3) Labyrinth Seals

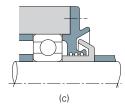
Labyrinth seals are formed by interdigitated segments attached to the shaft and housing that are separated by a very small gap. They are particularly suitable for preventing oil leakage from the shaft at high speeds. The type shown in Fig. 11.7 (a) is widely used because of its ease of assembly, but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





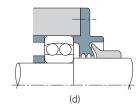
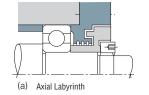


Fig. 11.6 Examples of Flinger Configurations



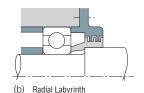




Fig. 11.7 Examples of Labyrinth Designs

NSK

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 11.9)

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 silicone-based oil will cause silicone-based material to swell. Moreover, urea-based grease will cause fluorine-based 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 11.6.

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.

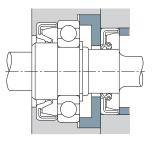


Fig. 11.8 Example of Application of Oil Seal (1)

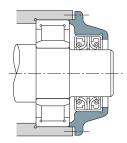


Fig. 11.9 Example of Application of Oil Seal (2)

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)
Synthetic	Nitrile Rubber	Under 16	-25 to +100
	Acrylic Rubber	Under 25	-15 to +130
Rubber	Silicone Rubber	Under 32	-70 to +200
	Fluorine- containes Rubber	Under 32	-30 to +200
Tetrafluori	de 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

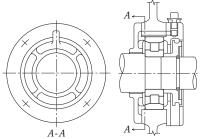


Fig. 12.1 Combination of Partitioned Grease Reservoir and Grease Valve

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

(1) Radial Ball Bearings, Cylindrical Roller Bearings

(3) Load factor

≤0.06 0.1 0.13 0.16 1.5 0.65 0.45 Load factor

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.)

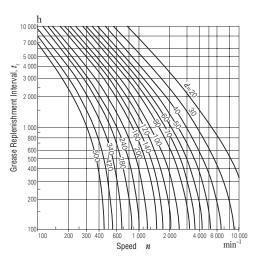
It is advisable to consult NSK.

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

(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

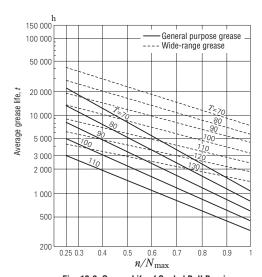


Fig. 12.3 Grease Life of Sealed Ball Bearings

(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.

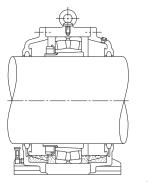


Fig. 12.4 Oil Bath Lubrication

Fig. 12.5 Drip Feed Lubrication

Fig. 12.2 Grease Replenishment Intervals



(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.

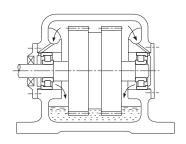


Fig. 12.6 Splash Lubrication

(5) Jet Lubrication

Jet lubrication is often used for ultra high speed bearings, such as the bearings in jet engines with a $d_{\rm m}n$ valve ($d_{\rm m}$: 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).

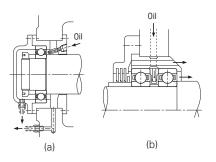


Fig. 12.8 Jet Lubrication

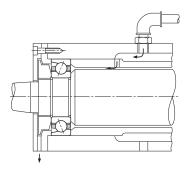


Fig. 12.9 Oil Mist Lubrication

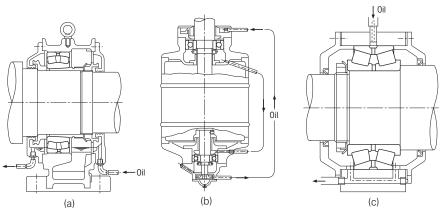


Fig. 12.7 Circulating Lubrication

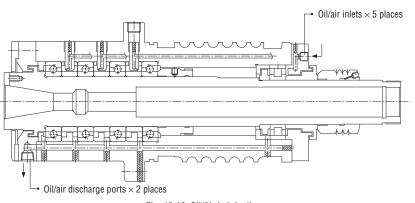


Fig. 12.10 Oil/Air Lubrication

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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

			10010 12.2
Name (Popular name)		Lithium Grease	
Thickener			
Base Oil Properties	Mineral Oil	Diester Oil, Polyatomic Ester 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	Fair	Poor
Water Resistance	Good	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 (1) 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)		oap Base Grease -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	Synthetic Oil (Ester Polyatomic Ester Oi Synthetic Hydrocart Oil, Silicone Oil, Flu 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	I Good Goo		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 required.	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 $13 \text{mm}^2/\text{s}$
Tapered Roller Bearings and Spherical Roller Bearings	Higher than 20mm²/s
Spherical Thrust Roller Bearings	Higher than $32 mm^2/s$

Remarks 1mm²/s=1cSt (centistokes)

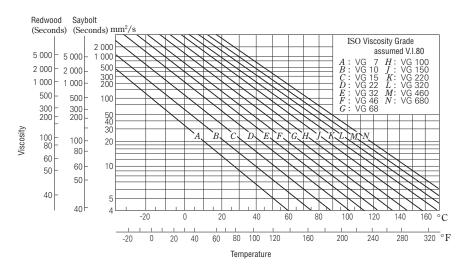


Fig. 12.11 Temperature-Viscosity Chart

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			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)	_
	Less than 50% of limiting speed	ISO VG 100, 150, 220 (bearings oil)	ISO VG 150, 220, 320 (bearing oil)
50 to 80 °C	50 to 100% of limiting speed	ISO VG 46, 68, 100 (bearing oil, turbine 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).
 - 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

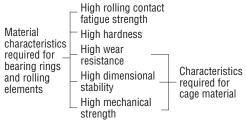
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13. BEARING MATERIALS

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)

Standard	Cumbala	Chemical Composition (%)						
Statiuaru	Symbols	С	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)

Standard	Cumbala				Chemical Cor	nposition (%)			
Stanuaru	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

Ctandard	Cumbala					Ch	emical Com	position (%))				
Statitual u	Standard Symbols	С	Si	Mn	P	S	Cr	Mo	V	Ni	Cu	Co	W
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)

Ctandard	Cumbolo	Chemical Composition (%)							
Standard 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 (%)						
Ciassilication	Stanuaru	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		Cu	Zn	Mn	Fe	Al	Sn	Ni	Impurities		
		Cu	ZII	10111	ге	Al	SII	111	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 lubricants.

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.

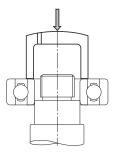


Fig. 14.1 Press Fitting Inner Ring

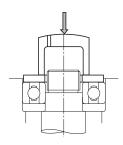
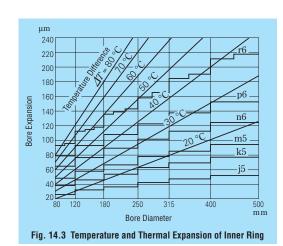


Fig. 14.2 Simultaneous Press Fitting of Inner and Outer Rings



(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

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 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 a and b (which are on a horizontal line passing through the bearing center) and 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.

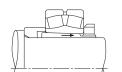


Fig. 14.4 Mounting with Adapter

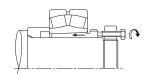


Fig. 14.5 Mounting with Withdrawal Sleeve



Fig. 14.6 Mounting with Hydraulic Nut

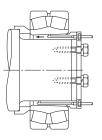


Fig. 14.7 Mounting with Special Sleeve and Hydraulic Pressure

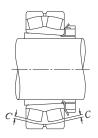


Fig. 14.8 Clearance Measurement of Spherical Roller Bearing

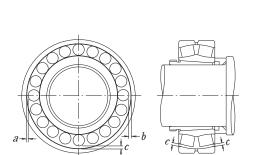


Fig. 14.9 Measuring Clearance in Large Spherical Roller Bearing

Table 14.1 Mounting of Spherical Roller Bearings with Tapered Bores

Units: mm

Bearinç Diam	ieter		n in Radial rance	Push	-in amour	nt in axial di	rection		Minimum Permissible Residual Clearance	
à	!			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	
Rema	rks The	values for	reduction i	n radial ir	nternal cle	arance are	for hearing	ns with CN		

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.

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	regularities	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	Laud Dagular	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			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.			
Abnorn	Abnormal load rmal Temperature		Improve the fit, internal clearance, preload, position of housing shoulder.			
	nise	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.			
,	Vibration	Flaking	Replace the bearing.			
	xial 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 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.

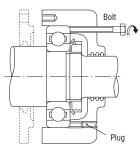


Fig. 14.10 Removal of Outer Ring with Dismounting Bolts

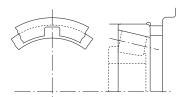


Fig. 14.11 Removal Notches

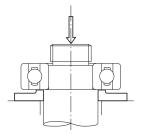


Fig. 14.12 Removal of Inner Ring Using a Press

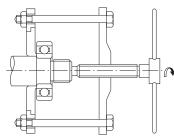


Fig. 14.13 Removal of Inner Ring Using Withdrawal Tool (1)

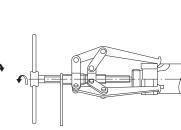


Fig. 14.14 Removal of Inner Ring Using Withdrawal Tool (2)



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.

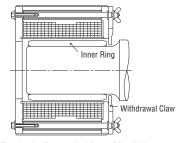


Fig. 14.15 Removal of Inner Ring Using Induction Heater



Fig. 14.16 Removal of Withdrawal Sleeve Using Withdrawal Nut (1)

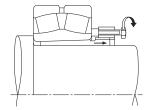


Fig. 14.17 Removal of Withdrawal Sleeve Using Withdrawal Nut (2)

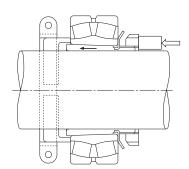


Fig. 14.18 Removal of Adapter with Stop and Axial Pressure

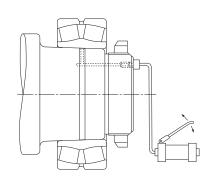


Fig. 14.19 Removal Using Oil Injection Hydraulic Pump

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.

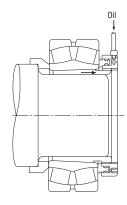


Fig. 14.20 Removal Using Hydraulic Nut

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.
- (i) 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

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.

In general, if rolling bearings are used correctly they

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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15. TECHNICAL DATA

Page 15. 1 AXIAL DISPLACEMENT OF BEARINGS A 128 (1) Contact Angle and Axial Displacement of Deep Groove Ball Bearings and Angular Contact Ball Bearings A 128 (2) Interferences or Clearances for Shafts and Inner Rings A 130 (3) Interferences or Clearances for Housing Bores and Outer Rings A 130 15. 3 RADIAL AND AXIAL INTERNAL CLEARANCES A 132 15. 4 PRELOAD AND STARTING TORQUE A 134 15. 5 COEFFICIENTS OF FRICTION AND OTHER BEARING DATA A 136 (3) Radial Internal Clearance and Fatigue Life A 136 15. 6 BRANDS AND PROPERTIES OF LUBRICATING GREASES A 138

DEFINIONS OF SYMBOLS AND THEIR UNITS

Symbols	Nomenclature	Units
$a \\ b$	Contact Ellipse Major Axis Contact Ellipse Major Axis	(mm) (mm)
$C_{\rm r}$	Basic Dynamic Load Rating of Radial Bearings	(N){kgf}
C_{0r}	Basic Static Load Radial of Radial Bearings	(N){kgf}
$C_{\rm a}$	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)
$D_{\rm e}$	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)
D_{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 MP _a {21 200 kgf/mm²}	
E(k)	Complete elliptic integral of the 2nd kind for which the population parameter is $k = \sqrt{1 - \left(\frac{b}{a}\right)^2}$	
$f_{\scriptscriptstyle 0}$	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_{e}/D	
h_0	D/D_0	
k	d/D_i	
K	Constant Determined by Internal Design of Bearing	
L	Fatigue Life when Effective Clearance is 0	
$L_{\rm we}$	Effective Leng of Roller	(mm)
L_{ϵ}	Fatigue Life when Effective Clearance is \varDelta	
$m_{\scriptscriptstyle 0}$	Distance between Centers of Curvature of Inner and Outer Rings $r_i + r_e - D_w$	(mm)
M	Frictional Torque	(N·mm){kgf·mm}
$M_{ m S}$	Spin Friction	(N·mm){kgf·mm}

Symbols	Nomenclature	Units
$n_{\rm a}$	Rotating Speed of Rolling Elements	(min ⁻¹)
$n_{\rm c}$	Revolving Speed of Rolling Elements (Cape Speed)	(min ⁻¹)
n_{e}	Speed of Ouder Ring	(min ⁻¹)
n_i	Speed of Inner Ring	(min ⁻¹)
$p_{ m m}$	Surface Pressure on Fitted Surface	(MP _a){kgf/mm ² }
\overline{P}	Bearing Load	$(N)\{kgf\}$
Q	Rolling Element Load	$(N)\{kgf\}$
$r_{ m e}$	Groove Radius of Outer Ring	(mm)
r_i	Groove Radius of Inner Ring	(mm)
v_{a}	Circumferential Speed of Rolling Element about Its Center	(m/sec)
$v_{ m c}$	Circumferential Speed of Rolling Element about Beaing Center	(m/sec)
Z	Number of Rolling Elements per Row	
α	Contact Angle (when axial load is applied on Radial Ball Bearning	(°)
α_0	Initial Confact Angle (Geometri) (when inner and outer rings of Angular Contact Ball Bearings are pushed axially)	(°)
α_R	Initial Contact Angle (Geometric) (when inner and outer rings Angular Contact Ball Bearing are pushed radially)	(°)
β	1/2 of Conical Angle of Roller	(°)
$\dot{\delta}_a$	Relative Axial Displacement of Inner and Outer Rings	(mm)
Δa	Axial Internal Clearance	(mm)
Δd	Effective Interference of Inner Ring and	
Δr	Shaft Radial Internal Clearance	(mm) (mm)
		(IIIII)
△D	Effective Interference of Outer Ring and Housing	(mm)
$\Delta D_{ m e}$	Contraction of Outer Ring Raceway Diameter due to Fit	(mm)
ΔD_i	Expansion of Inner Ring Raceway Diameter dus to Fit	(mm)
ε	Load Factor	
μ	Coefficient of Dynamic Friction of Rolling Bearing	
μ_{e}	Coefficient of Friction between Roller End Face and Rib	
μ_{s}	Coefficient of Sliding Friction	
σ_{tmax}	Maximum Stress on Fitted Surfaces	(MP _a){kgf/mm ² }

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NSK

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

(Figs. 15.1 to 15.3)
$$\delta_{a} = \frac{0.00044}{\sin \alpha} \left(\frac{Q^{2}}{D_{w}}\right)^{\frac{1}{3}} \dots (N)$$

$$\delta_{a} = \frac{0.002}{\sin \alpha} \left(\frac{Q^{2}}{D_{w}}\right)^{\frac{1}{3}} \dots \{kgf\}$$

$$Q = \frac{F_{a}}{Z\sin \alpha} (N), \{kgf\}$$

(2) Axial Load F_a and Axial Displacement δ_a of Tapered Roller Bearings (Fig. 15.4)

$$\delta_{a} = \frac{0.000077 \; F_{a}^{0.9}}{(\sin \alpha)^{1.9} \; Z^{0.9} \; L_{we}^{0.8}} \qquad \qquad (N) \\ \delta_{a} = \frac{0.0006 \; F_{a}^{0.9}}{(\sin \alpha)^{1.9} \; Z^{0.9} \; L_{we}^{0.8}} \qquad \qquad \{kgf\}$$

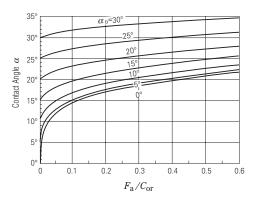


Fig. 15.1 $F_a/C_{
m or}$ and Contact Angle of Deep Groove and Angular Contact Ball Bearings

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.

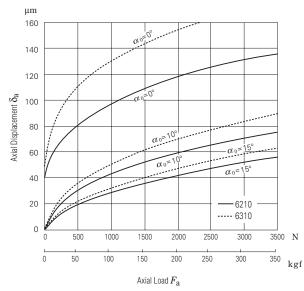


Fig. 15.2 Axial Load and Axial Displacement of Deep Groove Ball Bearings

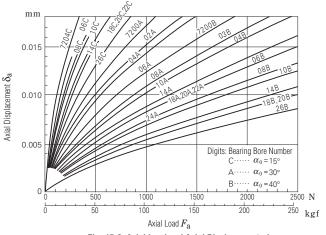


Fig. 15.3 Axial Load and Axial Displacement of Angular Contact Ball Bearings

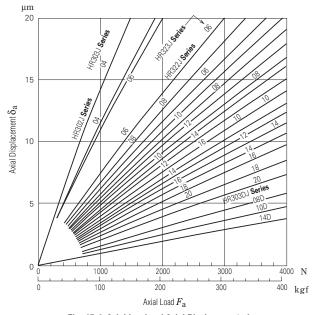


Fig. 15.4 Axial Load and Axial Displacement of Tapered Roller Bearings



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 $\Delta D_{\rm e}$ (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 $p_{ m m}$ (MP _a) {kgf/mm ² }	(In case of sold shaft) $p_{\rm m}=~\frac{E}{2}~\frac{\varDelta d}{2}~(1-k^2)$	In case of housing outside dia. $D_0 \neq \infty$ $p_{\mathrm{m}} = \frac{E}{2} \frac{\Delta D}{D} \frac{(1-h^2)(1-h_0^2)}{1-h^2 h_0^2}$ In case $D_0 = \infty$ $p_{\mathrm{m}} = \frac{E}{2} \frac{\Delta D}{D} (1-h^2)$
$\begin{array}{c} \text{Maximum stress} \\ \sigma_{\rm tmax} \\ \text{(MPa)} \\ \text{\{kgf/mm}^2\} \end{array}$	Maximum circumferential stress on fitted surface of inner ring bore is $\sigma_{\rm tmax} = p_{\rm m} \frac{1+k^2}{1-k^2}$	Maximum circumferential stress on outer ring bore surface is $\sigma_{t \max} = p_{\text{in}} \frac{2}{1 - h^2}$
Expansion of inner ring raceway dia. ΔD_i (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. △De (mm)		In case D_0 = ∞

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/mm^2 = 0.102 kgf/mm²

Table 15. 2 Interferences or Clearances

ı	Siz	70		e Plane											Interf	erences	or Cleara	ances for
	Classifi	ication	Mean Bore Dia. Deviation (Normal)		f	6	g	5	g	6	h	15	ŀ	16	js	5	j.	5
	(mı	m)		$d_{ m mp}$	Clear	ance	Clearance	Inter- ference										
	over	incl.	high	low	max.	min.	max.	max.										
	3	6	0	- 8	18	2	9	4	12	4	5	8	8	8				—
	6	10	0	- 8	22	5	11	3	14	3	6	8	9	8	3	11	2	12
	10	18	0	- 8	27	8	14	2	17	2	8	8	11	8	4	12	3	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

excessive are omitted.

2. The tolerance range js is now recommended instead of j.

Remarks 1. The figures for tolerance classes where stress caused by the fitting of the shaft and inner ring becomes excessive are omitted.

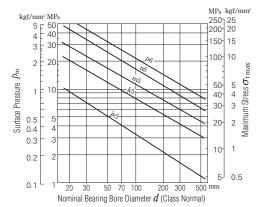


Fig. 15.5 Surface Pressure \dot{P}_{m} and Maximum Stress $\sigma_{t\,max}$ for Average Fitting Interference

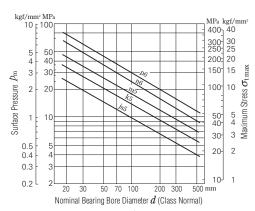


Fig. 15.6 Surface Pressure P_m and Maximum Stress $\sigma_{t \max}$ for Maximum Fitting Interference

of Shafts and Inner Rings

Units: µm

Each Fit	ting Cla	SS																Si	7 0
js	66	j(6	k	c 5	1	6	n	15	n	n6	r	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

Q	ize		e Plane n O. D.											Interf	erences	or Clear	ances for
Classi	fication	Dev	riation ormal)	G	7	Н	16	H	17	Н	18	J	6	JS	86	J	7
(m	nm)	٠.	D_{mp}	Clear	ance	Clea	rance	Clea	rance	Clea	rance	Clearance	Inter- ference	Clearance	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 $\varDelta_{\rm r}$ and Axial Internal Clearance $\varDelta_{\rm a}$ in Single-Row Deep Groove Ball Bearings (Fig. 15.7)

$$\Delta_{\mathbf{a}} = K \Delta_{\mathbf{r}}^{\frac{1}{2}} \tag{mm}$$

where

$$K=2 (r_e + r_i - D_w)^{\frac{1}{2}}$$

(2) Radial Internal Clearance \varDelta_r and Axial Internal Clearance \varDelta_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 01 02	0.80 0.80	 0.80 0.93	0.93 0.93 0.93	1.14 1.06 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	87	K	6	K	.7	N	16	N	17	N	16	N	17	I	P6	F	7	Classi	fication
Clearance	Inter- ference	Interf	erence	Interf	erence	(n	nm)												
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

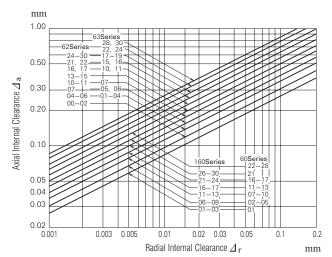


Fig. 15.7 Δ_r and Δ_a in Single-Row Deep Groove Ball Bearings

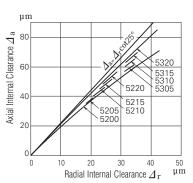


Fig. 15.8 \varDelta_r and \varDelta_a in Double-Row Angular Contact Ball Bearings (52, 53 Series)



15. 4 Preload and Staring Torque

(1) Axial Load $F_{\rm a}$ and Starting Torque M of Tapered Roller Bearings (Figs. 15.9 and 15.10)

$$M$$
 = $e~\mu_{\rm e}~F_{\rm a}~{\rm cos}\beta$ (N·mm), {kgf·mm} where

$$\mu_{
m e}$$
 : 0.20

When bearings with the same number are used in opposition, the torque M caused by the preload becomes 2M.

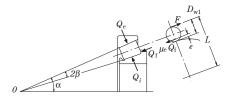


Fig. 15.9 Relation between e and β

(2) Preload $F_{\rm a}$ 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.

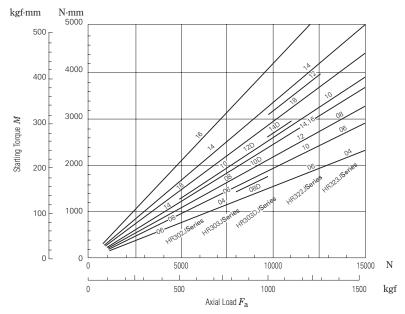


Fig. 15.10 Relation between Axial Load and Starting Torque of Tapered Roller Bearings

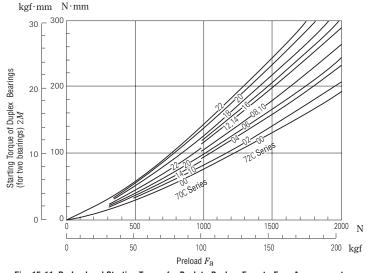


Fig. 15.11 Preload and Starting Torque for Back-to-Back or Face-to-Face Arrangements of Angular Contact Ball Bearings ($\alpha=$ 15°)

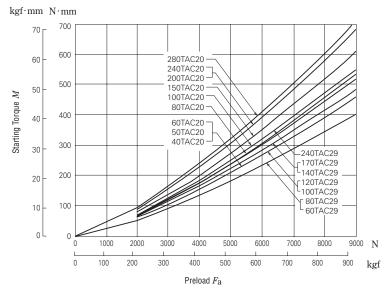


Fig. 15.12 Preload and Starting Torque of Double-Direction
Angular Contact Thrust Ball Bearings



15.5 Coefficients of Dynamic Friction and Other Bearing Data

(1) Bearing Types and Their Coefficients of Dynamic Friction $\boldsymbol{\mu}$

$$\mu = \frac{M}{P \cdot \frac{d}{2}}$$

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
5 5	
Needle Roller Bearings with Cages	0.0015
Full Complement Needle Roller Bearings	0.0025
Spherical Thrust Roller Bearings	0.0028

(3) Radial Internal Clearance $\varDelta_{\rm r}$ and Fatigue Life L (Fig. 15.13)

For the radial internal clearance Δ_r and the function $f(\varepsilon)$ of the load factor, the following equations are valid:

For Deep Groove Ball Bearings

$$f(\epsilon) = \frac{\Delta_{\rm r} \cdot D_{\rm w}^{\frac{1}{3}}}{0.00044 \left(\frac{F_{\rm r}}{Z}\right)^{\frac{2}{3}}}$$
....(N)

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot D_{\rm w}^{\frac{1}{3}}}{0.002 \left(\frac{F_{\rm r}}{Z}\right)^{\frac{2}{3}}} \dots \{\text{kgf}\}$$

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)

$$f(\varepsilon) = \frac{\Delta_{\rm r} \cdot L_{\rm we}^{0.8}}{0.0006 \left(\frac{F_{\rm r}}{Z}\right)^{0.9}} \dots \{\text{kgf}\}$$

The relation between the load factor ϵ and $f(\epsilon)$ and L_ϵ/L , when the radial internal clearance is $\varDelta_{\rm r}$ 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 $n_a (\mathrm{min}^{\scriptscriptstyle -1})$	$-\left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}}-\frac{\mathrm{cos}^{2}\alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right)\frac{n_{i}}{2}$	$+ \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^2 \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}} \right) \frac{n_{\mathrm{e}}}{2}$
Cicumferential speed around bearing ball's center $\upsilon_a(m/sec)$	$-\frac{\boldsymbol{\pi} \cdot D_{\mathrm{w}}}{60 \times 10^{3}} \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^{2} \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}} \right) \frac{\boldsymbol{n}_{i}}{2}$	$+\frac{\pi \cdot D_{\mathrm{w}}}{60 \times 10^{3}} \left(\frac{D_{\mathrm{pw}}}{D_{\mathrm{w}}} - \frac{\cos^{2} \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}} \right) \frac{n_{\mathrm{e}}}{2}$
Revolving speed around bearing center $n_{ m c}$ (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 υ_{c} (m/sec)	$-\frac{\pi \cdot D_{\mathrm{pw}}}{60 \times 10^{3}} \left(1 - \frac{\cos \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{i}}{2}$	$+\frac{\pi \cdot D_{\mathrm{pw}}}{60 \times 10^{3}} \left(1 - \frac{\cos \alpha}{D_{\mathrm{pw}}/D_{\mathrm{w}}}\right) \frac{n_{\mathrm{e}}}{2}$

Remarks

1. + sign indicates CW rotation and - sign CCW

Table 15. 7 ε and $f(\varepsilon)$, 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

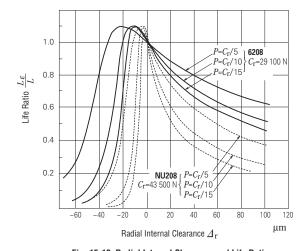


Fig. 15.13 Radial Internal Clearance and Life Ratio

The revolving speed and circumferential speed of the rolling elements are the same as those of the cage.



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 Poly-α-olefin oil Urea (3) EA5 GREASE Urea (3) Poly-α-olefin oil EA7 GREASE Urea (3) Poly-α-olefin oil **ENC GREASE** Polyol ester oil + Mineral oil (4) Urea (3) ENS GREASE Urea (3) Polyol ester oil (4) ECZ GREASE Lithium + Carbon black Poly-α-olefin oil ISOFLEX NBU 15 Barium Complex Ester oil + Mineral oil+ Poly-α-olefin oil (4) ISOFLEX SUPER LDS 18 Ester oil + Mineral oil (4) Lithium ISOFLEX TOPAS NB 52 Barium Complex Poly-α-olefin oil AEROSHELL GREASE 7 Micro Gel Diester oil (4) GREASE SH 33 L DOW CORNING® Lithium Silicone oil (5) GREASE SH 44 M DOW CORNING® Lithium Silicone oil (5) NS HI-LUBE Lithium Polyol ester oil + Diester oil (4) NSA GREASE Lithium Poly-α-olefin oil + Ester 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 Alkyldiphenyl ether oil + Poly- α -olefin oil Urea (3) 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 Mineral oil Lithium SHELL ALVANIA GREASE S3 Lithium Mineral oil SHELL 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

- Notes (1) If grease will be used at the upper or lower limit sufficient of the temperature range or in a special environment such as vacuum, it is advisable to consult NSK.
 - (2) 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.
 - (3) Urea-based grease causes fluorine-based material to deteriorate.
 - (4) Ester-based grease causes acrylic rubber material to swell.
 - (5) Silicone-based grease causes silicone-based material to swell.

and Comparison of Properties

Dropping Point (°C)	Consistency	Working Temperature Range(1)(°C)	Pressure Resistance	Usable Limit Compare 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	243	-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
≧260	288	-55 to +100	Poor	100
210	310	-60 to +120	Poor	60
210	260	-30 to +130	Poor	60
192	250	-40 to +130	Poor	100
201	311	-40 to +130	Fair	70
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
≧260	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

(continued on next page)

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Brands	Thickeners	Base Oils			
NIGACE WR-S	Urea (³)	Mixed oil			
NIGLUB RSH	Sodium Complex	Polyalkylene Glycol oil			
PYRONOC UNIVERSAL N6B	Urea (3)	Mineral oil			
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			

- Notes (1) If grease will be used at the upper or lower limit sufficient of the temperature range or in a special environment such as vacuum, it is advisable to consult NSK.
 - as vacuum, it is advisable to consult NSK.

 (2) 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.

 (3) Urea-based grease causes fluorine-based material to deteriorate.

 (4) Ester-based grease causes acrylic rubber material to swell.

 (5) 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)(%)
≧260	230	−30 to +150	Poor	70
≧260	270	270 —20 to +120 Fair		60
238	290	290 0 to +130 Fair		70
216	300	-10 to +130	Good	70
190	274	-50 to +110	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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	B3/8
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DEEP GROOVE BALL BEARINGS

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Open Type, Shielded Type, Sealed Type	Bore Diameter	10 – 240mm····· B
Open Type	Bore Diameter	260 – 800mm····· B2
MAXIMUM TYPE BALL BEARINGS	Bore Diameter	25 – 110mm B2
MAGNETO BEARINGS	Bore Diameter	4 – 20mm B2

Extra Small and Miniature Ball Bearings are described on Pages B30 to B45.

DESIGN, TYPES, AND FEATURES

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



With Snap Ring





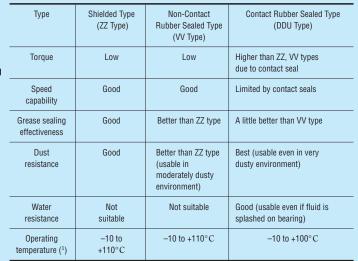
Shielded Type (ZZ Type)



Non-Contact **Rubber Sealed** Type (VV Type)



Contact **Rubber Sealed** Type (DDU Type)



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 to	A63)
MAXIMUM TYPE BALL BEARINGS	Table	8.2	(Pages	A60 to	A63)
MAGNETO BEARINGS	Table	8.5	(Pages	A70 and	d A71

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

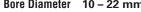
INTERNAL CLEARANCES

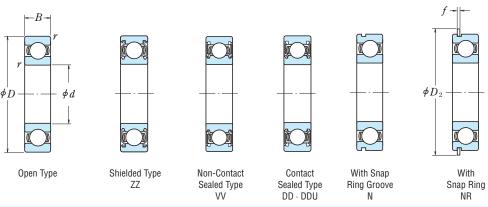
SINGLE-ROW DEEP GROOVE BALL	
BEARINGS	·· Table 9.9 (Page A89)
MAXIMUM TYPE BALL BEARINGS	·· Table 9.9 (Page A89)
MAGNETO BEARINGS	Table 9.11 (Page A89

LIMITING SPEEDS

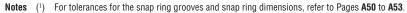
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

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						V	V		וטט י טט	U	IV			I۱	IK
Bour	ndary [)imen	sions		Basic Load I			Factor	Limitino	g Speeds	(min ⁻¹)		Rearir	ıa Nııı	mbers
	(mm)			1)	(N)		{kgf}		Grease Oil			Dourn	ig iva	1115010	
d	D	В	γ min.	C_{r}	C_{0r}	C_{r}	C_{0r}	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open S	Shielded	l Se	ealed
10	19 22 26	5 6 8	0.3 0.3 0.3	1 720 2 700 4 550	840 1 270 1 970	175 275 465	86 129 201	14.8 14.0 12.4	34 000 32 000 30 000	24 000 22 000 22 000	40 000 38 000 36 000	6800 6900 6000	ZZ ZZ ZZ	VV VV VV	DD DD DDU
	30 35	9 11	0.6 0.6	5 100 8 100	2 390 3 450	520 825	244 350	13.2 11.2	24 000 22 000	18 000 17 000	30 000 26 000	6200 6300	ZZ ZZ	VV VV	DDU DDU
12	21 24 28	5 6 7	0.3 0.3 0.3	1 920 2 890 5 100	1 040 1 460 2 370	195 295 520	106 149 241	15.3 14.5 13.0	32 000 30 000 28 000	20 000 20 000 —	38 000 36 000 32 000	6801 6901 16001	ZZ ZZ	VV VV	DD DD
	28 32 37	8 10 12	0.3 0.6 1	5 100 6 800 9 700	2 370 3 050 4 200	520 695 990	241 310 425	13.0 12.3 11.1	28 000 22 000 20 000	18 000 17 000 16 000	32 000 28 000 24 000	6001 6201 6301	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
15	24 28 32	5 7 8	0.3 0.3 0.3	2 070 4 350 5 600	1 260 2 260 2 830	212 440 570	128 230 289	15.8 14.3 13.9	28 000 26 000 24 000	17 000 17 000 —	34 000 30 000 28 000	6802 6902 16002	ZZ ZZ	VV VV	DD DD
	32 35 42	9 11 13	0.3 0.6 1	5 600 7 650 11 400	2 830 3 750 5 450	570 780 1 170	289 380 555	13.9 13.2 12.3	24 000 20 000 17 000	15 000 14 000 13 000	28 000 24 000 20 000	6002 6202 6302	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
17	26 30 35	5 7 8	0.3 0.3 0.3	2 630 4 600 6 000	1 570 2 550 3 250	268 470 610	160 260 330	15.7 14.7 14.4	26 000 24 000 22 000	15 000 15 000 —	30 000 28 000 26 000	6803 6903 16003	ZZ ZZ	VV VV —	DD DDU
	35 40 47	10 12 14	0.3 0.6 1	6 000 9 550 13 600	3 250 4 800 6 650	610 975 1 390	330 490 675	14.4 13.2 12.4	22 000 17 000 15 000	13 000 12 000 11 000	26 000 20 000 18 000	6003 6203 6303	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
20	32 37 42	7 9 8	0.3 0.3 0.3	4 000 6 400 7 900	2 470 3 700 4 450	410 650 810	252 375 455	15.5 14.7 14.5	22 000 19 000 18 000	13 000 12 000 —	26 000 22 000 20 000	6804 6904 16004	ZZ ZZ	VV VV	DD DDU
	42 47 52	12 14 15	0.6 1 1.1	9 400 12 800 15 900	5 000 6 600 7 900	955 1 300 1 620	510 670 805	13.8 13.1 12.4	18 000 15 000 14 000	11 000 11 000 10 000	20 000 18 000 17 000	6004 6204 6304	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
22	44 50 56	12 14 16	0.6 1 1.1	9 400 12 900 18 400	5 050 6 800 9 250	960 1 320 1 870	515 695 940	14.0 13.5 12.4	17 000 14 000 13 000	11 000 9 500 9 500	20 000 16 000 16 000	60/22 62/22 63/22	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU



⁽²⁾ 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	$\frac{F_{\rm a}}{F_{\rm r}}$	$\leq e$	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}}$	>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

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Static Equivalent Load

 $\frac{F_{\rm a}}{F_{\rm r}} > 0.8, P_0 = 0.6F_{\rm r} + 0.5F_{\rm a}$ $\frac{F_{\rm a}}{F_{\rm r}} \le 0.8, P_0 = F_{\rm r}$

										r _r					
With	With	Sna	p Ring G	roove Din (mm)	nensions	i (1)	Snap R Dimen	sions	Abutment and Fillet Dimensions (mm)						Mass (kg)
Snap Ring Groove	Snap Ring	а max.	$b \atop { m min.}$	$D_{\scriptscriptstyle 1}$ max.	${m r}_0$ max.	$ m \emph{r}_{N}$ min.	$D_2^{(m max.}$	f max.	min.	$l_{ m a^{(2)}}$ max.	$D_{ m a}^{(2)}$ max.	${m \gamma}_{\rm a}$ max.	$D_{\rm x} \atop {\rm min.}$	$C_{ m Y}$ max.	approx.
	— 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 _	NR —	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
_ N _	NR —	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 _	NR —	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

Notes (4) Snap ring groove dimensions and snap ring dimensions are not conformed to ISO15.

 ϕD_a

 ϕD_1

 $\phi d_a \phi D_X$

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⁾ Ring types N and NR applicable only to open-type bearings.

 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}}$	$\leq e$	$\frac{F_{\rm a}}{F_{ m r}}$	>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

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$\mathcal{L}_{0\mathrm{r}}$		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 E	quivaler	nt Load			

$\frac{F_{\rm a}}{F_{\rm r}}$ > 0.8, P_0 = 0.6 $F_{\rm r}$ + 0.5 $F_{\rm a}$	
$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, P_0 = F_{\rm r}$	

With	With Snap	Sna	p Ring G	roove Dim (mm)	ensions	(1)	Snap R Dimen	sions		Abutmer	t and Fille (mm		ensions		Mass (kg)
Snap Ring iroove	Ring	а max.	$oldsymbol{b}{min.}$	$D_{ m 1}$ max.	$oldsymbol{\gamma}_0$ max.	$\emph{r}_{ m N}$ min.	$D_2^{(m mr}$ max.	f max.	d min.	$I_{ m a}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	${m \gamma}_{\rm a}$ max.	$D_{ m x}$ min.	$C_{\scriptscriptstyle \mathrm{Y}}$ max.	approx.
N N	NR NR	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 N N	NR NR NR	2.06 2.46 3.28	1.35 1.35 1.9	44.6 49.73 59.61	0.4 0.4 0.6	0.5 0.5 0.5	52.7 57.9 67.7	1.12 1.12 1.7	29 30 31.5	30 32 36	43 47 55.5	0.6 1 1	53.5 58.5 68.5	2.9 3.3 4.6	0.079 0.129 0.235
N N N	NR NR NR	2.06 2.46 3.28	1.35 1.35 1.9	49.73 55.6 64.82	0.4 0.4 0.6	0.5 0.5 0.5	57.9 63.7 74.6	1.12 1.12 1.7	32 33 34.5	34 35.5 38	48 53 61.5	0.6 1 1	58.5 64.5 76	2.9 3.3 4.6	0.096 0.175 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 N N	NR NR NR	2.08 3.28 3.28	1.35 1.9 1.9	52.6 59.61 68.81	0.4 0.6 0.6	0.5 0.5 0.5	60.7 67.7 78.6	1.12 1.7 1.7	35 35 36.5	36.5 38.5 42.5	50 57 65.5	1 1 1	61.5 68.5 80	2.9 4.6 4.6	0.116 0.199 0.345
N N N	NR NR NR	2.08 3.28 3.28	1.35 1.9 1.9	55.6 62.6 71.83	0.4 0.6 0.6	0.5 0.5 0.5	63.7 70.7 81.6	1.12 1.7 1.7	37 37 38.5	38.5 40 44.5	53 60 68.5	1 1 1	64.5 71.5 83	2.9 4.6 4.6	0.122 0.225 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 N N	NR NR NR	2.08 3.28 3.28	1.9 1.9 1.9	59.61 68.81 76.81	0.6 0.6 0.6	0.5 0.5 0.5	67.7 78.6 86.6	1.7 1.7 1.7	40 41.5 43	41.5 44.5 47	57 65.5 72	1 1 1.5	68.5 80 88	3.4 4.6 4.6	0.151 0.284 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 N N	NR NR NR	2.49 3.28 3.28	1.9 1.9 2.7	64.82 76.81 86.79	0.6 0.6 0.6	0.5 0.5 0.5	74.6 86.6 96.5	1.7 1.7 2.46	45 46.5 48	47.5 50.5 53	63 73.5 82	1 1 1.5	76 88 98	3.8 4.6 5.4	0.19 0.366 0.636
N N	NR NR	1.3 1.7 —	0.95 0.95 —	56.7 66.7 —	0.25 0.25 —	0.3 0.5 —	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 N N	NR NR NR	2.49 3.28 3.28	1.9 1.9 2.7	71.83 81.81 96.8	0.6 0.6 0.6	0.5 0.5 0.5	81.6 91.6 106.5	1.7 1.7 2.46	50 51.5 53	53.5 55.5 61.5	70 78.5 92	1 1 1.5	83 93 108	3.8 4.6 5.4	0.241 0.42 0.829

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

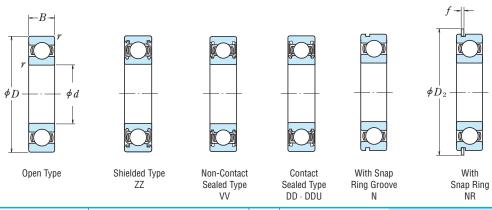
 $\phi D_{\rm a}$

 ϕD_1

 $\phi d_a \phi D_{\gamma}$

2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

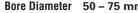
Bore Diameter 25 - 45 mm

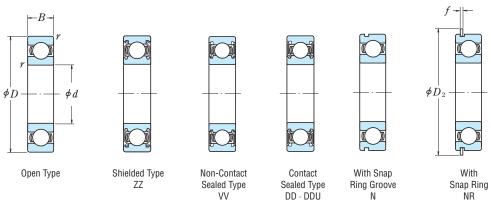


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Bou	ndary D		sions	Basic Load Ratings (N) {kgf}			Factor	Limiting	Speeds	(min ⁻¹)	F	Bearin	a Nur	nbers	
	(m	m)		(1	V)	{k	gf}		Gre	ase	Oil		J 0 u	9	
d	D	В	∤ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open S	hielded	Se	aled
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 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 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 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 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 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 80 90	15 18 23	1 1.1 1.5	16 800 29 100 40 500	11 500 17 900 24 000	1 710 2 970 4 150	1 180 1 820 2 450	15.3 14.0 13.2	10 000 8 500 7 500	6 000 5 600 5 300	12 000 10 000 9 000	6008 6208 6308	ZZ ZZ ZZ	VV VV VV	DDU DDU DDU
45	58 68 75	7 12 10	0.3 0.6 0.6	6 600 14 100 14 900	6 150 10 900 11 400	670 1 440 1 520	625 1 110 1 160	17.2 15.9 15.9	11 000 9 500 9 000	6 000 5 600 —	13 000 12 000 11 000	6809 6909 16009	ZZ ZZ	VV VV	DD DDU —
	75 85 100	16 19 25	1 1.1 1.5	20 900 31 500 53 000	15 200 20 400 32 000	2 140 3 200 5 400	1 550 2 080 3 250	15.3 14.4 13.1	9 000 7 500 6 700	5 300 5 300 4 800	11 000 9 000 8 000	6009 6209 6309	ZZ ZZ ZZ	VV VV VV	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.





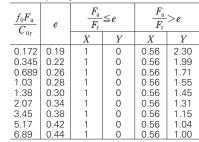
Bou	ndary [sions	()	Basic Load		0	Factor	Limiting	Speeds	(min ⁻¹)	Bea	ring Num	bers
	(111)	111/		(1)	1)	{kg	T}		Grea	se	Oil			
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open Shiel	ded Sea	led
50	65 72 80	7 12 10	0.3 0.6 0.6	6 400 14 500 15 400	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 ZZ 6910 ZZ 16010 —		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 ZZ 6210 ZZ 6310 ZZ	. 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 ZZ 6911 ZZ 16011 —		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 ZZ 6211 ZZ 6311 ZZ	. 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 ZZ 6912 ZZ 16012 —		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 ZZ 6212 ZZ 6312 ZZ	VV I	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 ZZ 6913 ZZ 16013 —		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 ZZ 6213 ZZ 6313 ZZ	VV I	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 —	8 000 7 500 7 100	6814 ZZ 6914 ZZ 16014 —	VV i	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 ZZ 6214 ZZ 6314 ZZ	VV I	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 ZZ 6915 ZZ 16015 —		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 ZZ 6215 ZZ 6315 ZZ	. VV	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.



 $P = XF_r + YF_a$



NSK

Static	Equiva	lent	Load

> 0.8, $P_0 = 0.6F_r + 0.5F_a$

With	With	Sna	p Ring G	iroove Dim (mm)	ensions	(1)	Snap Ri Dimen	sions		Abutmer	nt and Fill (mm		ensions		Mass (kg)
Snap Ring Iroove	Snap Ring	а max.	$m{b}$ min.	$D_{ m 1}$ max.	$oldsymbol{\gamma}_0$ max.	$\emph{r}_{ m N}$ min.	$D_2^{(m mr}$ max.	f max.	d min.	$f_{\rm a}^{(2)}$ max.	$D_{ m a}^{(2)}$ max.	${m \gamma}_{ m a}$ max.	$D_{ m x}$ 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 —	0.05 0.13 0.17
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	0.26 0.45 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 —	0.08 0.18 0.28
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	0.38 0.67 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 —	0.10 0.19 0.28
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	0.4° 0.78 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 —	0.13 0.2 0.3
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	0.43 1.0 2.1
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 —	0.13 0.34 0.44
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	0.60 1.00 2.5
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 —	0.14 0.30 0.40
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	0.64 1.19 3.08

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

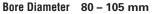
 ϕD_a

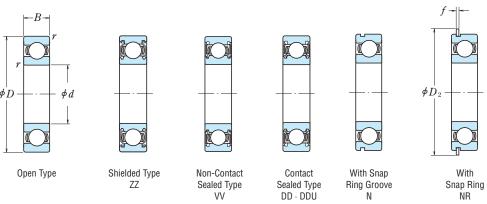
 ϕD_1

NR

 $\phi d_a \phi D_X$

2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.





							v v		DD DDC					VII (
Bou	Boundary Dimensions (mm)				Basic Load		0	Factor	Limiting	Speeds (min ⁻¹)	Bea	aring Nu	mbers
	(111)	111)		1)	۷)	{k	gt}		Grea	se	Oil			
d	D	В	∤ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open Shie	lded S	ealed
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	6816 Z 6916 Z 16016 —	z vv	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 Zi 6216 Zi 6316 Zi	Z VV	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	6817 Z 6917 Z 16017 —		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	6017 Z 6217 Z 6317 Z	z vv	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	6818 Z 6918 Z 16018 —	z vv	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	6018 Z 6218 Z 6318 Z	Z VV	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	6819 Z 6919 Z 16019 —		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	6019 Z 6219 Z 6319 Z	Z VV	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	6820 Z 6920 Z 16020 —	z vv	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	6020 Z 6220 Z 6320 Z	Z VV Z VV	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	6821 Z 6921 Z 16021 —	Z VV	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	6021 Z 6221 Z 6321 Z	Z VV	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.



 $P = XF_r + YF_a$

	-1 6	1			
$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}}$	$\leq e$	$\frac{F_{ m a}}{F_{ m r}}$	>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

NSK

Static Equivalent Load

 $\frac{F_{\rm a}}{F_{\rm r}} > 0.8, P_0 = 0.6F_{\rm r} + 0.5F_{\rm a}$ $\frac{F_{\rm a}}{F_{\rm r}} \le 0.8, P_0 = F_{\rm r}$

With		Sna	o Ring G	Groove Dim	ensions	S (1)	Snap R Dimen	sions		Abutmer	nt and Fille		ensions		Mass (kg)
Snap Ring Groov	Ring	а max.	$b \atop ext{min.}$	$D_{ m 1}$ max.	${m r}_0$ max.	$ m \emph{r}_{N}$ min.	$D_2^{(m max.}$	f max.	min.	$l_{ m a^{(2)}}$ max.	$D_{ m a}^{(2)}$ max.	${m \gamma}_{ m a}$ max.	$D_{ m x}$ min.	$C_{\scriptscriptstyle \mathrm{Y}}$ max.	approx.
N N	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 —	0.151 0.391 0.621
N N N	NR NR NR	2.87 4.9 5.69 2.1	3.1 3.1 3.5 1.3	120.22 135.23 163.65 107.6	0.6 0.6 0.6 0.4	0.5 0.5 0.5 0.5	134.7 149.7 182.9 115.7	2.82 2.82 3.1 1.12	86.5 89 91 90	91 95.5 104.5 90.5	118.5 131 159 105	1 2 2	136.5 152 185 117	5.3 7.3 8.4 2.9	0.872 1.42 3.67 0.263
N —	NR —	3.3	1.3	117.6 —	0.4	0.5 0.5 —	125.7 —	1.12 —	91.5 89	94.5	113.5 126	1 0.6	127 —	4.1	0.55 0.652
N N N	NR NR NR	2.87 4.9 5.69	3.1 3.1 3.5	125.22 145.24 173.66	0.6 0.6 0.6	0.5 0.5 0.5	139.7 159.7 192.9	2.82 2.82 3.1	91.5 94 98	96 102 110.5	123.5 141 167	1 2 2.5	141.5 162 195	5.3 7.3 8.4	0.918 1.76 4.28
N N	NR NR —	2.1 3.3 —	1.3 1.3 —	112.6 122.6 —	0.4 0.4 —	0.5 0.5 —	120.7 130.7 —	1.12 1.12 —	95 96.5 95	95.5 98.5 —	110 118.5 135	1 1 1	122 132 —	2.9 4.1 —	0.276 0.585 0.873
N N N	NR NR NR	3.71 4.9 5.69	3.1 3.1 3.5	135.23 155.22 183.64	0.6 0.6 0.6	0.5 0.5 0.5	149.7 169.7 202.9	2.82 2.82 3.1	98 99 103	103 107.5 117	132 151 177	1.5 2 2.5	152 172 205	6.1 7.3 8.4	1.19 2.18 4.98
N N	NR NR —	2.1 3.3 —	1.3 1.3 —	117.6 127.6 —	0.4 0.4 —	0.5 0.5 —	125.7 135.7 —	1.12 1.12 —	100 101.5 100	101.5 103.5 —	115 123.5 140	1 1 1	127 137 —	2.9 4.1 —	0.297 0.601 0.904
N N N	NR NR NR	3.71 5.69 5.69	3.1 3.5 3.5	140.23 163.65 193.65	0.6 0.6 0.6	0.5 0.5 0.5	154.7 182.9 212.9	2.82 3.1 3.1	103 106 108	108.5 114 123.5	137 159 187	1.5 2 2.5	157 185 215	6.1 8.4 8.4	1.23 2.64 5.76
N N	NR NR	2.1 3.3 —	1.3 1.9 —	122.6 137.6 —	0.4 0.6 —	0.5 0.5 —	130.7 145.7 —	1.12 1.7 —	105 106.5 105	105.5 111 —	120 133.5 145	1 1 1	132 147 —	2.9 4.7 —	0.31 0.828 0.945
N N	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 —	1.29 3.17 7.04
N N	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 —	0.324 0.856 1.24
N N	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 —	1.58 3.79 8.09

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact NSK.

 $\phi D_{\rm a}$

 ϕD_1

 $\phi d_a \phi D_X$

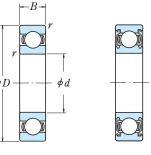
2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

Shielded Type

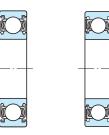
ZZ · ZZS

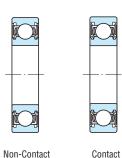
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Bore Diameter 110 - 160 mm



Open Type



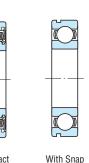


Sealed Type

DD · DDU

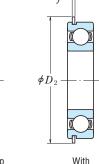
Sealed Type

VV



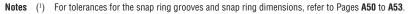
Ring Groove

N

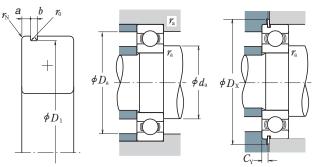




Bou	ndary D		sions		Basic Load			Factor Limiting Speeds (min ⁻¹) Grease Oil			min ⁻¹)	Bearing Numbers
	(m			1)	•		gf}	f _o Open			Oil	
<i>d</i>	D	В	∤ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open Shielded Sealed
110	140	16	1	28 100	32 500	2 860	3 350	17.1	4 300	2 400	5 300	6822 ZZ VV DDU
	150	20	1.1	43 500	44 500	4 450	4 550	16.6	4 300	2 400	5 000	6922 ZZ VV DDU
	170	19	1	57 500	56 500	5 850	5 800	16.3	3 800	—	4 500	16022 — — —
	170	28	2	85 000	73 000	8 650	7 450	15.5	3 800	2 200	4 500	6022 ZZ VV DDU
	200	38	2.1	144 000	117 000	14 700	11 900	14.3	2 800	2 200	3 400	6222 ZZ VV DDU
	240	50	3	205 000	179 000	20 900	18 300	13.2	2 400	—	3 000	6322 ZZ — —
120	150	16	1	28 900	35 500	2 950	3 650	17.3	4 000	2 200	4 800	6824 ZZ VV DD
	165	22	1.1	53 000	54 000	5 400	5 500	16.5	3 800	—	4 500	6924 ZZ — —
	180	19	1	56 500	57 500	5 800	5 850	16.5	3 600	—	4 300	16024 — — —
	180	28	2	88 000	80 000	9 000	8 150	15.7	3 600	2 200	4 300	6024 ZZ VV DDU
	215	40	2.1	155 000	131 000	15 800	13 400	14.4	2 600	2 000	3 200	6224 ZZ VV DDU
	260	55	3	207 000	185 000	21 100	18 800	13.5	2 200	1 800	2 800	6324 ZZS — 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 ZZS VV DD 6926 ZZ — — 16026 — — —
	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 ZZ — DDU 6226 ZZ — — 6326 ZZS — —
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 ZZ VV DDU 6928 ZZS VV — 16028 — — —
	210	33	2	110 000	109 000	11 200	11 100	16.0	2 800	1 800	3 400	6028 ZZ — DDU
	250	42	3	166 000	150 000	17 000	15 300	14.9	2 200	1 700	2 800	6228 ZZS — DDU
	300	62	4	253 000	246 000	25 800	25 100	13.6	2 000	—	2 400	6328 ZZS — —
150	190	20	1.1	47 500	58 500	4 850	5 950	17.1	3 200	1 800	3 800	6830 ZZ VV DDU
	210	28	2	85 000	90 500	8 650	9 200	16.5	2 600	1 700	3 200	6930 ZZS — DDU
	225	24	1.1	84 000	91 000	8 550	9 250	16.6	2 600	—	3 000	16030 — — —
	225	35	2.1	126 000	126 000	12 800	12 800	15.9	2 600	1 700	3 000	6030 ZZ VV DDU
	270	45	3	176 000	168 000	18 000	17 100	15.1	2 000	—	2 600	6230 ZZS — —
	320	65	4	274 000	284 000	28 000	28 900	13.9	1 800	—	2 200	6330 ZZS — —
160	200	20	1.1	48 500	61 000	4 950	6 250	17.2	2 600	1 700	3 200	6832 ZZS VV DDU
	220	28	2	87 000	96 000	8 850	9 800	16.6	2 600	1 600	3 000	6932 ZZS — DDU
	240	25	1.5	99 000	108 000	10 100	11 000	16.5	2 400	—	2 800	16032 — — —
	240	38	2.1	137 000	135 000	13 900	13 800	15.9	2 400	1 600	2 800	6032 ZZ — DDU
	290	48	3	185 000	186 000	18 900	19 000	15.4	1 900	—	2 400	6232 ZZS — —
	340	68	4	278 000	287 000	28 300	29 200	13.9	1 700	—	2 000	6332 ZZS — —



⁽²⁾ When heavy axial loads are applied, increase d_a and decrease D_a from the above values.



$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\rm a}}{F_{\rm r}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}} > e$	
U _{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

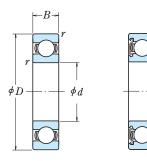
0.42 0.44 Static Equivalent Load

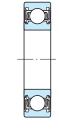
> 0.8, $P_0 = 0.6F_r + 0.5F_a$

Wit		Sna	p Ring (Groove Dim (mm)	ensions	S (1)	Snap R Dimen	sions		Abutmei	nt and Fille		ensions		Mass (kg)
Sna Rin Groo	g Ring	a max.	$b \atop ext{min.}$	$D_{ m 1}$ max.	${m \gamma}_0$ max.	$ m \emph{r}_{N}$ min.	$D_2^{(m max.}$	n) f max.	min.	$l_{ m a^{(2)}}$ max.	$D_{ m a}^{(2)}$ max.	${m \gamma}_{ m a}$ max.	$D_{ m x}$ min.	$C_{ m Y}$ max.	approx.
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	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
=	_	Ξ	_		_	_ _ _	_ _ _	_	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
=	_	Ξ	_	_ _ _	_	_	_ _ _		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

Remarks When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.

Bore Diameter 170 - 240 mm





Open	Туре		

Shielded Type ZZS

Non-Contact Sealed Type VV

										VV		
Bou	ndary [)imen:	sions		Basic Load	Ratings		Factor	Limiting	Speeds (i	min ⁻¹)	Bearing Numbers
	(m	m)		1)	V)	{kg	gf}		Grea	se	Oil	bearing Numbers
d	D	В	γ min.	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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	21 700	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		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	23 200	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		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	26 000	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	14 600	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	27 400	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	14 900	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	31 500	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	15 700	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	34 500	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.

B 18





$\frac{f_0 F_a}{C_{co}}$	$\frac{f_0 F_a}{C_{0r}}$ e		$\leq e$	$\frac{F_a}{F_r} > e$		
O ₀ 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
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \le 0.8, P_0 = F_r$$

$$\frac{F_{\rm a}}{F_{\rm r}} \leq 0.8, P_0 = F_{\rm r}$$

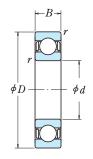
Mass (kg)

min.	$I_{ m a}^{(1)}$ max.	$D_{\mathrm{a}^{\left(1 ight)}}$ max.	${m r}_{\rm a}$ max.	approx.
176.5	182	208.5	1	1.86
179	186	221	2	3.34
178	—	252	1.5	5.71
181	194.5	249	2	6.89
186	215	294	3	15.8
186	—	344	3	36.6
186.5	192	218.5	1	1.98
189	198.5	241	2	4.16
189	—	271	2	7.5
191	208	269	2	8.88
196	223	304	3	15.9
196	—	364	3	43.1
198	202.5	232	1.5	2.53
199	—	251	2	5.18
199	—	281	2	7.78
201	218	279	2	9.39
206	236	324	3	22.3
210	—	380	4	49.7
208		242	1.5	2.67
211	222	269	2	7.28
209		301	2	10
211	231.5	299	2	12
216	252	344	3	26.7
220	—	400	4	55.3
228	233.5	262	1.5	2.9
231	242	289	2	7.88
231	—	329	2	13.1
233	254.5	327	2.5	18.6
236	—	384	3	37.4
240	—	440	4	73.9
249 251 251	262 —	291 309 349	2 2 2	4.48 8.49 13.9
253	=	347	2.5	19.9
256		424	3	50.5
260		480	4	94.4

 $\phi D_{\rm a}$

Abutment and Fillet Dimensions (mm)

Bore Diameter 260 - 360 mm



Open Type

Во	oundary [ons		Basic Load			Factor	Limiting S	•	Bearing Numbers
,	,	,		,	(N) {kgf}				(min	,	
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

Note (1) When heavy axial loads are applied, increase d_a and decrease D_a from the above values.

Dynamic Equivalent Load

 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{ m a}}{F_{ m r}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}} > e$	
O ₀ 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

 $\frac{F_a}{F}$ >0.8, P_0 =0.6 F_r +0.5 F_a

$$\frac{F_a}{F_r} \le 0.8, P_0 = F_1$$

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

Abutment and Fillet Dimensions (mm)

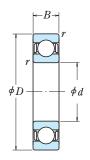
 $d_{
m a}^{(1)}$ min.

 $\begin{array}{cc} D_{\rm a} {}^{\scriptscriptstyle (1)} & \quad {\it r}_{\rm a} \\ {\rm max.} & \quad {\rm max.} \end{array}$

Mass (kg)

approx.

Bore Diameter 380 - 600 mm



Open Type

Во	oundary [(m	Dimension)	ons	1)	Basic Load		gf}	Factor	Limiting (Bearing Numbers
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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.

B 22



 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{\mathrm{a}}}{F_{\mathrm{r}}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}}$	>e
O ₀ 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

 $\phi D_{\!\scriptscriptstyle a}$

 $d_{
m a}^{(1)}$ min.

Abutment and Fillet Dimensions (mm)

 $D_{\mathrm{a}^{\left(1\right)}}$ max.

793.5

 $r_{\rm a}$

2.5

2.5

2.5

2.5

2.5 Mass (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

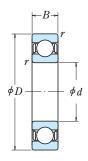
41.5

50.9

$$\frac{F_{\rm a}}{F_{\rm r}}$$
>0.8, P_0 =0.6 $F_{\rm r}$ +0.5 $F_{\rm a}$

$F_{\rm a}$	<00	D E
$F_{\rm r}$	≦0.8,	$\mathbf{r}_0 = \mathbf{r}_{\mathrm{r}}$

Bore Diameter 630 - 800 mm



Open Type

В	Boundary Dimensions (mm)			(1	Basic Load Ratings (N) {kgf}			Factor	Limiting S	'	Bearing Numbers
d	D	B	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	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.

Dynamic Equivalent Load

 $P = XF_r + YF_a$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_{ m a}}{F_{ m r}}$	$\leq e$	$\frac{F_{\rm a}}{F_{\rm r}}$	>e
O ₀ 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

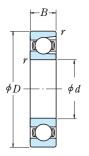
Static Equivalent Load
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

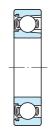
$$\frac{F_a}{F_r} \le 0.8, P_0 = F_r$$

$$\frac{F_{\rm a}}{F_{\rm r}} \le 0.8, P_0 = F_{\rm r}$$

Abut	Mass		
Dim	(kg)		
$d_{ m a}^{(1)}$ min.	$D_{ m a}^{(1)}$ max.	$\emph{\textbf{r}}_a$ max.	approx.
646	764	3	71.3
656	824	5	163
662	888	6	285
686	804	3	75.4
696	874	5	181
702	948	6	351
726	854	3	92.6
736	924	5	208
770	900	4	110
776	974	5	245
820	960	4	132
826	1 034	5	275

Bore Diameter 25 – 110 mm



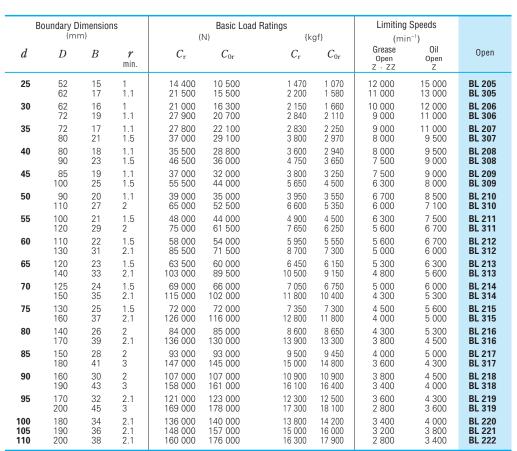




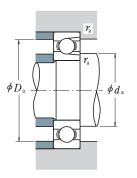
Open Type

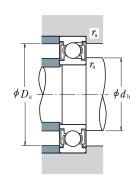
Shielded Type (One Shield) Z

Shielded Type (Two Shields) ZZ







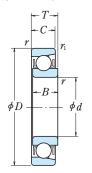


Bearing Nur	nbers	Abu	tment and Fill (mn		ns	Mass (kg)
With One Shield	With ed Two Shields	$d_{ m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$\emph{\textbf{r}}_{a}$ max.	approx.
BL 205 Z	BL 205 ZZ	30	32	47	1	0.133
BL 305 Z	BL 305 ZZ	31.5	36	55.5	1	0.246
BL 206 Z	BL 206 ZZ	35	38.5	57	1	0.215
BL 306 Z	BL 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 216 ZZ	89	95.5	131	2	1.61
BL 316 Z	BL 316 ZZ	91	104.5	159		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 220 ZZ	111	121.5	169	2	3.54
BL 221 Z	BL 221 ZZ	116	127.5	179		4.23
_	_	121	_	189	2	4.84

B 26 B 27

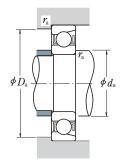


Bore Diameter 4 - 20 mm



Outside Diameter Tolerance (Class N)

Units : μm Single Plane Mean Outside
Diameter Nominal Outside Diameter D (mm) E Series **EN Series** Over Incl. High Low High Low 10 18 30 10 18 - 8 + 8 0 0 - 8 30 50 + 9 +11 0 0 - 9 -11



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	P	
X	X Y		Y	e
1	0	0.5	2.5	0.2

					I				1			
	Bound	dary Dim	ensions		1	Basic Loa			Limiting	•	Bearing	Numbers
		(mm)			1)	1)	{kg	gt}	(mir	n ⁻¹)		
<i>d</i>	D	B,C,T	γ min.	${m \gamma}_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	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	40	9	0.6	0.2	5 050	1 030	515	105	17 000	20 000	E 19	EN 18
19	40	9	0.6	0.2	5 050	1 030	515	105	17 000	20 000		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.

Abut Dim	Mass (kg)								
$d_{ m a}$ min.	$D_{ m a}$ max.	$m{\gamma}_{\mathrm{a}}$ 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 25	42 42	1							

EXTRA SMALL BALL BEARINGS AND MINIATURE BALL BEARINGS

EXTRA SMALL BALL BEARINGS · MINIATURE BALL BEARINGS

Metric Design			Bore Diameter 1 – 9mm·····	B34
	With F	lange	Bore Diameter 1 – 9mm·····	B38
	Inch Design		Bore Diameter 1.016 – 9.525mm ·····	B42
	With Fl	lange	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 Ball Bearings	Miniature Ball Bearings
Design	Latia Siliali Dali Dealligs	Williature Dali Dearings
Metric	Outside diameter $D \ge 9$	Outside diameter $D<9$
	Bore diameter $d < 10$	
Inch	Outside diameter $D \ge 9.525$	Outside diameter $D<9.525$
	Bore diameter $d < 10$	

Please refer to NSK Miniature Ball Bearings (CAT. No. E126) for details.









ZZS

B 31

Table 2 Design, Types, and Type Symbols

Necian Types		Туре о	·	ncial	Remarks
resigii · Types	Metric	Inch		ı	nemarks
	600	R	MR	—	Shielded · sealed bearings are available.
Thin section	_	_	SMT	_	
With flange	F6 0 0	FR	MF	_	Shielded - sealed bearings are available.
Extended inner ring	_	_	_	RW	Shielded bearings are available.
With flange and extended inner ring	_	_	_	FRW	Shielded bearings are available.
For synchro motors	_	_	_	SR00X00	Shielded bearings are available.
	_	_	BCF	_	
	_	_	F	_	
	With flange Extended inner ring With flange and extended inner ring For synchro motors	Metric 600 With flange Extended inner ring With flange and extended inner ring For synchro motors	Design · Types Metric Inch R Thin section F6 0 FR With flange Extended inner ring With flange and extended inner ring For synchro motors	Metric Inch Metric R MR MR SMT Thin section F600 FR MF With flange and extended inner ring With flange and extended inner ring For synchro motors BCF	Nesign - Types Metric Inch Metric Special Metric Inch Metric Inch Metric Inch Metric Inch MR — SMT — With flange With flange and extended inner ring With flange and extended inner ring — BCF — BCF — ME SROOXOO

Remarks Single-row angular contact ball bearings are available besides those shown above.

TOLERANCES AND RUNNING ACCURACY

METRIC DESIGN BEARINGSTable 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) Tolerances of Flange Outside Diameter								
Nominal Flange				er					
	Outside [Diameter							
D_1 (mm)			(1	D	(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

	Nomi Bearing C Diame D	Outside eter	Flange	ition of Width C18		ariation Width, VC _{1S}			Outside Genera	on of Bea e Surface etrix Inclir ange Bac S_{D1}	nation		Backface with Rai	
	(1111)	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.				max.			max.	
	2.5(1)	6	Use the ΔB_S	tolerance for d	Use the $\varDelta \mathit{V}_{\mathrm{BS}}$	5	2.5	1.5	8	4	1.5	11	7	3
-	6	18		bearing of the	tolerance for d of the same bearing	5	2.5	1.5	8	4	1.5	11	7	3
	18	30	same class		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 BEARINGSTable 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 BEARINGSTable 8.8 (Pages A76 to A77)

RECOMMENDED FITS

Please refer to NSK Miniature Ball Bearings (CAT.No.E126).

INTERNAL CLEARANCESTable 9.10 (Page A89)

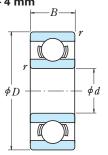
LIMITING SPEEDS

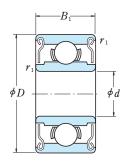
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing toad conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information



Metric Design

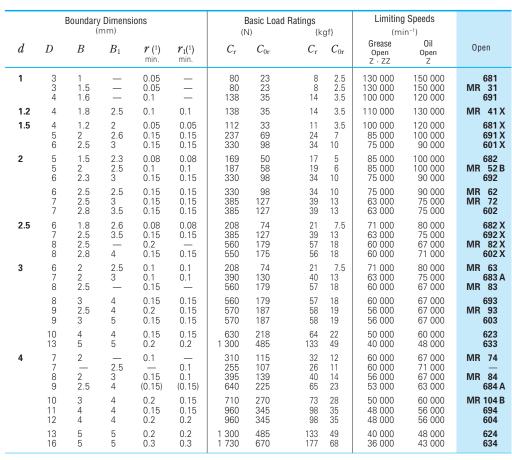
Bore Diameter 1 – 4 mm





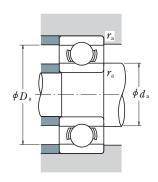
Open Type

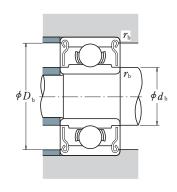
Shielded Type ZZ · ZZ1





Remarks When using bearings with a rotating outer ring, please contact NSK if they are shielded.



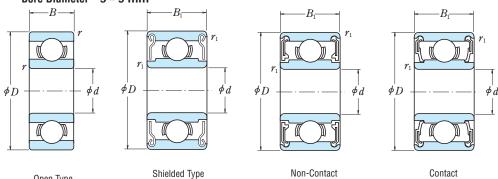


Bearing Numbers	Abutment and Fillet Dimensions (mm)	Mass (g)
Shielded Sealed	$egin{array}{cccccccccccccccccccccccccccccccccccc$	approx. Open Shielded
= = =	1.4 — 2.6 — 0.05 — 1.4 — 2.6 — 0.05 — 1.8 — 3.2 — 0.1 —	0.03 — 0.04 — 0.09 —
MR 41 XZZ — —	2.0 1.9 3.2 3.5 0.1 0.1	0.10 0.14
681 XZZ — — 691 XZZ — — 601 XZZ — —	1.9 2.1 3.6 3.6 0.05 0.05 2.7 2.5 3.8 4.3 0.15 0.15 2.7 3.0 4.8 5.4 0.15 0.15	0.07 0.11 0.17 0.20 0.33 0.38
682 ZZ — — MR 52 BZZ — — 692 ZZ — —	2.6 2.7 4.4 4.2 0.08 0.08 2.8 2.7 4.2 4.4 0.1 0.1 3.2 3.0 4.8 5.4 0.15 0.15	0.12 0.17 0.16 0.23 0.28 0.38
MR 62 ZZ — — MR 72 ZZ — — 602 ZZ — —	3.2 3.0 4.8 5.2 0.15 0.15 3.2 3.8 5.8 6.2 0.15 0.15 3.2 3.8 5.8 6.2 0.15 0.15	0.30 0.29 0.45 0.49 0.51 0.58
682 XZZ — — 692 XZZ — — — — — — 602 XZZ — —	3.1 3.7 5.4 5.4 0.08 0.08 3.7 3.8 5.8 6.2 0.15 0.15 4.1 — 6.4 — 0.2 — 3.7 4.1 6.8 7.0 0.15 0.15	0.23 0.29 0.41 0.55 0.56 — 0.63 0.83
MR 63 ZZ — — — 683 AZZ — — —	3.8 3.7 5.2 5.4 0.1 0.1 3.8 4.0 6.2 6.4 0.1 0.1 4.2 — 6.8 — 0.15 —	0.20 0.27 0.32 0.45 0.54 —
693 ZZ — — MR 93 ZZ — — 603 ZZ — —	4.2 4.3 6.8 7.3 0.15 0.15 4.6 4.3 7.4 7.9 0.2 0.15 4.2 4.3 7.8 7.9 0.15 0.15	0.61 0.83 0.73 1.18 0.87 1.45
623 ZZ — — 633 ZZ — —	4.2 4.3 8.8 8.0 0.15 0.15 4.6 6.0 11.4 11.3 0.2 0.2	1.65 1.66 3.38 3.33
MR 74 ZZ — — — — — — — — — — — — — — — — — —	4.8 — 6.2 — 0.1 — — 4.8 — 6.3 — 0.1 5.2 5.0 6.8 7.4 0.15 0.1 4.8 5.2 8.2 8.1 0.1 0.1	0.22 — 0.29 0.36 0.56 0.63 1.01
MR 104 BZZ — — 694 ZZ — — 604 ZZ — —	5.6 5.9 8.4 8.8 0.2 0.15 5.2 5.6 9.8 9.9 0.15 0.15 5.6 5.6 10.4 9.9 0.2 0.2	1.04 1.42 1.7 1.75 2.25 2.29
624 ZZ — — 634 ZZ1 — —	5.6 6.0 11.4 11.3 0.2 0.2 6.0 7.5 14.0 13.8 0.3 0.3	3.03 3.04 5.24 5.21



Metric Design

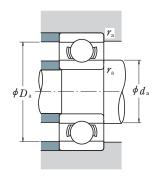
Bore Diameter 5 – 9 mm

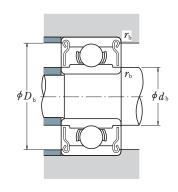


	Open	Туре			Shielded ZZ · Z				Non-Co Sealed V	Type		Conta Sealed T DD	
	Е	Boundary (r	Dimens	ions		B (N	asic Load 1)	Ratings {kg	ιf}	Limitir Grea	ng Speeds (r ise	min ⁻¹) Oil	
d	D	В	B_1	૪ (¹) min.	$ m \emph{r}_{1}(^{1})$ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Open Z · ZZ V · VV	D · DD	Open Z	Open
5	8 9 10 11	2 2.5 3 	2.5 3 4 4	0.1 0.15 0.15 —	0.1 0.15 0.15 0.15	310 278 430 430 715	120 131 168 168 276	31 28 44 44 73	12 13 17 17 28	53 000 53 000 50 000 50 000 48 000	_ _ _ _	63 000 63 000 60 000 60 000 56 000	MR 85 MR 95 MR 105
	11 13 14 16	3 4 5	5 4 5	0.15 0.2 0.2 0.3	0.15 0.2 0.2 0.3	715 1 080 1 330 1 730	281 430 505 670	73 110 135 177	29 44 52 68	45 000 43 000 40 000 36 000	40 000 38 000 32 000	53 000 50 000 50 000 43 000	685 695 605 625
6	19 10 12 13	6 2.5 3 3.5	6 3 4 5	0.3 0.15 0.2 0.15	0.3 0.1 0.15 0.15	2 340 495 715 1 080	885 218 292 440	238 51 73 110	90 22 30 45	32 000 45 000 43 000 40 000	30 000 — 40 000 38 000	40 000 53 000 50 000 50 000	635 MR 106 MR 126 686 A
	15 17 19 22	5 6 6 7	5 6 6 7	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	696 606 626 636
7	11 13 14 17	2.5 3 3.5 5	3 4 5 5	0.15 0.2 0.15 0.3	0.1 0.15 0.15 0.3	455 540 1 170 1 610	201 276 510 710	47 55 120 164	21 28 52 73	43 000 40 000 40 000 36 000	— 34 000 28 000	50 000 48 000 45 000 43 000	MR 117 MR 137 687 697
	19 22 26	6 7 9	6 7 9	0.3 0.3 0.3	0.3 0.3 0.3	2 340 3 300 4 550	885 1 370 1 970	238 335 465	90 140 201	36 000 30 000 28 000	32 000 28 000 22 000	43 000 36 000 34 000	607 627 637
8	12 14 16 19	2.5 3.5 4	3.5 4 5 6	0.15 0.2 0.2 0.3	0.1 0.15 0.2	545 820 1 610 2 240	274 385 710	56 83 164	28 39 73 93	40 000 38 000 36 000	32 000 28 000	48 000 45 000 43 000	MR 128 MR 148 688 A
	22 24 28	6 7 8 9	7 8 9	0.3 0.3 0.3	0.3 0.3 0.3 0.3	3 300 3 350 4 550	910 1 370 1 430 1 970	228 335 340 465	140 146 201	36 000 34 000 28 000 28 000	28 000 28 000 24 000 22 000	43 000 40 000 34 000 34 000	698 608 628 638
9	17 20 24 26	4 6 7 8	5 6 7 8	0.2 0.3 0.3 (0.6)	0.2 0.3 0.3 (0.6)	1 330 1 720 3 350 4 550	665 840 1 430 1 970	136 175 340 465	68 86 146 201	36 000 34 000 32 000 28 000	24 000 24 000 24 000 22 000	43 000 40 000 38 000 34 000	689 699 609 629
	30	10	10	0.6	0.6	5 100	2 390	520	244	24 000	_	30 000	639



Remarks 1. When using bearings with a rotating outer ring, please contact NSK if they are sealed or shielded.





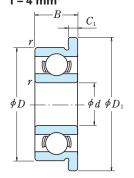
Bearing Numbers		Abutr	nent and F (m		ensions		Ma (g	
Shielded Sealer	$d_{ m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$D_{ m b}$ min.	${m \gamma}_{ m a}$ max.	$ m \emph{r}_b$ max.	app Open	rox. Shielded
MR 85 ZZ — — — — — — — — — — — — — — — — — —	6.2 - 6.2 - 6.2	5.8 6.0 6.0 6.3 6.2	7.2 — 7.8 8.8 — 9.8 11.4	7.4 8.2 8.4 9.8 9.9	0.1 0.15 0.15 0.15	0.1 0.15 0.15 0.15 0.15	0.26 — 0.50 0.95 — 1.2 2.45	0.34 0.58 1.29 1.49 1.96 2.5
635 ZZ VV DI 605 ZZ — DI 625 ZZ1 VV DI 635 ZZ1 VV DI MR 106 ZZ1 — —	6.6 7.0 7.0	6.6 6.9 7.5 8.5 7.0	11.4 12.4 14.0 17.0 8.8	12.2 13.8 16.5 9.3	0.2 0.2 0.3 0.3	0.2 0.2 0.3 0.3	3.54 4.95 8.56 0.56	2.5 3.48 4.86 8.34 0.68
MR 126 ZZ — Di 686 AZZ VV Di 696 ZZ1 VV Di 606 ZZ VV Di 626 ZZ1 VV Di	7.6 7.2 7.6 8.0 8.0	7.2 7.4 7.9 8.2 8.5	10.4 11.8 13.4 15.0 17.0	10.9 11.7 13.3 14.8 16.5	0.2 0.15 0.2 0.3 0.3	0.15 0.15 0.2 0.3 0.3	1.27 1.91 3.88 5.97 8.15	1.74 2.69 3.72 6.08 7.94
636 ZZ VV DI MR 117 ZZ — — MR 137 ZZ — — 687 ZZ1 VV DI 697 ZZ1 VV DI	8.2 8.6 8.2	10.5 8.0 9.0 8.5 10.2	20.0 9.8 11.4 12.8 15.0	19.0 10.5 11.6 12.7 14.8	0.3 0.15 0.2 0.15 0.3	0.3 0.1 0.15 0.15 0.3	0.62 1.58 2.13 5.26	14 0.72 2.02 2.97 5.12
607 ZZ1 VV DI 627 ZZ VV DI 637 ZZ1 VV DI MR 128 ZZ1 — —	9.0	9.1 10.5 12.8 9.0	17.0 20.0 24.0 10.8	16.5 19.0 22.8 11.3	0.3 0.3 0.3 0.3	0.3 0.3 0.3 0.3	7.67 12.7 24 0.71	7.51 12.9 25 0.97
MR 148 ZZ VV DI 688 AZZ1 VV DI 698 ZZ VV DI 608 ZZ VV DI 628 ZZ VV DI 638 ZZ1 VV DI	9.6 10.0 10.0 10.0	9.2 10.2 10.0 10.5 12.0 12.8	12.4 14.4 17.0 20.0 22.0 26.0	12.8 14.2 16.5 19.0 20.5 22.8	0.2 0.2 0.3 0.3 0.3 0.3	0.15 0.2 0.3 0.3 0.3 0.3	1.86 3.12 7.23 12.1 17.2 28.3	2.16 4.02 7.18 12.2 17.4 28.6
689 ZZ1 VV DI 699 ZZ1 VV DI 609 ZZ VV DI 629 ZZ VV DI 639 ZZ VV —	11.0 11.0 11.0	11.5 12.0 12.0 12.8 16.1	15.4 18.0 22.8 24.0 26.0	15.2 17.2 20.5 22.8 25.6	0.2 0.3 0.3 0.3 0.6	0.2 0.3 0.3 0.3 0.6	3.53 8.45 14.5 19.5 36.5	4.43 8.33 14.7 19.3 36

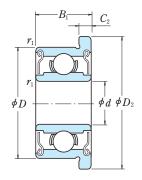
B 36 B 37

^{2.} Bearings with snap rings are also available, please contact NSK.



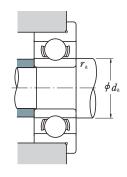
Metric Design With Flange Bore Diameter 1 – 4 mm

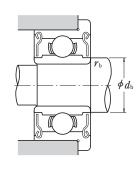




Open Type $\begin{array}{c} \text{Shielded Type} \\ \text{ZZ} \cdot \text{ZZ1} \end{array}$

			Bour		Dimens	ions						ad Ratings		Limiting	
				(m	m)					1)	1)	{k	gf}	(mi	
<i>d</i>	D	D_1	D_2	В	B_1	C_1	C_2	γ (¹) min.	r_1 (1) min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease Open Z · ZZ	Oil Open Z
1	3 4	3.8 5	_	1 1.6	_	0.3 0.5	_	0.05 0.1	_	80 140	23 36	8 14	2.5 3.5	130 000 100 000	150 000 120 000
1.2	4	4.8	_	1.8	_	0.4	_	0.1	_	138	35	14	3.5	110 000	130 000
1.5	4 5 6	5 6.5 7.5	5 6.5 7.5	1.2 2 2.5	2 2.6 3	0.4 0.6 0.6	0.6 0.8 0.8	0.05 0.15 0.15	0.05 0.15 0.15	112 237 330	33 69 98	11 24 34	3.5 7 10	100 000 85 000 75 000	120 000 100 000 90 000
2	5 5 6	6.1 6.2 7.5	6.1 6.2 7.5	1.5 2 2.3	2.3 2.5 3	0.5 0.6 0.6	0.6 0.6 0.8	0.08 0.1 0.15	0.08 0.1 0.15	169 187 330	50 58 98	17 19 34	5 6 10	85 000 85 000 75 000	100 000 100 000 90 000
	6 7 7	7.2 8.2 8.5	8.2 8.5	2.5 2.5 2.8	— 3 3.5	0.6 0.6 0.7	0.6 0.9	0.15 0.15 0.15	— 0.15 0.15	330 385 385	98 127 127	34 39 39	10 13 13	75 000 63 000 63 000	90 000 75 000 75 000
2.5	6 7 8 8	7.1 8.5 9.2 9.5	7.1 8.5 — 9.5	1.8 2.5 2.5 2.8	2.6 3.5 — 4	0.5 0.7 0.6 0.7	0.8 0.9 — 0.9	0.08 0.15 0.2 0.15	0.08 0.15 — 0.15	208 385 560 550	74 127 179 175	21 39 57 56	7.5 13 18 18	71 000 63 000 60 000 60 000	80 000 75 000 67 000 71 000
3	6 7 8	7.2 8.1 9.2	7.2 8.1 —	2 2 2.5	2.5 3 —	0.6 0.5 0.6	0.6 0.8 —	0.1 0.1 0.15	0.1 0.1 —	208 390 560	74 130 179	21 40 57	7.5 13 18	71 000 63 000 60 000	80 000 75 000 67 000
	8 9 9 10 13	9.5 10.2 10.5 11.5 15	9.5 10.6 10.5 11.5 15	3 2.5 3 4 5	4 4 5 4 5	0.7 0.6 0.7 1	0.9 0.8 1 1	0.15 0.2 0.15 0.15 0.2	0.15 0.15 0.15 0.15 0.2	560 570 570 630 1 300	179 187 187 218 485	57 58 58 64 133	18 19 19 22 49	60 000 56 000 56 000 50 000 36 000	67 000 67 000 67 000 60 000 43 000
4	7 7 8 9	8.2 — 9.2 10.3	8.2 9.2 10.3	2 2 2.5	2.5 3 4	0.6 0.6 0.6	0.6 0.6 1	0.1 0.15 (0.15)	0.1 0.1 (0.15)	310 255 395 640	115 107 139 225	32 26 40 65	12 11 14 23	60 000 60 000 56 000 53 000	67 000 71 000 67 000 63 000
	10 11 12	11.2 12.5 13.5	11.6 12.5 13.5	3 4 4	4 4 4	0.6 1 1	0.8 1 1	0.2 0.15 0.2	0.15 0.15 0.2	710 960 960	270 345 345	73 98 98	28 35 35	50 000 48 000 48 000	60 000 56 000 56 000
	13 16	15 18	15 18	5 5	5 5	1 1	1 1	0.2 0.3	0.2 0.3	1 300 1 730	485 670	133 177	49 68	40 000 36 000	48 000 43 000





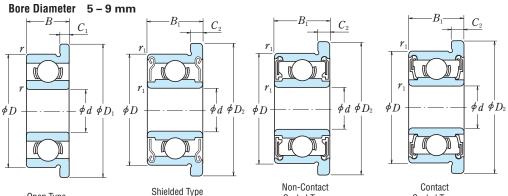
	Bearing Numbers		Abutme		illet Dim m)	ensions		ass g)
Open	Shielded	Sealed	$d_{ m a}$ min.	$d_{ m b}$ max.	$\pmb{\gamma}_{\mathrm{a}}$ max.	$ m \emph{r}_b$ max.		orox. Shielded
F 681 F 691	_		1.4 1.8	_	0.05 0.1	_	0.04 0.14	_
MF 41 X	_		2.0	_	0.1	_	0.12	_
F 681 X F 691 X F 601 X	F 681 XZZ F 691 XZZ F 601 XZZ	= =	1.9 2.7 2.7	2.1 2.5 3.0	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	= =	2.6 2.8 3.2	2.7 2.7 3.0	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	= =	3.2 3.2 3.2	3.8 3.1	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	= =	3.1 3.7 4.1 3.7	3.7 3.8 — 3.5	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 3.8 4.2	3.7 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 4.6 4.2 4.2 4.6	4.3 4.3 4.3 4.3 6.0	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	= = = =	4.8 — 5.2 4.8	 4.8 5.0 5.2	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	= =	5.6 5.2 5.6	5.9 5.6 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 6.0	6.0 7.5	0.2 0.3	0.2 0.3	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.

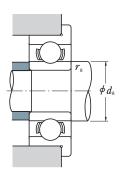


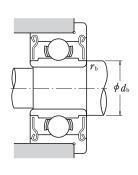




	Op	en Type					iaea i Z · ZZ1				Sealed T VV	ype		;	Sealed Type DD	е
			Boun	idary D (mr		ons				Ba (N	ısic Load 1)	Ratings {kg	gf}	Limiting Grea	g Speeds (r se	min ⁻¹) Oil
d	D	D_1	D_2	В	B_1	C_1	C_2	γ min.	${m \gamma}_1$ min.	$C_{\rm r}$	C_{0r}	C_{r}	C_{0r}	Open Z · ZZ V · VV	D · DD	Open Z
5	8 8 9 10	9.2 — 10.2 11.2	9.2 10.2 11.6	2 — 2.5 3	 2.5 3 4	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

Remarks When using bearings with a rotating outer ring, please contact NSK if they are shielded.



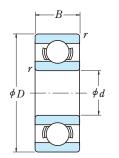


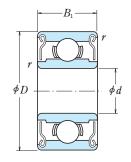
	Bearing Numbers					and Fille		Ma (g	
Open	Shielded	Sea	aled	$d_{ m a}$ min.	$d_{ m b}$ max.	${m \gamma}_{\rm a}$ max.	$ m \emph{r}_b$ max.	appi Open	rox. Shielded
MF 85 MF 95 MF 105	MF 85 ZZ MF 95 ZZ1 MF 105 ZZ	_ _ _	_	5.8 — 6.2 6.2	5.8 6.0 6.0	0.1 0.15 0.15	— 0.1 0.15 0.15	0.33 — 0.59 1.05	— 0.41 0.66 1.46
F 685 F 695 F 605	F 685 ZZ F 695 ZZ F 605 ZZ	 VV 	DD DD	6.2 6.6 6.6	6.2 6.6 6.9	0.15 0.2 0.2	0.15 0.2 0.2	1.37 2.79 3.9	2.18 2.84 3.85
F 625 F 635	F 625 ZZ1 F 635 ZZ1	VV VV	DD DD	7.0 7.0	7.5 8.5	0.3 0.3	0.3 0.3	5.37 9.49	5.27 9.49
MF 106 MF 126 F 686 A	MF 106 ZZ1 MF 126 ZZ F 686 AZZ	_ _ VV	DD 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 606 F 626 F 636	F 696 ZZ1 F 606 ZZ F 626 ZZ1 F 636 ZZ	VV VV VV	DD DD DD DD	7.6 8.0 8.0 8.0	7.9 8.2 8.5 10.5	0.2 0.3 0.3 0.3	0.2 0.3 0.3 0.3	4.34 6.58 9.09 14.6	4.26 6.61 9.09 14.7
MF 117 MF 137 F 687	MF 117 ZZ MF 137 ZZ F 687 ZZ1	_ _ VV	_ _ DD	8.2 8.6 8.2	8.0 9.0 8.5	0.15 0.2 0.15	0.1 0.15 0.15	0.72 1.7 2.48	0.82 2.23 3.37
F 697 F 607 F 627	F 697 ZZ1 F 607 ZZ1 F 627 ZZ	VV VV VV	DD DD DD	9.0 9.0 9.0	10.2 9.1 10.5	0.3 0.3 0.3	0.3 0.3 0.3	5.65 8.66 14.2	5.65 8.66 14.2
MF 128 MF 148 F 688 A	MF 128 ZZ1 MF 148 ZZ F 688 AZZ	VV VV	DD DD	9.2 9.6 9.6	9.0 9.2 10.2	0.15 0.2 0.2	0.1 0.15 0.2	0.82 2.09 3.54	1.15 2.39 4.47
F 698 F 608	F 698 ZZ F 608 ZZ	VV VV	DD DD	10.0 10.0	10.0 10.5	0.3 0.3	0.3 0.3	8.35 13.4	8.3 13.5
F 689 F 699	F 689 ZZ1 F 699 ZZ1	VV VV	DD DD	10.6 11.0	11.5 12.0	0.2 0.3	0.2 0.3	3.97 9.51	4.91 9.51



Inch Design

Bore Diameter 1.016 - 9.525 mm

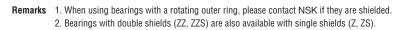


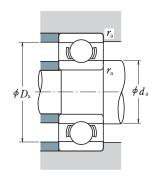


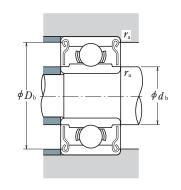
Open Type

Shielded Type ZZ · ZZS

	Bound	ary Dimens	ions		1	Basic Lo	ad Ratings	gf}	Limiting (mi	Speeds	Bearing
d	D	В	B_1	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	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





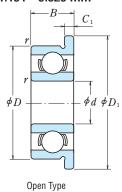


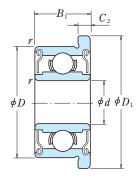
Numbers	А	butment a	nd Fillet D (mm)	imension	S		lass (g)
Shielded	$d_{ m a}$ min.	$d_{ m b}$ max.	$D_{ m a}$ max.	$D_{ m b}$ min.	${m \gamma}_a$ max.	ap Open	prox. Shielded
_	1.9	_	2.3	_	0.1	0.04	_
R 0 ZZ	2.0	1.9	3.1	3.5	0.1	0.09	0.11
R 1 ZZ	2.2	2.3	3.9	4.1	0.1	0.15	0.19
R 1-4 ZZ	2.8	3.9	5.5	5.9	0.1	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

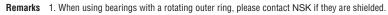
Bore Diameter 1.191 – 9.525 mm



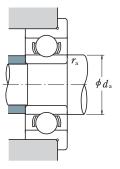


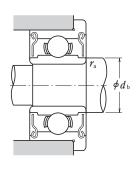
Shielded Type ZZ · ZZS

		Е	Boundary Di							oad Ratings	
			(mn	n)				1)	1)	{	kgf}
d	D	D_1	В	B_1	C_1	C_2	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}
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



^{2.} Bearings with double shields (ZZ, ZZS) are also available with single shields (Z, ZS).





Limiting (mi	•	Beari	ng Numbers		ment and ensions (n			ass g)
Grease Open Z · ZZ	Oil Open Z	Open	Shielded	$d_{ m a}$ min.	$d_{ m b}$ max.	${m \gamma}_{ m a}$ 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

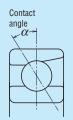
ANGULAR CONTACT BALL BEARINGS

SINGLE-ROW AND MATCHED ANGULAR CONTACT BALL BEARINGS

	Bore Diameter	10 –	65mm	B50
	Bore Diameter	70 –	120mm	B60
	Bore Diameter	130 – 2	200mm	B66
DOUBLE-ROW ANGULAR CONTACT	Bore Diameter	10 –	85mm	B70
BALL BEARINGS				
FOUR-POINT CONTACT BALL BEARI	NGS			
	Bore Diameter	30 - 2	200mm	B72

DESIGN, TYPES, AND FEATURES

SINGLE-ROW ANGULAR CONTACT BALL BEARINGS



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

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 direction can be sustained. Since the distance between the effective load centers a_0 is big, this type is suitable 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			
BALL BEARINGS	Table 8.2	(Pages A	60 to A63)
NSKHPS ANGULAR CONTACT BALL BEARINGS		, -	ŕ
Tolerance for Dimensions: Class 6,			
Running Accuracy: Class 5	Table 8.2	(Pages A	60 to A63)
MATCHED ANGULAR CONTACT	14510 0.2	- (1 ugoo 71	00 10 7100)
BALL BEARINGS	Table 9 () (Dagge A	60 to A62)
DOUBLE-ROW ANGULAR CONTACT	··· lable 0.2	(rayes A	00 to A03)
	T.I. 0.0	\ /D	00 400)
BALL BEARINGS	lable 8.2	2 (Pages A	60 to A63)
FOUR-POINT CONTACT BALL			
BEARINGS	···Table 8.2	? (Pages A	60 to A63)
RECOMMENDED FITS			
SINGLE-ROW ANGULAR CONTACT BALL			
BEARINGS AND HPS ANGULAR CONTACT			
BALL BEARINGS	···Table 9.2	? (Page A8	4)
		l (Page A8	
MATCHED ANGULAR CONTACT BALL BEARINGS	Table 9.2	Page A8	4)
		Page A8	
DOUBLE-ROW ANGULAR CONTACT BALL		(-,
BEARINGS	Tahle 9 3	Page Δ8	4)
DEMINIO		l (Page A8	
FOUR-POINT CONTACT BALL BEARINGS	Table 0.	r (rayt Au	4)
FUUN-FUINT GUNTAGT DALL DEANINGS			
	Table 9.4	l (Page A8	5)

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 Bore Diameter Axial Internal Clearance												
d (mm) CNB 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

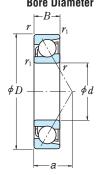
In cases of single-row and matched angular contact ball bearings, the Limiting speeds listed in the bearing table are for bearings with machined cage. For those with pressed cages, the listed speeds must be reduced by 20%.

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).

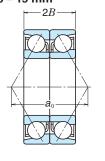
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

B 48 B 49

SINGLE/MATCHED MOUNTINGS Bore Diameter 10 – 15 mm

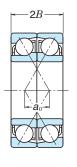


Single

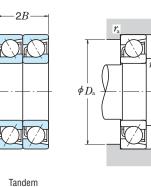


Back-to-Back

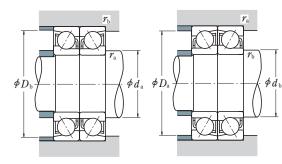
DB

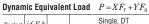


Face-to-Face



DT





Contact	$if_0F_a^*$			Singl	e, DT			DB c	or DF	
Angle	$\frac{\iota J_0 P_a}{C_{or}}$	e	F_a/F	$r \leq e$	F_a/F	r > e	F_a/F	r≤e	F_a/F	r > e
Allyle	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 o	or DF	
Angle	<i>X</i> ₀	Y_0	<i>X</i> 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	Numb	ers (²)		Basic (1	: Load Ratings	(Matched)		Speeds (1)	iting (Matched)	Load C Spacing	s (mm)		ent and nsions (r	
Single	D	uplex		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	Grease	n ⁻¹) Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{\rm b} \\ {\rm max.}$	γ _b (³) max.
7900 A5 7900 C 7000 A	DB	DF D	T T	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	DF D	T T T	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	DF D	T T T	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	DF D	T T T	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	DF D	T T T	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)T	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		DF C	т	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		DF D	T T	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 D	T T T	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	DB	DF C)T	 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 C	т	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.

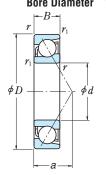
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

Во	undar	y Dim (mm)	nensio	ons		Basic Load Ratings (Single) (N) {kgf}			Factor	Lim Spee (mi	ds (¹)	Eff.Load Centers		ent and nsions (r		Mass (kg)
d	D	B	γ min.	$ eals_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	${\it r}_{\rm a}$ max.	approx.
10	22 22 26	6 6 8	0.3 0.3 0.3	0.15 0.15 0.15	2 880 3 000 5 350	1 450 1 520 2 600	305	148 155 266	— 14.1 —	40 000 48 000 32 000	56 000 63 000 43 000	6.7 5.1 9.2	12.5 12.5 12.5	19.5 19.5 23.5	0.3 0.3 0.3	0.009 0.009 0.019
	26 30 30	8 9 9	0.3 0.6 0.6	0.15 0.3 0.3	5 300 5 400 5 000	2 490 2 710 2 500	555	254 276 255	12.6 — —	45 000 28 000 20 000	63 000 38 000 28 000	6.4 10.3 12.9	12.5 15 15	23.5 25 25	0.3 0.6 0.6	0.021 0.032 0.032
	30 35 35	9 11 11	0.6 0.6 0.6	0.3 0.3 0.3	5 400 9 300 8 750	2 610 4 300 4 050	950	266 440 410	13.2 — —	40 000 20 000 18 000	56 000 26 000 24 000	7.2 12.0 14.9	15 15 15	25 30 30	0.6 0.6 0.6	0.036 0.053 0.054
12	24 24 28	6 6 8	0.3 0.3 0.3	0.15 0.15 0.15	3 200 3 350 5 800	1 770 1 860 2 980	340	181 189 305	_ 14.7 _	38 000 45 000 28 000	53 000 63 000 38 000	7.2 5.4 9.8	14.5 14.5 14.5	21.5 21.5 25.5	0.3 0.3 0.3	0.011 0.011 0.021
	28 32 32	8 10 10	0.3 0.6 0.6	0.15 0.3 0.3	5 800 8 000 7 450	2 900 4 050 3 750	815	296 410 380	13.2 — —	40 000 26 000 18 000	56 000 34 000 26 000	6.7 11.4 14.2	14.5 17 17	25.5 27 27	0.3 0.6 0.6	0.024 0.037 0.038
	32 32 37	10 10 12	0.6 0.6 1	0.3 0.3 0.6	8 150 7 900 9 450	3 750 3 850 4 500	805	380 395 460	 12.5 	20 000 36 000 18 000	30 000 50 000 24 000	14.2 7.9 13.1	17 17 18	27 27 31	0.6 0.6 1	0.036 0.041 0.060
	37 37	12 12	1 1	0.6 0.6	8 850 11 100	4 200 4 950		425 505	_	16 000 18 000	22 000 26 000	16.3 16.3	18 18	31 31	1 1	0.062 0.061
15	28 28 32	7 7 9	0.3 0.3 0.3	0.15 0.15 0.15	4 550 4 750 6 100	2 530 2 640 3 450	485	258 270 350	— 14.5 —	32 000 38 000 24 000	43 000 53 000 32 000	8.5 6.4 11.3	17.5 17.5 17.5	25.5 25.5 29.5	0.3 0.3 0.3	0.015 0.015 0.030
	32 35 35	9 11 11	0.3 0.6 0.6	0.15 0.3 0.3	6 250 8 650 7 950	3 400 4 650 4 300	880	345 475 440	14.1 — —	34 000 22 000 16 000	48 000 30 000 22 000	7.6 12.7 16.0	17.5 20 20	29.5 30 30	0.3 0.6 0.6	0.034 0.045 0.046
	35 35 42	11 11 13	0.6 0.6 1	0.3 0.3 0.6	9 800 8 650 13 400	4 800 4 550 7 100	885	490 460 720	— 13.2 —	18 000 32 000 16 000	26 000 45 000 22 000	16.0 8.8 14.7	20 20 21	30 30 36	0.6 0.6 1	0.044 0.052 0.084
	42 42	13 13	1 1	0.6 0.6	12 500 14 300	6 600 6 900		670 705	_	14 000 16 000	19 000 22 000	18.5 18.5	21 21	36 36	1 1	0.086 0.084

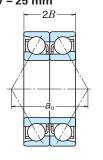
Notes (1) For applications operating near the limiting speed, refer to Page B49.

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

SINGLE/MATCHED MOUNTINGS Bore Diameter 17 - 25 mm

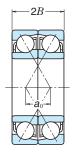


Single

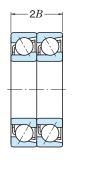


Back-to-Back

DB

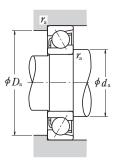


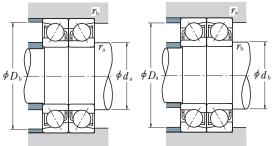
Face-to-Face

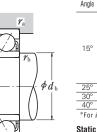


Tandem

DT







Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$			Singl	e, DT			DB o	r DF	
Contact		e	F_a/I	$r \leq e$	F_a/I	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 $P_0=X_0F_r+Y_0F_a$

Contact	Singl	e, DT	DB o	r DF	
Angle	<i>X</i> ₀	Y_0	<i>X</i> 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	

Bearing Numbers (2)		C Load Ratings		iting (Matched)	Load (Spacing <i>a</i>	s (mm)		ent and nsions (r			
Single Duplex	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _b (³) max.
7903 A5 DB DF DT	7 750	5 600	790	570	24 000	32 000	18.0	4.0	—	28.8	0.15
7903 C DB DF DT	8 150	5 850	830	600	28 000	38 000	13.3	0.7	—	28.8	0.15
7003 A DB DF DT	10 400	7 650	1 060	780	17 000	24 000	25.0	5.0	18.2	33.8	0.15
7003 C DB DF DT	10 700	7 600	1 100	775	26 000	34 000	17.0	3.0	—	33.8	0.15
7203 A DB DF DT	17 600	12 000	1 790	1 220	16 000	22 000	28.5	4.5	19.5	37.5	0.3
7203 B DB DF DT	16 100	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 DT 7303 A DB DF DT	17 600 25 900	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 DT	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 DT	10 700	8 100	1 090	825	19 000	26 000	22.3	4.3	_	35.8	0.15
7904 C DB DF DT	11 300	8 500	1 150	865	22 000	32 000	16.6	1.4		35.8	0.15
7004 A DB DF DT	17 600	13 200	1 800	1 340	15 000	20 000	29.9	5.9	22.5	39.5	0.3
7004 C DB DF DT	18 000	13 100	1 840	1 330	20 000	30 000	20.3	3.7	—	39.5	0.3
7204 A DB DF DT	23 500	16 600	2 400	1 690	13 000	19 000	33.3	5.3	25	42	0.6
7204 B DB DF DT	21 600	15 300	2 210	1 560	9 500	13 000	42.1	14.1	25	42	0.6
*7204 BEA 7204 C DB DF DT 7304 A DB DF DT	23 600 30 500	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 DT	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 DT	12 100	10 300	1 230	1 050	16 000	22 000	24.6	6.6	_	40.8	0.15
7905 C DB DF DT	12 700	10 800	1 300	1 110	19 000	26 000	18.0	0.0		40.8	0.15
7005 A DB DF DT	18 300	14 800	1 870	1 510	13 000	17 000	32.8	8.8	27.5	44.5	0.3
7005 C DB DF DT	19 000	14 800	1 940	1 510	18 000	26 000	21.6	2.4		44.5	0.3
7205 A DB DF DT	26 300	20 500	2 690	2 090	12 000	16 000	37.2	7.2	30	47	0.6
7205 B DB DF DT	24 000	18 800	2 450	1 920	8 500	11 000	47.3	17.3	30	47	0.6
*7205 BEA 7205 C DB DF DT 7305 A DB DF DT	27 000 43 000	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 hearing	ago markad	in the colum	on for d d	and	for obotto		:n\ and	(100.014) 11		h.,	

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.

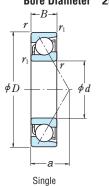
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

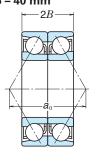
Во		nry Dimensions (mm)		ns	Basi (N		ngs (Single) {kg		Factor	Spee	iting ds (¹)	Eff.Load Centers		ent and Isions (r		Mass (kg)
d	D	В	r min.	$ eals_1$ min.	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Grease	n ⁻¹) Oil	(mm) a	$d_{ m a}$ min.	$D_{\rm a} \atop {\rm max.}$	${m \gamma}_{\rm a}$ max.	approx.
17	30 30 35	7 7 10	0.3 0.3 0.3	0.15 0.15 0.15	4 750 5 000 6 400	2 800 2 940 3 800	485 510 655	286 299 390	_ 14.8 _	30 000 34 000 22 000	40 000 48 000 30 000	9.0 6.6 12.5	19.5 19.5 19.5	27.5 27.5 32.5	0.3 0.3 0.3	0.017 0.017 0.040
	35 40 40	10 12 12		0.15 0.3 0.3	6 600 10 800 9 950	3 800 6 000 5 500	675 1 100 1 010	390 610 565	14.5 — —	32 000 20 000 14 000	43 000 28 000 19 000	8.5 14.2 18.0	19.5 22 22	32.5 35 35	0.3 0.6 0.6	0.044 0.067 0.068
	40 40 47	12 12 14	0.6 0.6 1	0.3 0.3 0.6	11 600 10 900 15 900	6 100 5 850 8 650	1 180 1 110 1 630	625 595 880	13.3 —	16 000 28 000 14 000	22 000 38 000 19 000	18.2 9.8 16.2	22 22 23	35 35 41	0.6 0.6 1	0.065 0.075 0.116
	47 47	14 14	1 1	0.6 0.6	14 800 16 800	8 000 8 300	1 510 1 720	820 850	_	13 000 14 000	17 000 20 000	20.4 20.4	23 23	41 41	1 1	0.118 0.113
20	37 37 42	9 9 12	0.3 0.3 0.6	0.15 0.15 0.3	6 600 6 950 10 800	4 050 4 250 6 600	675 710 1 110	410 430 670	14.9 —	24 000 28 000 18 000	32 000 38 000 24 000	11.1 8.3 14.9	22.5 22.5 25	34.5 34.5 37	0.3 0.3 0.6	0.036 0.036 0.068
	42 47 47	12 14 14	0.6 1 1	0.3 0.6 0.6	11 100 14 500 13 300	6 550 8 300 7 650	1 130 1 480 1 360	665 845 780	14.0 —	26 000 17 000 12 000	36 000 22 000 16 000	10.1 16.7 21.1	25 26 26	37 41 41	0.6 1 1	0.076 0.106 0.109
	47 47 52	14 14 15	1 1 1.1	0.6 0.6 0.6	15 600 14 600 18 700	8 150 8 050 10 400	1 590 1 480 1 910	830 825 1 060	13.3 —	13 000 24 000 13 000	19 000 34 000 17 000	21.1 11.5 17.9	26 26 27	41 41 45	1 1 1	0.103 0.118 0.146
	52 52	15 15	1.1 1.1	0.6 0.6	17 300 19 800	9 650 10 500	1 770 2 020	985 1 070	=	11 000 13 000	15 000 18 000	22.6 22.6	27 27	45 45	1 1	0.15 0.149
25	42 42 47	9 9 12	0.3 0.3 0.6	0.15 0.15 0.3	7 450 7 850 11 300	5 150 5 400 7 400	760 800 1 150	525 555 750	15.5 —	20 000 24 000 16 000	28 000 34 000 22 000	12.3 9.0 16.4	27.5 27.5 30	39.5 39.5 42	0.3 0.3 0.6	0.043 0.042 0.079
	47 52 52	12 15 15	0.6 1 1	0.3 0.6 0.6	11 700 16 200 14 800	7 400 10 300 9 400	1 190 1 650 1 510	755 1 050 960	14.7 — —	22 000 15 000 10 000	30 000 20 000 14 000	10.8 18.6 23.7	30 31 31	42 46 46	0.6 1 1	0.089 0.13 0.133
	52 52 62	15 15 17	1 1 1.1	0.6 0.6 0.6	17 600 16 600 26 400	10 200 10 200 15 800	1 790 1 690 2 690	1 040 1 040 1 610	14.0 —	12 000 22 000 10 000	17 000 28 000 14 000	23.7 12.7 21.1	31 31 32	46 46 55	1 1 1	0.127 0.143 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.

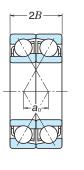
SINGLE/MATCHED MOUNTINGS Bore Diameter 25 - 40 mm



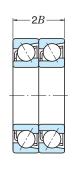


Back-to-Back

DB

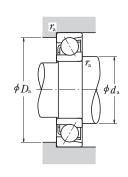


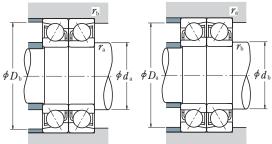
Face-to-Face

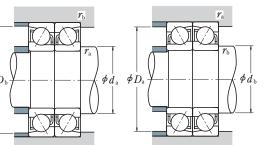


Tandem

DT







Dynamic Equivalent Load $P = XF_r + YF_a$

Contact if E * Single, DT DB or [DI
Contact Angle C_{or} e	$F_a/F_r > e$
Allyle Cor X Y X Y X Y	X = Y
0.178 0.38 1 0 0.44 1.47 1 1.65 0	0.72 2.39
0.357 0.40 1 0 0.44 1.40 1 1.57 0	0.72 2.28
0.714 0.43 1 0 0.44 1.30 1 1.46 0	0.72 2.11
15° 1.07 0.46 1 0 0.44 1.23 1 1.38 0	0.72 2.00
15 1.43 0.47 1 0 0.44 1.19 1 1.34 0	0.72 1.93
2.14 0.50 1 0 0.44 1.12 1 1.26 0	0.72 1.82
3.57 0.55 1 0 0.44 1.02 1 1.14 0	0.72 1.66
5.35 0.56 1 0 0.44 1.00 1 1.12 0	0.72 1.63
25° — 0.68 1 0 0.41 0.87 1 0.92 0	0.67 1.41
	0.63 1.24
40° 1.14 1 0 0.35 0.57 1 0.55 0	0.57 0.93

*For i, use 2 for DB, DF and 1 for DT

Static Equivalent Load $P_0=X_0F_r+Y_0F_a$

Contact	Singl	e, DT	DB o	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	$F_r > 0.5F$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

	X_0		Y_0		X	0		Y_0	Single o				
	0.5		0.46).92	mountin When	g			
	0.5		0.38	3	1 0.76					5 F.	$+Y_0F_a$		
	0.5		0.33 1 0.66					use Pn=		1101 a			
	0.5		0.26	6	1 0.52).52		•				
				.0 1 0.02									
)	Limi eeds (¹)	(Ma	atched)		oad (acing <i>a</i>	s (m							
	Grease	(min ⁻¹) ease Oil			DB	O DI	=	$d_{ m b}$ (3 min.) $D_{ m ma}$		γ _b (³) max.		
	7 500 8 500		000 000		3.5 3.5	19 19		30 30	57 57		0.6 0.6		

Во	undar	y Dim mm)		ons	Bas (1		ngs (Single) {k	gf}	Factor	Spee	iting ds (¹)	Eff.Load Centers		ent and isions (i		Mass (kg)
d	D	В	∤ min.	$oldsymbol{\gamma}_1$ min.	C_{r}	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	f_0	(mi Grease	n-¹) Oil	(mm) <i>a</i>	$d_{ m a}$ min.	$D_{ m a}$ max.	${m \gamma}_{ m a}$ max.	approx.
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	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	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

Notes (1) For applications operating near the limiting speed, refer to Page B49.

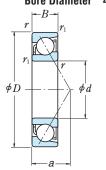
(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

Bearing	Bearing Numbers (2) Single Duplex		c Load Ratings	s (Matched) {kg		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		ent and nsions (r	
Single	Duplex	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	Grease	in ⁻¹) Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _b (³) max.
7305 B *7305 BE	DB DF DT	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 DF DT DB DF DT DB DF DT	12 800 13 500 23 600	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 DF DT DB DF DT DB DF DT	24 600 36 500 33 500	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 BEA 7206 C 7306 A	DB DF DT DB DF DT	37 500 54 500	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	DB DF DT	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 DF DT DB DF DT DB DF DT	18 600 19 600 29 700	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 DF DT DB DF DT DB DF DT	31 000 48 500 44 000	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
*7207BEA 7207 C 7307 A	DB DF DT DB DF DT	49 500 65 000	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	DB DF DT	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 DF DT DB DF DT DB DF DT	23 300 24 600 31 500	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 DF DT DB DF DT DB DF DT	33 500 57 500 52 000	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
	(2) 5 1						1 /		()			

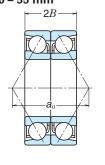
Note (3) For bearings marked — in the column for d_b , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

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.

SINGLE/MATCHED MOUNTINGS Bore Diameter 40 - 55 mm

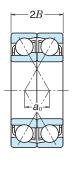


Single

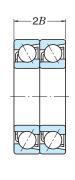


Back-to-Back

DB

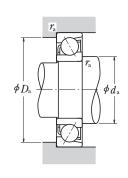


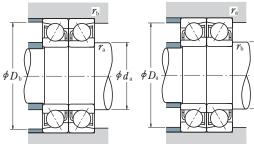
Face-to-Face

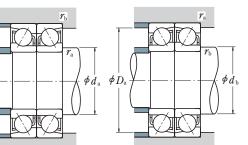


Tandem

DT







Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$			Singl				DB c	r DF	
		e	F_a/F	$r \leq e$	F_a/I	r > e	F_a/F	$r \leq e$	F_a/F	r > e
Angle	C_{or}		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 $P_0=X_0F_r+Y_0F_a$

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	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0=F_r$
40°	0.5	0.26	1	0.52	

Bearing Numbers (2)		Basic (N	: Load Ratings	s (Matched) {kg	,	Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (r	
Single Duplex		$C_{\rm r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	n ⁻¹) Oil	DB DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _b (³) max.
	T T	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 I *7308 BEA	TC	73 000 —	60 500 —	7 400 —	6 200 —	5 000 5 600	6 700 8 000	77.5 77.5	31.5 31.5	46 46	84 84	1 1
7909 C DB DF I	T T T	24 600 26 000 37 500	25 400 26 800 37 500	2 510 2 660 3 850	2 590 2 730 3 800	9 500 12 000 7 500	13 000 16 000 10 000	38.4 27.1 50.6	14.4 3.1 18.6	— — 50	65.5 65.5 70	0.3 0.3 0.6
7209 A DB DF I	T T T	39 500 64 500 58 500	38 500 57 500 52 500	4 050 6 550 5 950	3 950 5 850 5 350	11 000 7 100 5 000	15 000 9 500 6 700	32.1 56.5 73.5	0.1 18.5 35.5	— 50 50	70 80 80	0.6 0.6 0.6
	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 *7309 BEA	TC	95 000 —	80 500 —	9 650 —	8 200 —	4 500 5 000	6 000 7 100	85.8 85.8	35.8 35.8	51 51	94 94	1 1
7910 C DB DF I	T T T	25 900 27 400 40 000	28 400 30 000 42 000	2 640 2 800 4 050	2 900 3 050 4 300	9 000 11 000 7 100	12 000 15 000 9 500	40.5 28.3 53.5	16.5 4.3 21.5	— — 55	69.5 69.5 75	0.3 0.3 0.6
7210 A DB DF I	T T T	42 000 67 000 60 500	44 000 63 000 57 000	4 300 6 850 6 200	4 450 6 400 5 850	10 000 6 300 4 500	14 000 9 000 6 300	33.4 60.4 78.7	1.4 20.4 38.7	— 55 55	75 85 85	0.6 0.6 0.6
	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 I *7310 BEA	TC	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 1
	TOT TOT	29 300 31 000 52 500	33 500 35 500 55 500	2 990 3 150 5 350	3 400 3 600 5 650	8 000 9 500 6 300	11 000 13 000 8 500	44.5 31.1 59.9	18.5 5.1 23.9	— 60	75 75 85	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.

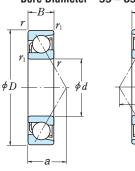
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

Во	oundar	y Din (mm)		ons	Basi (N		ngs (Single) {kg		Factor	Spee	iting ds (¹)	Eff.Load Centers		nent and nsions (Mass (kg)
d	D	В	γ min.	$oldsymbol{r}_1$ min.	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Grease	n ⁻¹) Oil	(mm) <i>a</i>	$d_{ m a}$ min.	$D_{ m a}$ max.	r a max.	approx.
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	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	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

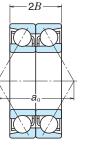
Notes (1) For applications operating near the limiting speed, refer to Page B49.

(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

SINGLE/MATCHED MOUNTINGS Bore Diameter 55 - 65 mm

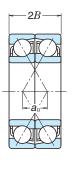


Single

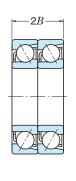


Back-to-Back

DB

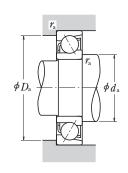


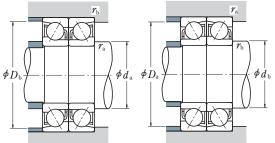
Face-to-Face

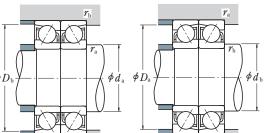


Tandem

DT







Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	$if_0F_a^*$		$F_a/F_r \leq e$		e, DT			DB c	or DF	
		e	F_a/F	$r \leq e$	F_a/F	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 $P_0=X_0F_r+Y_0F_a$

Contact	Singl	e, DT	DB c	r DF	
Angle	<i>X</i> ₀	Y_0	<i>X</i> ₀	Y_0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_r > 0.5F_r +$
30°	0.5	0.33	1	0.66	use $P_0 = F_r$
40°	0.5	0.26	1	0.52	

 $+Y_0F_a$

						,,,		DI			Di					
Во	undar	y Dim (mm)		ns	Basi (N		ngs (Single) {kg	f}	Factor	Limi Spee (mi		Eff.Load Centers		nent and nsions		Mass (kg)
d	D	В	γ min.	$ m \emph{r}_1$ min.	C_{r}	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	f_0	Grease	Oil	a (mm)	$d_{ m a}$ min.	$D_{ m a}$ max.	${m \gamma}_{ m a}$ max.	approx.
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	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 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 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	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	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	2.17 2.09

Notes	(1)	For applications	operating nea	r the limiting	speed, refer	to Page B49.
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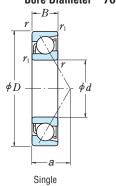
(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

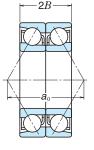
Bearing	Numbers (2)	Basi (N	c Load Rating	s (Matched {kg		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (
Single	Duplex	$C_{ m r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	in ⁻¹) Oil	DB DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _b (³) max.
7011 C 7211 A 7211 B	DB DF DT DB DF DT	83 000	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	A DB DF DT DB DF DT		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	DB DF DT A	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 DB DF DT	31 500	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 DB DF DT	100 000	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	A DB DF D1 DB DF D1		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	DB DF DT A	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 DB DF DT	33 000	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 DB DF DT	114 000	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	A DB DF DT DB DF DT		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	DB DF DT A	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.

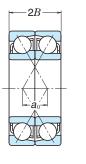
SINGLE/MATCHED MOUNTINGS Bore Diameter 70 - 80 mm



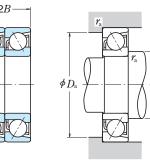


Back-to-Back

DB

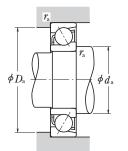


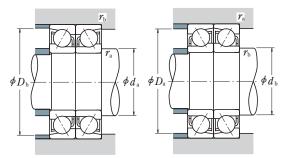
Face-to-Face

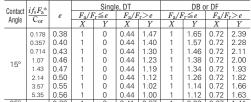


Tandem

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 $P = XF_r + YF_a$

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	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0=F_r$
40°	0.5	0.26	1	0.52	

В	Bearing Numbers (2) Single Duplex		Basi (N	c Load Rating	s (Matched {kç		Speeds (1)	iting (Matched)	Load (Spacing	s (mm)		nent and nsions (
Si	ngle	Duplex	C_{r}	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	n ⁻¹) Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	$ m \emph{r}_b$ (3) max.
791	14 A5 14 C 14 A	DB DF DT DB DF DT DB DF DT	43 000 45 500 71 500	52 500 55 500 82 500	4 400 4 650 7 300	5 350 5 650 8 450	6 300 7 500 5 000	9 000 11 000 6 700	55.6 38.8 72.0	23.6 6.8 32.0	— — 75	95 95 105	0.6 0.6 0.6
721	14 C 14 A 14 B	DB DF DT DB DF DT DB DF DT	76 000 124 000 112 000	86 000 127 000 116 000	7 750 12 600 11 500	8 750 13 000 11 800	7 100 4 500 3 200	10 000 6 300 4 500	44.1 80.3 105.8	4.1 32.3 57.8	— 76 76	105 119 119	0.6 1 1
721	14 BE <i>l</i> 14 C 14 A	DB DF DT DB DF DT	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
	14 B 14 BE	DB DF DT	186 000 —	172 000 —	19 000 —	17 500 —	2 800 3 200	4 000 4 800	127.3 127.3	57.3 57.3	77 77	143 143	1
791	15 A5 15 C 15 A	DB DF DT DB DF DT DB DF DT	44 000 46 500 73 000	55 500 58 500 87 500	4 450 4 750 7 450	5 650 5 950 8 900	6 000 7 100 4 800	8 500 10 000 6 700	58.0 40.1 74.8	26.0 8.1 34.8	— 80	100 100 110	0.6 0.6 0.6
721	15 C 15 A 15 B	DB DF DT DB DF DT DB DF DT	78 000 123 000 112 000	91 500 129 000 117 000	7 950 12 600 11 400	9 300 13 100 11 900	6 700 4 300 3 200	9 500 6 000 4 300	45.4 84.2 111.0	5.4 34.2 61.0	— 81 81	110 124 124	0.6 1 1
721 731	15 BE <i>l</i> 15 C 15 A 15 B	DB DF DT DB DF DT 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
791	16 A5 16 C 16 A	DB DF DT DB DF DT DB DF DT	44 500 47 000 89 500	58 000 61 500 106 000	4 550 4 800 9 150	5 900 6 250 10 800	5 600 6 700 4 300	8 000 9 500 6 000	60.3 41.5 81.2	28.3 9.5 37.2	— — 85	105 105 120	0.6 0.6 0.6
721	16 C 16 A 16 B	DB DF DT DB DF DT DB DF DT	95 500 145 000 131 000	111 000 152 000 139 000	9 700 14 700 13 300	11 300 15 600 14 100	6 300 4 000 2 800	9 000 5 600 4 000	49.4 89.5 118.3	5.4 37.5 66.3	— 86 86	120 134 134	0.6 1 1
721 731	16 BE A 16 C 16 A 16 B	DB DF DT DB DF DT 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	82 — 87 87	153 134 163 163	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.

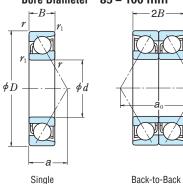
Remarks The bearings denoted by an asterisk (*) are NSKHPS Angular contact ball bearings and the column of Duplex in Bearing Numbers indicates the universal matching.

В	oundar	y Din (mm)		ns	Bas (N		tings (Single) {kg) gf}	Factor		ds (¹)	Eff.Load Centers		nent and nsions (Mass (kg)
d	D	В	∤ min.	$oldsymbol{\gamma}_1$ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	f_0	Grease	n ⁻¹) Oil	(mm) <i>a</i>	$d_{ m a}$ min.	$D_{ m a}$ max.	r 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	87 90 92 92	148 130 158 158	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.

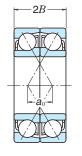
SINGLE/MATCHED MOUNTINGS Bore Diameter 85 - 100 mm



Boundary Dimensions

DB

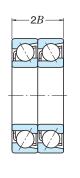
Basic Load Ratings (Single)



Face-to-Face

DF

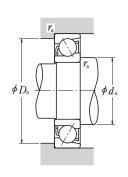
Factor



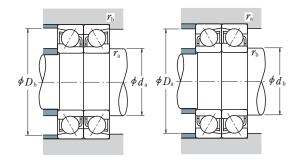
Tandem

DT

Limiting



Eff.Load Abutment and Fillet Mass



Dynamic Equivalent Load $P = XF_r + YF_a$

	$if_0F_a^*$			Singl	e, DT			DB c	r DF	
		e	F_a/F	r≤e	F_a/F	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 $P_0=X_0F_r+Y_0F_a$

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	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0=F_r$
40°	0.5	0.26	1	0.52	

Bearing	Numbers (2)	Basi (N	c Load Rating	s (Matched {kg	,	Limi Speeds (1)	(Matched)	Load (Spacing	s (mm)		nent and nsions (
Single	Duplex	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	(mir Grease	Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	г _ь (³) max.
7917 A5 7917 C 7017 A	DB DF DT DB DF DT DB DF DT	59 500 63 000 91 500	77 000 81 500 112 000	6 100 6 450 9 350	7 850 8 300 11 400	5 300 6 300 4 300	7 500 9 000 5 600	65.8 45.5 84.1	29.8 9.5 40.1	— 90	115 115 125	0.6 0.6 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 7918 C 7018 A	DB DF DT DB DF DT DB DF DT	64 000 67 500 109 000	87 000 92 000 133 000	6 500 6 900 11 200	8 900 9 400 13 500	5 000 6 000 3 800	7 100 8 500 5 300	68.1 46.8 90.4	32.1 10.8 42.4	— — 96	120 120 134	0.6 0.6 1
7018 C 7218 A 7218 B	DB DF DT DB DF DT DB DF DT	116 000 191 000 173 000	138 000 206 000 188 000	11 900 19 500 17 700	14 100 21 000 19 100	5 600 3 600 2 600	8 000 5 000 3 400	54.8 102.2 134.9	6.8 42.2 74.9	96 96	134 154 154	1 1 1
7218 C 7318 A 7318 B	DB DF DT DB DF DT DB DF DT	199 000 277 000 254 000	209 000 294 000 270 000	20 300 28 300 25 900	21 400 30 000 27 600	5 300 2 600 2 200	7 100 3 400 3 000	63.5 123.8 160.5	3.5 37.8 74.5	97 97	154 183 183	1 1 1
7919 A5 7919 C 7019 A	DB DF DT DB DF DT DB DF DT	64 500 68 500 109 000	91 000 96 000 134 000	6 600 7 000 11 100	9 250 9 800 13 600	4 800 5 600 3 800	6 700 8 000 5 000	70.5 48.1 93.3	34.5 12.1 45.3	_ _ _	125 125 139	0.6 0.6 1
7019 C 7219 A 7219 B	DB DF DT DB DF DT DB DF DT	119 000 208 000 188 000	146 000 221 000 202 000	12 200 21 200 19 200	14 900 22 600 20 500	5 300 3 400 2 400	7 500 4 500 3 200	56.1 108.5 143.2	8.1 44.5 79.2	102 102	139 163 163	1 1 1
7219 C 7319 A 7319 B	DB DF DT DB DF DT DB DF DT	216 000 297 000 272 000	224 000 325 000 298 000	22 000 30 500 27 700	22 800 33 000 30 500	4 800 2 400 2 200	6 700 3 200 3 000	67.5 130.2 168.7	3.5 40.2 78.7	102 102	163 193 193	1 1 1
7920 A5 7920 C 7020 A	DB DF DT DB DF DT DB DF DT	77 000 81 500 111 000	103 000 108 000 141 000	7 850 8 300 11 300	10 500 11 100 14 400	4 500 5 300 3 600	6 300 7 500 5 000	76.0 52.2 96.2	36.0 12.2 48.2	_ _ _	135 135 144	0.6 0.6 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.

(mm)		ONS		(N) {kgf}			Factor	Spee	ds (¹)	Centers	Additional parameters and Fillet Dimensions (mm) $d_a = D_a = r_a$ min. $d_a = 0$ max. $d_a = 0$		(kg)			
d	D	В	∤ min.	$oldsymbol{\gamma}_1$ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	f_0	(mi Grease	n-¹) Oil	(mm) a				approx.
85	120 120 130	18 18 22	1.1 1.1 1.1	0.6 0.6 0.6	36 500 39 000 56 500	38 500 40 500 56 000	3 750 3 950 5 750	3 900 4 150 5 700	— 16.5 —	6 700 8 000 5 300	9 000 11 000 7 100	32.9 22.7 42.0	92	113	1	0.541 0.534 0.913
	130 150 150	22 28 28	1.1 2 2	0.6 1 1	60 000 103 000 93 000	58 500 89 000 81 000	6 150 10 500 9 500	6 000 9 100 8 250	15.9 — —	7 500 4 800 3 400	10 000 6 700 4 800	25.4 47.9 63.3	92 95 95	123 140 140	1 2 2	1.01 1.83 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	125 125 140	18 18 24	1.1 1.1 1.5	0.6 0.6 1	39 500 41 500 67 500	43 500 46 000 66 500	4 000 4 250 6 850	4 450 4 700 6 750	16.6 —	6 300 7 500 4 800	8 500 10 000 6 700	34.1 23.4 45.2	97 97 99	118 118 131	1 1 1.5	0.56 0.563 1.19
	140 160 160	24 30 30	1.5 2 2	1 1 1	71 500 118 000 107 000	69 000 103 000 94 000	7 300 12 000 10 900	7 050 10 500 9 550	15.7 — —	7 100 4 500 3 200	9 500 6 000 4 300	27.4 51.1 67.4	99 100 100	131 150 150	1.5 2 2	1.34 2.25 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	130 130 145	18 18 24	1.1 1.1 1.5	0.6 0.6 1	40 000 42 500 67 000	45 500 48 000 67 000	4 050 4 300 6 800	4 650 4 900 6 800	— 16.7 —	6 000 7 100 4 500	8 500 10 000 6 300	35.2 24.1 46.6	102 102 104	123 123 136	1 1 1.5	0.597 0.591 1.43
	145 170 170	24 32 32	2.1		73 500 128 000 116 000	73 000 111 000 101 000	7 500 13 000 11 800	7 450 11 300 10 300	15.9 — —	6 700 4 300 3 000	9 000 5 600 4 000	28.1 54.2 71.6	104 107 107	136 158 158	1.5 2 2	1.42 2.68 2.74
	170 200 200	32 45 45	2.1 3 3	1.1 1.1 1.1	133 000 183 000 167 000	112 000 162 000 149 000	13 500 18 600 17 100	16 600	14.6 —	6 000 3 000 2 600	8 500 4 000 3 600	33.7 65.1 84.3	107 109 109	158 186 186	2 2.5 2.5	3.05 5.83 5.98

Notes (1) For applications operating near the limiting speed, refer to Page B49.

51 500

54 000

70 500

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

5 100 5 550

6 950 7 200

5 250

16.5

5 600

6 700

4 500

8 000

9 000

6 000

38.0 107

26.1 107

48.1 109

133

133

1.5 | 1.48

0.804

0.794

B 62

140 150

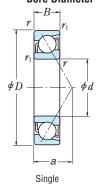
20 1.1 0.6

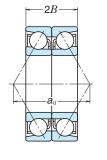
20 1.1 0.6

24 1.5 1

100 140

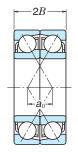
SINGLE/MATCHED MOUNTINGS Bore Diameter 100 - 120 mm



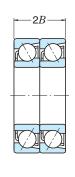


Back-to-Back

DB

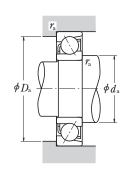


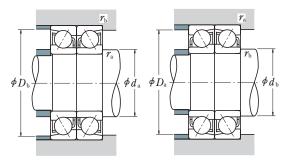
Face-to-Face



Tandem

DT





Dynamic Equivalent Load $P = XF_r + YF_a$

Contact	; f F *			Singl	e, DT			DB c	or DF	
	$\frac{i J_0 P_a}{C_{or}}$	e	F_a/F	$r \leq e$	F_a/F	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	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
_	$F_{\rm r} > 0.5F_{\rm r} + Y_0F_{\rm a}$
_	use $P_0 = F_r$

Во	oundar	y Din (mm)		ons	Bas (1		ings (Single)) gf}	Factor	Limit Speed (mir	ls (¹)	Eff.Load Centers		nent and		Mass (kg)
d	D	В	γ min.	$oldsymbol{\gamma}_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	${m \gamma}_{ m a}$ 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	2 2 2.5 2.5	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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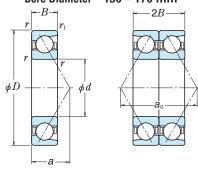
(2) The suffixes A, A5, B, and C represent contact angles of 30°, 25°, 40°, and 15° respectively.

Bearing Numbers (2) Single Duplex		Basi (N	c Load Rating	s (Matched	,	Limi Speeds (¹)	(Matched)	Load (Spacing	s (mm)		nent and nsions (
Single	Duplex	$C_{ m r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	(mii Grease	Oil	DB	O DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _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 DT	233 000	251 000	23 800	25 600	3 200	4 300	114.8	46.8	107	173	1
7220 B	DB DF DT	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 DT	335 000	385 000	34 500	39 500	2 200	3 000	137.9	43.9	107	208	1
7320 B	DB DF DT	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 DT	83 000	114 000	8 450	11 600	5 300	7 100	53.5	13.5	_	140	0.6
7021 A	DB DF DT	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 DT	254 000	283 000	25 900	28 900	3 000	4 000	121.2	49.2	112	183	1
7221 B	DB DF DT	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 DT	335 000	385 000	34 500	39 500	2 200	2 800	144.3	46.3	_	218	1
7321 B	DB DF DT	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 DT	84 500	119 000	8 600	12 100	5 000	6 700	54.8	14.8	_	145	0.6
7022 A	DB DF DT	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 DT	276 000	315 000	28 100	32 500	2 800	4 000	127.5	51.5	117	193	1
7222 B	DB DF DT	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 DT	360 000	430 000	36 500	44 000	2 000	2 600	151.0	51.0	_	233	1
7322 B	DB DF DT	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 DT	117 000	162 000	11 900	16 600	4 500	6 300	60.2	16.2	_	160	0.6
7024 A	DB DF DT	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 DT DB DF DT DB DF DT DB DF 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

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

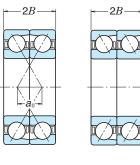
SINGLE/MATCHED MOUNTINGS Bore Diameter 130 - 170 mm



Back-to-Back

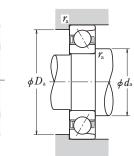
DB

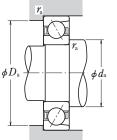
Single

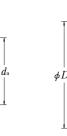


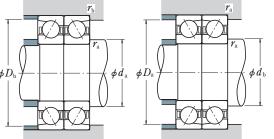
Tandem

DT











Contact	$\frac{if_0F_a^*}{C_{or}}$			Singl	e, DT			DB c	r DF	
Angle		e	$F_{\rm a}/I$	r≤e	F_a/F	r > e	$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	$c_{\rm r} > e$
Allyle	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 $P_0=X_0F_r+Y_0F_a$

Contact	Singl	e, DT	DB o	or 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	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0=F_r$
40°	0.5	0.26	1	0.52	0 - 1

Bearing Numbers (2)	Basi (N	c Load Rating	s (Matched	,	Limi Speeds (1)	(Matched)	Spacing	Center IS (mm)		nent and nsions (
Single Duplex	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	(mii Grease	Oil	DB	DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	γ _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 DB DF DT	355 000	470 000	36 000	48 000	1 800	2 400	154.6	70.6	_	243	1
7228 B DB DF DT	320 000	425 000	32 500	43 500	1 600	2 200	205.6	121.6	_	243	1
7328 A DB DF DT	490 000	670 000	50 000	68 500	1 600	2 000	189.0	65.0	_	291	1.5
7328 B DB DF DT	445 000	615 000	45 500	63 000	1 400	1 900	246.6	122.6	_	291	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 , d_b and r_b for shafts are d_a (min.) and r_a (max.) respectively.

Во				ns	Bas (N		tings (Single) {k) gf}	Factor	Limi Speed	ls (¹)	Eff.Load Centers		nent and		Mass (kg)
d	D	В	γ min.	$ eals_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	f_0	(mir Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	r _a max.	approx.
130	180	24	1.5	1	74 000	86 000	7 550	8 750	—	4 300	6 000	48.1	139	171	1.5	1.54
	180	24	1.5	1	78 500	91 000	8 000	9 250	16.5	5 000	7 100	32.8	139	171	1.5	1.5
	200	33	2	1	117 000	125 000	12 000	12 800	—	3 400	4 500	64.1	140	190	2	3.68
	230 230 280 280	40 40 58 58	3 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	17 800	_ _ _ _	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 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	22 300 20 100 30 500 28 100	34 500	_ _ _	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	9 850 10 400 14 000	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	45	3	1.1	248 000	280 000	25 300	28 500	_	2 000	2 800	83.1	164	256	2.5	11.2
	270	45	3	1.1	225 000	254 000	22 900	25 900	_	1 800	2 600	110.6	164	256	2.5	11.2
	320	65	4	1.5	315 000	370 000	32 500	38 000	_	1 800	2 400	100.3	168	302	3	26
	320	65	4	1.5	289 000	340 000	29 400	34 500	_	1 600	2 200	131.1	168	302	3	25.9
160	220	28	2	1	106 000	133 000	10 800	13 500	16.7	3 800	5 000	39.4	170	210	2	3.1
	240	38	2.1	1.1	155 000	176 000	15 800	18 000	—	2 200	2 800	76.7	172	228	2	5.77
	290	48	3	1.1	263 000	305 000	26 800	31 500	—	1 900	2 600	89.0	174	276	2.5	14.1
	290	48	3	1.1	238 000	279 000	24 200	28 400	_	1 700	2 400	118.4	174	276	2.5	14.2
	340	68	4	1.5	345 000	420 000	35 500	43 000	_	1 700	2 200	106.2	178	322	3	30.7
	340	68	4	1.5	315 000	385 000	32 000	39 500	_	1 500	2 000	138.9	178	322	3	30.8
170	230	28	2	1	113 000	148 000	11 500	15 100	16.8	3 600	4 800	40.8	180	220	2	3.36
	260	42	2.1	1.1	186 000	214 000	19 000	21 900	—	2 000	2 600	83.1	182	248	2	7.9
	310	52	4	1.5	295 000	360 000	30 000	36 500	—	1 800	2 400	95.3	188	292	3	17.3
	310	52	4	1.5	266 000	325 000	27 200	33 000	_	1 600	2 200	126.7	188	292	3	17.6
	360	72	4	1.5	390 000	485 000	39 500	49 500	_	1 600	2 200	112.5	188	342	3	35.8
	360	72	4	1.5	355 000	445 000	36 000	45 500	_	1 400	2 000	147.2	188	342	3	35.6

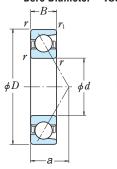
Face-to-Face

DF

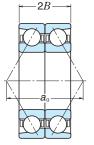
Notes (1) For applications operating near the limiting speed, refer to Page **B49**.

(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

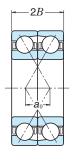


Single



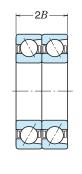
Back-to-Back

DB



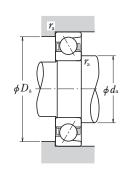
Face-to-Face

DF



Tandem

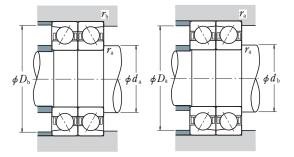
DT



Во	oundar	y Din (mm)		ons	l	sic Load Rati	ngs (Single {kç	,	Factor	Limit Speed (mir	ls (¹)	Eff.Load Centers	rs Dimensions (mm			Mass (kg)
d	D	В	γ min.	${m r}_1$ min.	C_{r}	C_{0r}	C_{r}	$C_{0\mathrm{r}}$	f_0	Grease	Oil	(mm) a	$d_{ m a}$ min.	$D_{ m a}$ max.	${m \gamma}_{ m a}$ max.	approx.
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	52	4	1.5	276 000	350 000	28 100	35 500	_	1 500	2 000	130.9	198	302	3	18.4
	380	75	4	1.5	410 000	535 000	41 500	54 500	_	1 500	2 000	118.3	198	362	3	42.1
	380	75	4	1.5	375 000	490 000	38 000	50 000	_	1 300	1 800	155.0	198	362	3	42.6
190	260	33	2	1	147 000	192 000	15 000	19 600	16.7	3 000	4 300	46.6	200	250	2	4.98
	290	46	2.1	1.1	224 000	280 000	22 800	28 600	—	1 800	2 400	92.3	202	278	2	11.3
	340	55	4	1.5	315 000	410 000	32 000	42 000	—	1 600	2 200	104.0	208	322	3	22.4
	340	55	4	1.5	284 000	375 000	28 900	38 000	_	1 400	2 000	138.7	208	322	3	22.5
	400	78	5	2	450 000	600 000	46 000	61 000	_	1 400	1 900	124.2	212	378	4	47.5
	400	78	5	2	410 000	550 000	42 000	56 000	_	1 300	1 700	162.8	212	378	4	47.2
200	280	38	2.1	1.1	189 000	244 000	19 300	24 900	16.5	2 800	4 000	51.2	212	268	2	6.85
	310	51	2.1	1.1	240 000	310 000	24 500	31 500	—	1 700	2 200	99.1	212	298	2	13.7
	360	58	4	1.5	335 000	450 000	34 500	46 000	—	1 500	2 000	109.8	218	342	3	26.5
	360	58	4	1.5	305 000	410 000	31 000	41 500	_	1 300	1 800	146.5	218	342	3	26.6
	420	80	5	2	475 000	660 000	48 500	67 000	_	1 300	1 800	129.5	222	398	4	54.4
	420	80	5	2	430 000	600 000	44 000	61 500	_	1 200	1 600	170.1	222	398	4	55.3

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.



Dynamic Equivalent Load $P = XF_r + YF_a$

	Contact	$if_0F_a^*$			Singl	e, DT			DB c	r DF	
	Angle	$\frac{i j_0 r_a}{C_{or}}$	e	F_a/F	$r \leq e$	F_a/F	r > e	$F_{\rm a}/F$	$r \leq e$	F_a/F	r > e
	Allyle	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

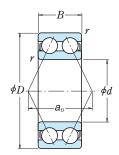
Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

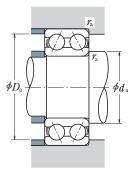
Contact	Singl	e, DT	DB o	r DF	
Angle	<i>X</i> ₀	Y_0	<i>X</i> ₀	Y_0	Single or DT
15°	0.5	0.46	1	0.92	mounting When
25°	0.5	0.38	1	0.76	$F_r > 0.5F_r + Y_0F_a$
30°	0.5	0.33	1	0.66	use $P_0=F_r$
40°	0.5	0.26	1	0.52	

Bearing	Numbers (2)		Basi (N	c Load Rating	s (Matched	,	Limi Speeds (¹)	(Matched)	Load Center Spacings (mm)				
Single	Duplex		C_{r}	C_{0r}	C_{r}	C_{0r}	Grease	Oil	DB	DF	$d_{ m b}$ (3) min.	$D_{ m b}$ max.	火 _b (³) max.
7936 C 7036 A 7236 A	DB DF D	T T T	236 000 335 000 495 000	370 000 505 000 770 000	24 000 34 500 50 500	37 500 51 500 78 500	2 600 1 500 1 400	3 600 2 000 1 800	90.6 178.8 196.3	24.6 86.8 92.3	_ _ _	244 273 311	1 1 1.5
7236 B 7336 A 7336 B	DB DF D	T T T	450 000 665 000 605 000	700 000 1 070 000 975 000	45 500 68 000 62 000	71 000 109 000 99 500	1 200 1 200 1 100	1 700 1 600 1 500	261.8 236.6 309.9	157.8 86.6 159.9	_ _ _	311 371 371	1.5 1.5 1.5
7938 C 7038 A 7238 A	DB DF D	T T T	239 000 365 000 510 000	385 000 560 000 825 000	24 400 37 000 52 000	39 000 57 000 84 000	2 400 1 400 1 300	3 400 1 900 1 700	93.3 184.6 208.0	27.3 92.6 98.0	_ _ _	254 283 331	1 1 1.5
7238 B 7338 A 7338 B	DB DF D	T T T	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 7040 A 7240 A	DB DF D	T T T	305 000 390 000 550 000	490 000 620 000 900 000	31 500 40 000 56 000	50 000 63 500 92 000	2 200 1 300 1 200	3 200 1 800 1 600	102.3 198.2 219.6	26.3 96.2 103.6	_ _ _	273 303 351	1 1 1.5
7240 B 7340 A 7340 B	DB DF D	T T T	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	1.5 2 2

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.

Bore Diameter 10 – 85 mm





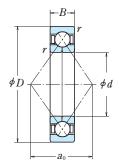
Dynamic Equivalent Load $P = XF_{\rm r} + YF_{\rm a}$								
$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	e					
X	Y	X	Y	e				
1 0.92		0.67	1.41	0.68				

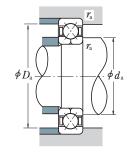
Static Equivalent Load $P_0 = F_r + 0.76 F_a$

	Boundary Dimensions					d Ratings		Limiting	g Speeds	
	,			(1)	,		gf}		in ⁻¹)	Bearing Numbers
d	D	В	γ min.	$C_{ m r}$	C_{0r}	C_{r}	C_{0r}	Grease	Oil	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 F mensions (m		Mass (kg)
(mm) <i>a</i> ₀	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{\gamma}_{\mathrm{a}}$ 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 $P_{\rm a}\!=\!F_{\rm a}$

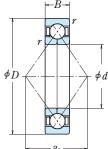
Static Equivalent Load $P_{0\mathrm{a}}\!=\!F_{\mathrm{a}}$

	Boundary D		3	()	Basic Load	•	gf}	Limiting (mi	
d	D	В	γ min.	$C_{\rm a}$	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	(mm) <i>a</i> ₀	$d_{ m a}$ min.	$D_{\rm a} \\ {\rm max.}$	$m{\gamma}_{\mathrm{a}}$ 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.

Bore Diameter 100 - 200 mm





Dynamic Equivalent Load $P_{\rm a} = F_{\rm a}$

Static Equivalent Load $P_{0\mathrm{a}}\!=\!F_{\mathrm{a}}$

E	Boundary Dimensions (mm)				Basic Load	•	0	Limiting Speeds	
d	D	В	r	C_{a}	(N) $C_{0\mathrm{a}}$	$C_{ m a}$	$C_{0\mathrm{a}}$	(mir Grease	n=') Oil
и	D	Б	min.	Ca	C_{0a}	Ca	c_{0a}	Grease	Oli
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		outment and limensions (n		Mass (kg)
	Numbers	(mm) <i>a</i> ₀	$d_{ m a}$ min.	D_{a} max.	$m{\gamma}_{\mathrm{a}}$ max.	approx.
	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 QJ 234 QJ 334	150.5 168.0 185.6	182 188 188	248 292 342	2 3 3	8.6 19.5 41
	QJ 1036 QJ 236 QJ 336	161.0 175.1 196.1	192 198 198	268 302 362	2 3 3	11 20.5 48
	QJ 1038 QJ 238 QJ 338	168.0 185.6 206.6	202 208 212	278 322 378	2 3 4	11.5 23 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

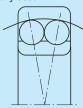
SELF-ALIGNING BALL BEARINGS

Bore Diameter 5 – 110 mm..... B78

DESIGN, TYPES, AND FEATURES

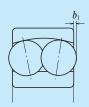
The outer ring has a spherical raceway and its center of curvature coincides with that of the bearing; therefore, the axis of the inner ring, balls and cage can deflect to some extent around the bearing center. This type is recommended when the alignment of the shaft and housing is difficult and when 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.	<i>b</i> 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)

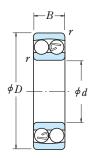
INTERNAL CLEARANCE...... Table 9.12 (Page A90)

PERMISSIBLE MISALIGNMENT

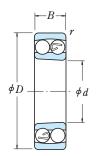
The permissible misalignment of self-aligning ball bearings is approximately 0.07 to 0.12 radian (4° to 7°) under normal loads. However, depending on the surrounding structure, such an angle may not be possible. Use care in the structural design.



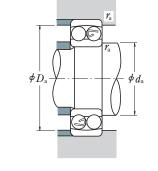
Bore Diameter 5 – 30 mm







Tapered Bore



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	0.65	Y_2	

Static Equivalent Load

 $P_0 = F_{\rm r} + Y_0 F_{\rm a}$

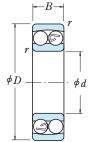
The values of $e,\,Y_2$, Y_3 , and Y_0 are listed in the table below.

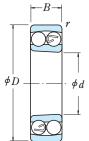
Вс			ns	(1)		ad Ratings	{kg	ιf}	"		Bearing
d	D	В	γ min.	$C_{\rm r}$	C_{0r}	($C_{\rm r}$	C_{0r}	Grease	Oil	Cylindrical Bore
5 6 7	19 19 22	6 6 7	0.3 0.3 0.3	2 530 2 530 2 750	475 475 600	2	258	49 49 61	30 000 30 000 26 000	36 000 36 000 32 000	135 126 127
8 9	22 26	7 8	0.3 0.6	2 750 4 150	600 895			61 91	26 000 26 000	32 000 30 000	108 129
10	30 30 35 35	9 14 11 17	0.6 0.6 0.6 0.6	5 550 7 450 7 350 9 200	1 190 1 590 1 620 2 010	-	760 750	121 162 165 205	22 000 24 000 20 000 18 000	28 000 28 000 24 000 22 000	1200 2200 1300 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	-	790 985	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	-	795 990	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	1 (1 3	010 300	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 47 52 52	14 18 15 21	1 1 1.1 1.1	10 000 12 800 12 600 18 500	2 610 3 300 3 350 4 700	1 3 1 2	310 280	266 340 340 480	14 000 14 000 12 000 11 000	17 000 17 000 15 000 14 000	1204 2204 1304 2304
25	52 52 62 62	15 18 17 24	1 1 1.1 1.1	12 200 12 400 18 200 24 900	3 300 3 450 5 000 6 600	1 2 1 8	270 850	335 350 510 675	12 000 12 000 10 000 9 500	14 000 14 000 13 000 12 000	1205 2205 1305 2305
30	62 62 72 72	16 20 19 27	1 1 1.1 1.1	15 800 15 300 21 400 32 000	4 650 4 550 6 300 8 750	1 5 2	560 190	475 460 645 895	10 000 10 000 8 500 8 000	12 000 12 000 11 000 10 000	1206 2206 1306 2306
	d 5 6 7 8 9 10 12 15 17	d D 5 19 6 19 7 22 8 22 9 26 10 30 30 35 35 12 32 37 37 15 35 42 42 42 17 40 40 40 47 47 47 20 47 47 52 52 25 52 62 62 30 62 72	(mm) d D B 5 19 6 6 19 6 7 22 7 8 26 8 10 30 9 30 14 35 11 35 17 12 32 10 32 14 37 12 37 17 15 35 11 35 11 42 13 42 17 17 40 12 40 16 47 14 47 19 20 47 14 47 19 20 47 14 47 19 20 47 14 47 19 21 52 15 52 15 52 17 62 24 30 62 16 62 20 72 19	d D B r min. 5 19 6 0.3 6 19 6 0.3 7 22 7 0.3 8 22 7 0.3 9 26 8 0.6 10 30 9 0.6 30 14 0.6 35 17 0.6 35 17 0.6 37 12 1 37 12 1 37 17 1 15 35 14 0.6 42 13 1 42 17 1 17 40 12 0.6 40 16 0.6 47 14 1 47 18 1 52 15 1.1 52 15 1.1 52 18 1 62 17	(mm) (Nmi) (6 D B r min. Cr Cor 5 19 6 0.3 2 530 475 6 19 6 0.3 2 530 475 7 22 7 0.3 2 750 600 8 22 7 0.3 2 750 600 9 26 8 0.6 4 150 895 10 30 9 0.6 5 550 1 190 30 14 0.6 7 450 1 590 35 11 0.6 7 350 1 620 35 17 0.6 9 200 2 010 12 32 10 0.6 5 700 1 270 32 14 0.6 7 750 1 730 37 12 1 9 650 2 160 37 17 1 12 100 2 730 15 35 14 0.6 7 800 1 850	(mm) d D B r Cr Cor Cor Cor Cor Cor Cor	d D B r min. Cr Cor Cor Cr 2580 2580 2580 2580 2580 2480 280 280 280 280 280 280 280 280 280 280 280 280 280 281 281 281 281 281 281 281 281	d D B r min. Cr Cor Cor Cr Cor 5 19 6 0.3 2 530 475 258 49 6 19 6 0.3 2 530 475 258 49 7 22 7 0.3 2 750 600 280 61 8 22 7 0.3 2 750 600 280 61 9 26 8 0.6 4 150 895 425 91 10 30 9 0.6 7 450 1 590 760 121 30 14 0.6 7 450 1 590 750 162 35 11 0.6 7 350 1 620 750 165 35 17 0.6 9 200 2 010 935 205 12 32 10 0.6 5 700 1 270 580 130 35 17 <th>d D B r min. Cr Cor Cor Cr Cor Grease 5 19 6 0.3 2 530 475 258 49 30 000 7 22 7 0.3 2 530 475 258 49 30 000 8 22 7 0.3 2 750 600 280 61 26 000 9 26 8 0.6 4 150 895 425 91 26 000 10 30 9 0.6 5 550 1 190 570 121 22 000 30 14 0.6 7 450 1 590 760 162 24 000 35 11 0.6 7 450 1 590 760 162 24 000 35 17 0.6 9 200 2 010 935 205 18 000 12 32 10 0.6 5 700 1 270 580 130 22 000</th> <th> Mathematical Color Mathem</th>	d D B r min. Cr Cor Cor Cr Cor Grease 5 19 6 0.3 2 530 475 258 49 30 000 7 22 7 0.3 2 530 475 258 49 30 000 8 22 7 0.3 2 750 600 280 61 26 000 9 26 8 0.6 4 150 895 425 91 26 000 10 30 9 0.6 5 550 1 190 570 121 22 000 30 14 0.6 7 450 1 590 760 162 24 000 35 11 0.6 7 450 1 590 760 162 24 000 35 17 0.6 9 200 2 010 935 205 18 000 12 32 10 0.6 5 700 1 270 580 130 22 000	Mathematical Color Mathem

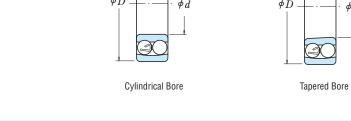
Note (1) The suffix K represents bearings with tapered bores (1 : 12)
Remarks	For the dimensions related to adapters, refer to Page B358 .

Numbers	Abutment a	and Fillet Din (mm)	nensions	Constant	Ax	Axial Load Factors		
Tapered Bore(1)	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{\gamma}_{ m a}$ 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 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 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

Bore Diameter 35 - 70 mm



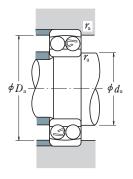




В	oundary D		1S	(N		oad Ratings {kg	nfl.	Limiting (mi	•	Bearing
d	D	В	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil	Cylindrical Bore
35	72	17	1.1	15 900	5 100	1 620	520	8 500	10 000	1207
	72	23	1.1	21 700	6 600	2 210	675	8 500	10 000	2207
	80	21	1.5	25 300	7 850	2 580	800	7 500	9 500	1307
	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$		
X	Y	X	Y	
1	Y_3	0.65	Y_2	

Static Equivalent Load

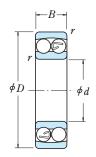
 $P_0 = F_r + Y_0 F_a$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are listed in the table below.

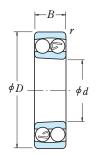
ľ	lumbers	Abutment a	and Fillet Din (mm)	nensions	Constant	Ах	ial Load Fa	actors	Mass (kg)
	Tapered Bore(1)	$d_{ m a}$ min.	$D_{ m a}$ max.	$oldsymbol{\gamma}_{\mathrm{a}}$ max.	e	Y_2	Y_3	Y_0	approx.
	1207 K	41.5	65.5	1	0.23	4.2	2.7	2.8	0.32
	2207 K	41.5	65.5	1	0.37	2.6	1.7	1.8	0.378
	1307 K	43	72	1.5	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	56.5	83.5	1	0.21	4.7	3.1	3.2	0.525
	2210 K	56.5	83.5	1	0.28	3.4	2.2	2.3	0.564
	1310 K	59	101	2	0.23	4.2	2.7	2.8	1.25
	2310 K	59	101	2	0.42	2.3	1.5	1.6	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	1.3 1.52 3.19 3.9

B 80 B 81

Bore Diameter 75 – 110 mm





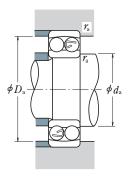


Tapered Bore

В	oundary D		ns	l (N		oad Ratings	~£)	Limiting		Bearing
d	D	В	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	(mir 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

Notes (1) The suffix K represents bearings with tapered bores (1:12)

Remarks For the dimensions related to adapters, refer to Pages **B360** and **B361**.



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	0.65	Y_2		

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

The values of $e,\,Y_2\,,\,Y_3\,$, and Y_0 are listed in the table below.

Numbers	Abutment	and Fillet Di (mm)	mensions	Constant	Ax	ial Load Fa	actors	Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{\gamma}_{\mathrm{a}}$ 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
_ _ _	116 116 118 118	179 179 212 212	2 2 2.5 2.5	0.18 0.28 0.23 0.38	5.5 3.5 4.2 2.6	3.6 2.3 2.7 1.7	3.7 2.4 2.9 1.7	4.52 5.64 10 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

^(*) The balls of the bearings marked * protrude slightly from the bearing face. The protrusion amounts are shown on Page B77.



CYLINDRICAL ROLLER BEARINGS

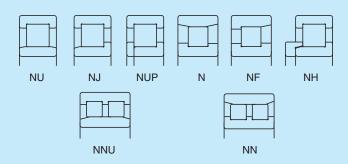
SINGLE-ROW CYLINDRICAL ROLLER BEARINGS		20 - 65mm············· 70 - 160mm·········	
LANAPER TURNOT AND LARGE FOR AVUINDRIAN DOLLER READINGS	Bore Diameter 1	170 – 500mm······	B10
L-SHAPED THRUST COLLARS FOR CYLINDRICAL ROLLER BEARINGS Double-row Cylindrical Roller Bearings		20 – 320mm············· 25 – 360mm··········	

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 REARINGS	Table 8.2	(Panes	A60 to	A63)

 $\begin{array}{ccc} \textbf{Table 2} & \textbf{Tolerances for Roller Inscribed Circle Diameter } F_w \text{ and } \\ \textbf{Roller Circumscribed Circle Diameter } E_w \text{ of Cylindrical } \\ \textbf{Roller Bearings Having Interchangeable Rings} \\ & \textbf{Units}: \mu m \\ \end{array}$

_											
Nominal Bore Diameter d (mm)			Tolerances fo NU, NJ, NUP, NF	or $F_{ m w}$ of types I, and NNU ${ extstyle \Delta F_{ m w}}$	Tolerances for $E_{ m w}$ of types N, NF, and NN $\varDelta_{E_{ m w}}$						
C	over	incl.	high low		high	low					
	_	20	+10	0	0	-10					
	20	50	+15	0	0	- 15					
	50	120	+20	0	0	-20					
1	20	200	+25	0	0	-2 5					
2	200	250	+30	0	0	-30					
2	250	315	+35	0	0	-3 5					
3	315	400	+40	0	0	-40					
4	400 500		+45	0	_	<u> </u>					

RECOMMENDED FITS

CYLINDRICAL ROLLER BEARINGS	Table 9.2 (Page A	184)
	Table 9.4 (Page A	A85)
DOUBLE-ROW CYLINDRICAL ROLLER			
BEARINGS	Table 9.2 (Page A	A84)
	Table 9.4 (Page A	485)

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:

'Cylindrical Roller Bearings of width series 0 or 10.0012 radian (4') Cylindrical Roller Bearings of width series 2...............0.0006 radian (2')

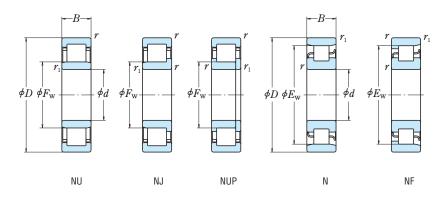
For double-row cylindrical roller bearings, nearly no misalignment is allowed.

LIMITING SPEEDS

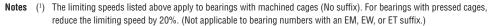
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

B 86 B 87

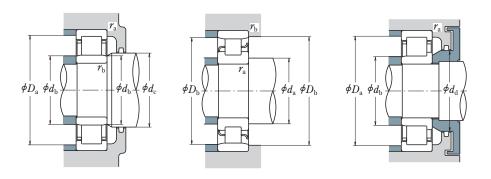
Bore Diameter 20 – 35 mm



		Bou	ndary Dii (mm	mensions			Basic Load		Limiting S (min	
d	D	В	γ min.	${m \gamma}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{ m r}$	$C_{0\mathrm{r}}$	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	18	1	0.6	26.5	—	30 500	28 300	13 000	16 000
	52	15	1.1	0.6	—	44.5	21 400	17 300	12 000	15 000
	52	15	1.1	0.6	27.5	—	31 500	26 900	12 000	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	24	1.1	1.1	34	—	57 000	56 000	9 000	11 000
	80	21	1.5	1.5	38.8	62.8	46 500	40 000	9 000	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.

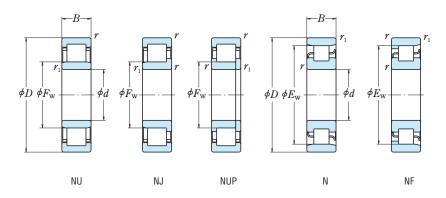


Веа	ring Numbers(2)				Þ	Abutmer	nt and Fi (m	illet Dime m)	nsions				Mass (kg)
	(3) NU NJ NUP	N NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	${\pmb{\gamma}}_a$ max.	$ m \emph{r}_{b}$ max.	approx.
N 204 NU 204 ET NU2204	ONU 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	NU NJ NUP NU NJ 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	NU NJ NUP NU NJ 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	NU NJ NUP NU NJ 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 NU NJ —	N NF	31.5 33	31.5 33	32 37	37 41	40 46	55.5 72	 72	— 64	1 1.5	1 1.5	0.338 0.57
NU1006 N 206 NU 206 EW	NU — — NU NJ NUP	N — N NF — —	35 35 35	34 — 34	36 — 36	38 — 40	_ 44	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	NU NJ NUP NU NJ 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 NU NJ —	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	NU NJ — NU NJ NUP	N — N NF — —	40 41.5 41.5	39 — 39	41 — 42	44 — 46	<u> </u>	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	NU NJ NUP NU NJ 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	NU NJ NUP NU NJ —	U U	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

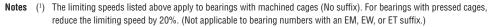
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{
 m b}$ (max.) are values for adjusting rings for NU, NJ Types.

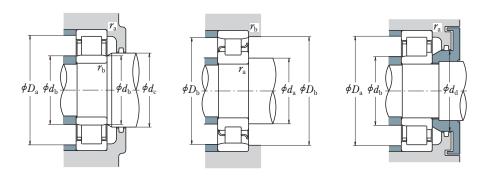
Bore Diameter 40 – 55 mm



		Bou	ndary Di (mm	mensions			Basic Load		Limiting S (min	
d	D	В	γ min.	$ m \emph{Y}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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	92	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.

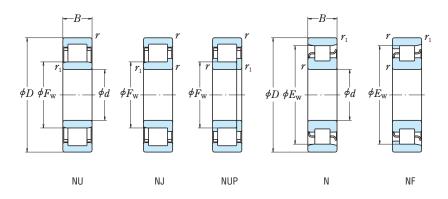


Bear	ring Numbers(²	?)				Д	butmer	nt and Fi	illet Dime	ensions				Mass (kg)
	(3) NU NJ NI	JP N	NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}$ (5) max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{\mathrm{a}}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	r a max.	$\emph{r}_{ m b}$ max.	approx.
NU1008 N 208 NU 208 EW	NU NJ NI	- N	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	NU NJ NI	- N	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	NU NJ NU		NF	48 49	48 49	50 56	55 60	60 67	82 101	 101	— 94	1.5 2	1.5 2	0.933 1.28
NU1009 N 209 NU 209 EW	NU — - NU NJ NI	– N – N JP –	NF NF	50 51.5 51.5	49 — 51.5	51 — 52	54 — 57	<u> </u>	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	NU NJ NI	- N	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	NU NJ NU NU NJ NU		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	NU NJ NI NU NJ NI	- N	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	NU NJ NI	- N	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	NU NJ NI	- 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	NU NJ -	– N – N JP –	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	NU NJ NI	- N	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	NU NJ NI NU NJ NI		_ NF	64 66	64 66	68 75	72 79	80 87	111 129	 129	— 119	2 2	2 2	2.18 2.5

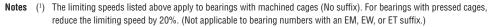
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

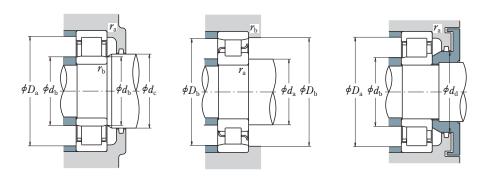
Bore Diameter 60 – 75 mm



		Bou	ndary Di	mensions			Basic Load		Limiting Sp (min	
d	D	В	γ min.	${m \gamma}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	C_{0r}	Grease	Oil
60	95 110 110 110 130 130	18 22 22 28 31 31	1.1 1.5 1.5 1.5 2.1 2.1	1 1.5 1.5 1.5 2.1 2.1 2.1	69.5 72 72 77 77	85.5 97.5 — — 113 —	40 000 68 500 97 500 131 000 124 000 124 000	48 500 75 000 107 000 157 000 126 000 126 000 157 000	6 700 6 000 5 300 5 300 4 800 4 800 4 800	8 500 7 100 6 300 6 300 5 600 5 600 5 600
65	130 150 100 120 120	46 35 18 23 23	2.1 2.1 1.1 1.5 1.5	2.1 2.1 1 1.5 1.5	77 83 74.5 — 78.5	127 90.5 105.6	222 000 167 000 41 000 84 000 108 000	262 000 168 000 51 000 94 500 119 000	4 300 4 300 6 300 5 300 4 800	5 300 5 300 8 000 6 300 5 600
	120 140 140 140 140 160	31 33 33 33 48 37	1.5 2.1 2.1 2.1 2.1 2.1	1.5 2.1 2.1 2.1 2.1 2.1	78.5 — 83.5 82.5 82.5 89.3		149 000 135 000 135 000 181 000 233 000 182 000	181 000 139 000 139 000 191 000 265 000 186 000	4 800 4 300 4 300 4 300 3 800 4 000	6 000 5 300 5 300 5 300 4 800 4 800
70	110 125 125 125 150 150 150	20 24 24 31 35 35 35	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	80 — 83.5 83.5 — 90 89	100 110.5 — — 130 —	58 500 83 500 119 000 156 000 149 000 158 000 205 000 274 000	70 500 95 000 137 000 194 000 156 000 168 000 222 000 325 000	6 000 5 000 5 000 4 500 4 000 4 000 4 000 3 600	7 100 6 300 6 300 5 600 5 000 5 000 5 000 4 500
75	180 115 130 130 130 160 160 160 160 190	42 20 25 25 31 37 37 37 55 45	3 1.1 1.5 1.5 1.5 2.1 2.1 2.1 2.1 3	3 1 1.5 1.5 1.5 2.1 2.1 2.1 2.1 3	100 85 — 88.5 88.5 — 95.5 95 95 104.5	152 105 116.5 — 139.5 — — 160.5	228 000 60 000 96 500 130 000 162 000 179 000 179 000 240 000 330 000 262 000	236 000 74 500 111 000 156 000 207 000 189 000 189 000 263 000 395 000 274 000	3 600 5 600 4 800 4 800 3 800 3 800 3 800 3 400 3 400	4 300 6 700 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.

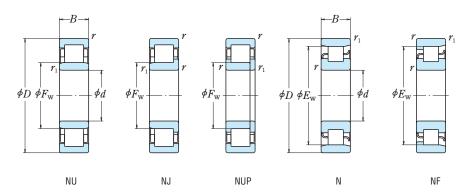


Bear	ring Numbers((2)				P	butmen	it and Fi (mi	llet Dime	ensions				Mass (kg)
	(3) NU NJ N	UP N	NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	r a max.	$ m \emph{r}_b$ max.	approx.
NU1012 N 212 NU 212 EW	NO NJ N	- N - N UP -	NF NF	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		UP — — N UP —	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	NU NJ N	UP — UP — UP N	_ NF	71 71 71	71 71 71	75 75 80	79 79 85	86 86 94	119 119 139	_ 139	_ 130	2 2 2	2 2 2	2.06 2.7 3.04
NU1013 N 213 NU 213 EW	NU NJ N	— N — N UP —	NF NF	71.5 73 73	70 — 73	73 — 76	76 — 81	— 87	93.5 — 112	95 112 —	92 108 —	1 1.5 1.5	1 1.5 1.5	0.504 1.05 1.05
NU2213 ET N 313 NU 313	NU NJ N	UP — — N UP —	NF	73 76 76	73 — 76	76 — 81	81 — 85	87 — 93	112 — 129	129 —	125 —	1.5 2 2	1.5 2 2	1.41 2.17 2.23
NU 313 EM NU2313 ET NU 413	NU NJ N	UP — UP — — N	_ _ NF	76 76 76	76 76 76	80 80 86	85 85 91	93 93 100	129 129 149	_ _ 149	_ _ 138.8	2 2 2	2 2 2	2.56 3.16 3.63
NU1014 N 214 NU 214 EM	NU NJ N	UP N — N UP —	NF NF	76.5 78 78	75 — 78	79 — 81	82 — 86	92	103.5 — 117	105 117	101 113	1 1.5 1.5	1 1.5 1.5	0.693 1.14 1.29
NU2214 ET N 314 NU 314	NU NJ N	UP — — N UP —	_ NF	78 81 81	78 — 81	81 — 87	86 — 92	92 — 100	117 117 — 139	 139	 133.5	1.5 2 2	1.5 2 2	1.49 2.67 2.75
NU 314 EM NU2314 ET NU 414	NU NJ N	UP — UP — UP N	_ _ NF	81 81 83	81 81 83	86 86 97	92 92 102	100 100 100 112	139 139 167	— — 167	— — — 155	2 2 2.5	2 2 2 2.5	3.09 3.92 5.28
NU1015 N 215	NU —	– N – N	NF NF	81.5 83	80	83	87	_	108.5	110 122	106 119	1 1.5	1 1.5	0.731 1.23
NU 215 EM NU2215 ET N 315	NU NJ N	UP — UP — — N	_ NF	83 83 86	83 83 —	86 86 —	90 90 —	96 96 —	122 122 —	— 149	 143	1.5 1.5 2	1.5 1.5 2	1.44 1.57 3.2
NU 315 NU 315 EM NU2315 ET NU 415	NU NJ N	UP — UP — UP — N	_ _ NF	86 86 86 88	86 86 86 88	93 92 92 102	97 97 97 107	106 106 106 118	149 149 149 177	_ _ 177	 164	2 2 2 2.5	2 2 2 2.5	3.26 3.73 4.86 6.27

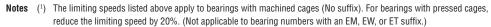
Notes (3) When L-shaped thrust collars (See section for L-Shaped Thrust Collars starting on page **B104**) are used, the bearings become the NH type.

- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

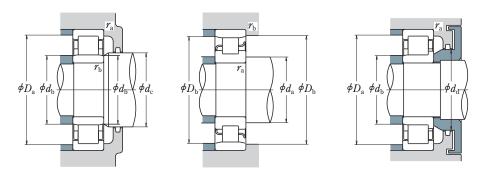
Bore Diameter 80 – 95 mm



									ı	
		Bou	ndary Di (mm	mensions 1)			Basic Load		Limiting Sp (min	
d	D	В	γ min.	${m r}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	Oil
80	125	22	1.1	1	91.5	113.5	72 500	90 500	5 300	6 300
	140	26	2	2	—	125.3	106 000	122 000	4 500	5 300
	140	26	2	2	95.3	—	139 000	167 000	4 500	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	58	2.1	2.1	101		355 000	430 000	3 200	4 000
	200	48	3	3	110	170	299 000	315 000	3 200	3 800
85	130	22	1.1	1	96.5	118.5	74 500	95 500	5 000	6 000
	150	28	2	2	—	133.8	120 000	140 000	4 300	5 000
	150	28	2	2	100.5	—	167 000	199 000	4 300	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	41	3	3	108	_	291 000	330 000	3 400	4 000
	180	60	3	3	108	_	395 000	485 000	3 000	3 800
	210	52	4	4	113	177	335 000	350 000	3 000	3 800
90	140	24	1.5	1.1	103	127	88 000	114 000	4 500	5 600
	160	30	2	2	—	143	152 000	178 000	4 000	4 800
	160	30	2	2	107	—	182 000	217 000	4 000	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	43	3	3	113.5	—	315 000	355 000	3 200	3 800
	190	64	3	3	113.5	—	435 000	535 000	2 800	3 400
	225	54	4	4	123.5	191.5	375 000	400 000	2 800	3 400
95	145	24	1.5	1.1	108	132	90 500	120 000	4 300	5 300
	170	32	2.1	2.1	—	151.5	166 000	196 000	3 800	4 500
	170	32	2.1	2.1	112.5	—	220 000	265 000	3 800	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	45	3	3	121.5		335 000	385 000	3 000	3 600
	200	67	3	3	121.5		460 000	585 000	2 600	3 400
	240	55	4	4	133.5	201.5	400 000	445 000	2 600	3 200



⁽²⁾ The bearings with suffix ET have polyamide cage. The maximum operating temperature should be less than 120 °C.



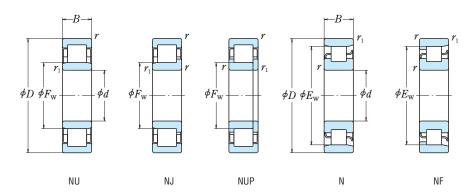
Bea	ring Numbers(2)				A	Abutmer	nt and F	illet Dime m)	ensions				Mass (kg)
	(3) NU NJ NUP	N NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}$ (5) max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	${m \gamma}_{\rm a}$ max.	$ m \emph{r}_b$ max.	approx.
NU1016 N 216 NU 216 EM	NU — NUP — — — NU NJ 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	NU NJ 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	NU NJ NUP NU NJ —	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	NU — — NU NJ 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 	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 NUP NU NJ NUP NU NJ —	 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 — NUP — — — NU NJ 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 NU NJ 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 NU NJ NUP NU NJ —	 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 — 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 NU NJ 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	NU NJ NUP NU NJ NUP NU NJ NUP	 NF	108 108 111	108 108 111	118 118 130	124 124 136	134 134 149	187 187 224	_ 224	 206	2.5 2.5 3	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.

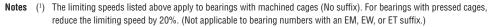
- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{
 m b}$ (max.) are values for adjusting rings for NU, NJ Types.



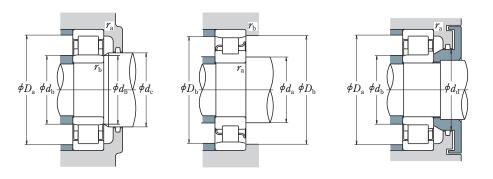
Bore Diameter 100 - 120 mm



		Bou	ndary Dii (mm	mensions				ad Ratings	Limiting Տ լ (min	
d	D	В	γ min.	${m r}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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	46	2.1	2.1	119	—	335 000	445 000	3 200	3 800
	215	47	3	3	—	185.5	299 000	335 000	2 800	3 400
	215	47	3	3	129.5	—	299 000	335 000	2 800	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	58	2.1	2.1	143.5		450 000	620 000	2 600	3 200
	260	55	3	3	—	226	450 000	510 000	2 200	2 800
	260	55	3	3	154		530 000	610 000	2 200	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.



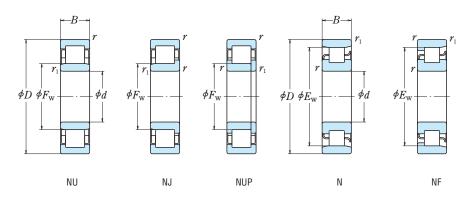
Beari	ing Numbe	ers(2)					P	butmer	nt and Fi	illet Dime m)	ensions				Mass (kg)
	NU NJ	NUP	Ν	NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{ m a}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	${\it r}_{\rm a}$ max.	$ m \emph{r}_b$ max.	approx.
NU1020 N 220 NU 220 EM	NU NJ NU NJ	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	NU NJ NU NJ	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	NU NJ NU NJ	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	NU — — — NU NJ	_ 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	U NJ	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	NU NJ NU NJ	_ 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	NU NJ NU NJ	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	NU NJ NU NJ	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	NU NJ NU NJ	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	NU 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.

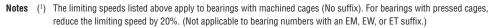
- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.



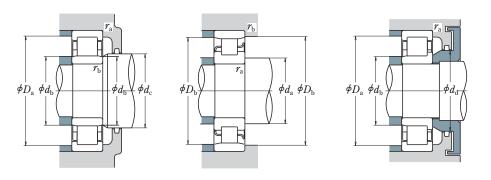
Bore Diameter 130 - 160 mm



		Bou	ndary Di (mm	mensions				ad Ratings	Limiting Տ լ (min	
d	D	B	γ min.	${m \gamma}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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.

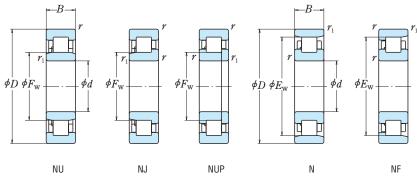


Bearing Numbers ⁽²⁾				A	Abutmer	nt and F (m	illet Dim m)	ensions				Mass (kg)
NU NJ NUP	N NF	$d_{ m a}^{(4)}$ min.	$d_{ m b}$ min.	$d_{ m b}^{(5)}$ max.	$d_{ m c}$ min.	$d_{ m d}$ min.	$D_{\mathrm{a}}^{(4)}$ max.	$D_{ m b}$ max.	$D_{ m b}$ min.	$\gamma_{\rm a}$ max.	$ m \emph{r}_b$ max.	approx.
NU1026 NU NJ — N 226 — — — NU 226 EM NU NJ NUP	N NF N NF	139 143 143	136.5 — 143	146 — 150	151 — 158	— — 168	191 — 217	193.5 217 —	184 208 —	2 2.5 2.5	1 2.5 2.5	3.66 6.48 8.03
NU2226 EM NU NJ NUP N 326 — — — NU326EM NU NJ NUP	 N NF	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 NU 426 NU NJ —	NF	146 150	146 150	163 180	169 187	184 208	264 320	 320	 291	3 4	3 4	30 39.6
NU1028 NU NJ NUP N 228 — — — NU228EM NU NJ NUP	N — N NF — —	149 153 153	146.5 — 153	156 — 165	161 — 171	_ _ 182	201 — 237	203.5 237 —	194 225 —	2 2.5 2.5	1 2.5 2.5	3.87 8.08 9.38
NU2228EM NU NJ NUP N 328 — — — NU328EM NU NJ NUP	N NF	153 156 156	153 — 156	165 — 176	171 — 182	182 — 198	237 — 284	 284 	 266 	2.5 3 3	2.5 3 3	15.2 21.7 22.8
NU2328EM NU NJ NUP NU 428 NU NJ —		156 160	156 160	176 193	182 200	198 222	284 340	 340	308	3 4	3 4	37.7 46.4
NU1030 NU NJ — N 230 — — — NU230EM NU NJ NUP	N NF N NF	161 163 163	158 — 163	167 — 177	173 — 184	— — 196	214 — 257	217 257 —	208 242 —	2 2.5 2.5	1.5 2.5 2.5	4.77 10.4 11.9
NU2230EM NU NJ NUP N 330 — — — NU330EM NU NJ NUP	 N NF 	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 232 — — — NU232EM NU NJ NUP	N NF N NF	171 173 173	168 — 173	178 — 190	184 — 197	 210	229 — 277	232 277 —	222 261 —	2 2.5 2.5	1.5 2.5 2.5	5.81 14.1 14.7
NU2232EM NU NJ NUP N 332 — — — NU332EM NU NJ NUP NU2332EM NU NJ NUP	 N _ 	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.

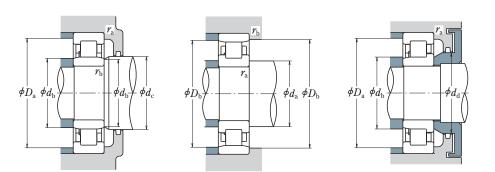
- (4) If axial loads are applied, increase d_a and reduce D_a from the values listed above.
- (5) $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

Bore Diameter 170 - 220 mm



		Bou	ndary Dii (mm	mensions				nd Ratings	Limiting S	•
d	D	В	γ min.	${m \gamma}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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	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

	NU			NJ		NUP	IV		INF	
		Bou	ndary Di (mm	mensions 1)				ad Ratings N)	Limiting S	•
d	D	B	γ min.	${m r}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{ m r}$	$C_{0\mathrm{r}}$	Grease	Oil
170	260 310 310	42 52 52	2.1 4 4	2.1 4 4	193 — 207	237 272 —	287 000 475 000 605 000	415 000 635 000 800 000	2 400 2 000 2 000	2 800 2 400 2 400
	310 360 360 360	86 72 72 120	4 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	280 320 320	46 52 52	2.1 4 4	2.1 4 4	205 — 217	255 282 —	355 000 495 000 625 000	510 000 675 000 850 000	2 200 1 900 1 900	2 600 2 200 2 200
	320 380 380 380	86 75 75 126	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	290 340 340	46 55 55	2.1 4 4	2.1 4 4	215 — 230	265 299 —	365 000 555 000 695 000	535 000 770 000 955 000	2 000 1 800 1 800	2 600 2 200 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	310 360 360	51 58 58	2.1 4 4	2.1 4 4	229 — 243	281 316 —	390 000 620 000 765 000	580 000 865 000 1 060 000	2 000 1 700 1 700	2 400 2 000 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	340 400 400	56 65 65	3 4 4	3 4 4	250 — 270	310 350 —	500 000 760 000 760 000	750 000 1 080 000 1 080 000	1 800 1 500 1 500	2 200 1 800 1 800
	400 460	108 88	4 5	4 5	270 —	 396	1 140 000 1 190 000	1 810 000 1 570 000	1 300 1 200	1 600 1 500



Bearing Numbers	Abutment and Fillet Dimensions (mm)	Mass (kg)
(1) NU NJ NUP N NF	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	approx.
NU1034 NU NJ — N — N 234 — — N NF NU234EM NU NJ NUP — —		7.91 17.4 18.3
NU2234EM NU NJ NUP N 334 NU NJ NUP NU334EM NU NJ NUP NU2334EM NU NJ NUP	186 — — — — 344 316 3 3 186 186 213 223 241 344 — — 3 3	29.9 36.6 37.9 63.4
NU1036 NU NJ — N NF N 236 — — N NF NU236EM NU NJ NUP — —	196 — — — — 304 288 3 3	10.2 18.1 19
NU2236EM NU NJ NUP — — N 336 — — N NF NU336EM NU NJ NUP — — NU2336EM NU NJ NUP — —	196 — — — — 364 335 3 3 196 196 226 235 255 364 — — 3 3	31.4 42.6 44 74.6
NU1038 NU NJ — N — N 238 — — N NF NU238EM NU NJ NUP — —	206 324 305 3 3	10.7 22 23
NU2238EM NU NJ NUP — — N 338 — — N — N — NU338EM NU NJ NUP — — NU2338EM NU NJ NUP — —	210 — — — — — 380 352 4 4 210 210 240 248 268 380 — — 4 4	38.3 48.7 50.6 86.2
NU1040 NU NJ — N NF N 240 — — N NF NU240EM NU NJ NUP — —	216 — — — — 344 323 3 3	14 26.2 27.4
NU2240EM NU NJ NUP — — N 340 — — N NF NU340EM NU NJ NUP — — NU2340EM NU NJ NUP — —	220 — — — — — 400 367 4 4 220 220 252 263 283 400 — — 4 4	46.1 55.3 57.1 99.3
NU1044 NU NJ — N — N 244 — — N NF NU 244 NU NJ NUP — —	236 384 357 3 3	18.2 37 37.3
NU2244 NU — — — — N 344 — — N — NU 344 NU NJ — — —	240 — — — — 440 403 4 4	61.8 72.8 74.6

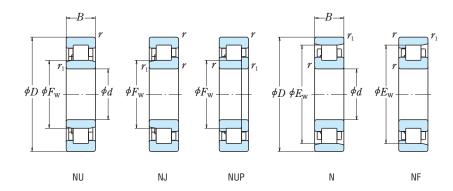
Notes (1) When L-shaped thrust collars (Refer to page **B105**) are used, the bearings become the NH Type.

B 100 B 101

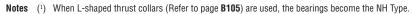
⁽²⁾ If axial loads are applied, increase d_a and reduce D_a from the values listed above.

⁽³⁾ $d_{
m b}$ (max.) are values for adjusting rings for NU, NJ Types.

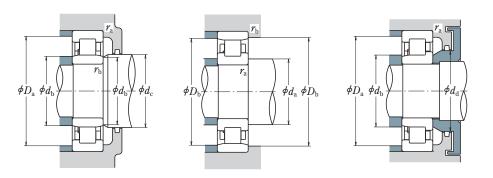
Bore Diameter 240 - 500 mm



		Bou	ndary Di (mm	mensions n)				ad Ratings N)	Limiting Speeds (min ⁻¹)	
d	D	В	γ min.	${m \gamma}_1$ min.	$F_{ m W}$	$E_{ m W}$	$C_{ m r}$	$C_{0\mathrm{r}}$	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_a and reduce D_a from the values listed above.

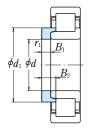


Bearing Numbers	Abutment and Fillet Dimensions (mm)	Mass (kg)
NU NJ NUP N NF	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	approx.
NU1048 NU NJ — N — N 248 — — N NF NU 248 NU NJ NUP — —	256 — — — — 424 392 3 3	19.5 49.6 50.4
NU2248 NU — — — — N 348 — — N — NU 348 NU NJ — —	260 — — — — 480 438 4 4 9	84.9 92.3 94.6
NU1052 NU NJ — N NF N 252 — — N — NU 252 NU NJ — —	280 — — — — 460 428 4 4 6	29.1 66.2 67.1
NU2252 NU — NUP — — NU 352 NU NJ — — —		11 18
NU1056 NU NJ NUP N NF N 256 — — N NF NU 256 NU NJ — —	300 — — — — 480 448 4 4 6	30.8 69.6 70.7
NU1060 NU NJ — N NF NU 260 NU NJ — — —		43.7 89.2
NU1064 NU — — N NF N 264 — — N — NU 264 NU NJ — —	340 — — — — 560 519 4 4 1	46.1 10 12
NU1068 NU NJ — N NF	360 360 381 390 — 500 500 479 4 4	61.8
NU1072 NU — N NF		64.6
NU1076 NU — — —		67.5
NU1080 NU — NUP N —		88.2
NU1084 NU — — N — NU1088 NU — — —		91.7 05
NU1088 NO — — — — NU1092 NU — NUP N —		23
NU1096 NU NJ — N —		27
NU10/500 NU — N —		31

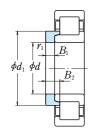
⁽³⁾ $d_{\rm b}$ (max.) are values for adjusting rings for NU, NJ Types.

L-Shaped Thrust Collars Bore Diameter 20 – 85 mm

Bore Diameter 90 - 320 mm







L-Shaped Thrust Collar

	Bounda	ry Dim	ensions			Mass (kg)
d	d_1	B_1	B_2	r_1	Bearing Numbers	(Ng)
и	\boldsymbol{u}_1	D_1	D_2	min.		approx.
20	30 29.8	3	6.75 5.5	0.6	HJ 204 HJ 204 E	0.012 0.011
	30	3	7.5	0.6	HJ 2204	0.012
	29.8 31.7	3 4	6.5 7.5	0.6	HJ 2204 E HJ 304	0.012 0.017
	31.4	4	6.5	0.6	HJ 304 E	0.017
	31.8 31.4	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 38.2	3 4	6.5 7	0.6 1.1	HJ 2205 E HJ 305 E	0.014 0.025
	38.2 43.6	4 6	8 10.5	1.1 1.5	HJ 2305 E HJ 405	0.026 0.057
30	43.0	4	7	0.6	ну 405 НЈ 206 Е	0.037
	41.4 45.1	4 5	7.5 8.5	0.6 1.1	HJ 2206 E HJ 306 E	0.025 0.042
	45.1 50.5	5 7	9.5 11.5	1.1 1.5	HJ 2306 E HJ 406	0.043 0.080
35	48.2	4	7	0.6	HJ 207 E	0.033
	48.2 51.1	4 6	8.5 9.5	0.6 1.1	HJ 2207 E HJ 307 E	0.035 0.060
	51.1 59	6 8	11 13	1.1 1.5	HJ 2307 E HJ 407	0.062 0.12
40	54.1 54.1	5 5	8.5 9	1.1 1.1	HJ 208 E HJ 2208 E	0.049 0.050
	57.6	7	11	1.5	HJ 308 E	0.088
	57.7 64.8	7 8	12.5 13	1.5 2	HJ 2308 E HJ 408	0.091 0.14
45	59.1	5	8.5	1.1	HJ 209 E	0.055
	59.1 64.5	5 7	9 11.5	1.1 1.5	HJ 2209 E HJ 309 E	0.055 0.11
	64.5 71.7	7 8	13 13.5	1.5 2	HJ 2309 E HJ 409	0.113 0.175
50	64.1	5	9	1.1	HJ 210 E	0.061
	64.1 71.4	5 8	9 13	1.1 2	HJ 2210 E HJ 310 E	0.061 0.151
	71.4 78.8	8 9	14.5 14.5	2 2.1	HJ 2310 E HJ 410	0.155 0.23

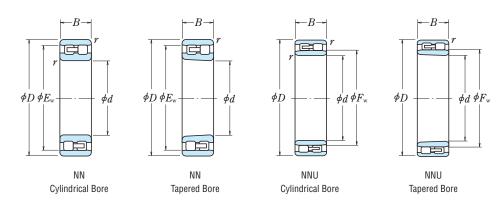
	Bounda	ı ry Dim (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$ eals_1$ min.	Numbers	approx.
55	70.9	6	9.5	1.1	HJ 211 E	0.087
	70.9	6	10	1.1	HJ 2211 E	0.088
	77.6	9	14	2	HJ 311 E	0.195
	77.6	9	15.5	2	HJ 2311 E	0.20
	85.2	10	16.5	2.1	HJ 411	0.29
60	77.7	6	10	1.5	HJ 212 E	0.108
	77.7	6	10	1.5	HJ 2212 E	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	ı ry Dim (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	${\pmb{\gamma}}_1 \\ \text{min.}$	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

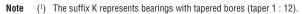
	Bounda	ry Dimo (mm)	ensions		Bearing	Mass (kg)
d	d_1	B_1	B_2	$ m \emph{Y}_1$ min.	Numbers	approx.
150	193.7	12	19.5	3	HJ 230 E	1.26
	193.7	12	24.5	3	HJ 2230 E	1.35
	210	15	25	4	HJ 330 E	2.35
	210	15	31.5	4	HJ 2330 E	2.48
	234	20	36.5	5	HJ 430	4.7
160	207.3	12	20	3	HJ 232 E	1.48
	206.1	12	24.5	3	HJ 2232 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



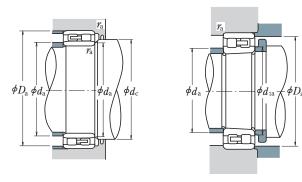
Bore Diameter 25 – 140 mm



			ry Dimensio (mm)	ons		Basic Load		Limiting (mi	
d	D	B	γ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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).

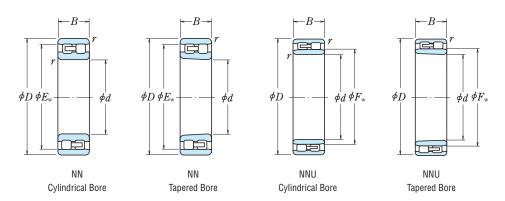


Bearing	Numbers		Ab	utment a	nd Fillet (mm)	Dimension	S		Mass (kg)
Cylindrical Bore	Tapered Bore(1)	$d_{arepsilon}$ min.	(2) max.	$d_{ m 1a}$ min.	$d_{ m c}$ min.	\max . D	a min.	${m r}_{ m a}$ max.	approx.
NN 3005	NN 3005 K	29	_	29	_	43	42	0.6	0.127
NN 3006	NN 3006 K	35	_	36	_	50	50	1	0.198
NN 3007	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
NNU 4928 NN 3028	NNU 4928 K NN 3028 K	148 149	153 —	150 151	158 —	182 201	— 195	1.5 2	4.08 6.34

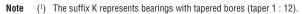
Note (2) d_a (max.) are values for adjusting rings for the NNU Type.



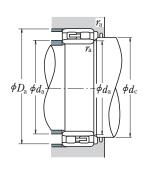
Bore Diameter 150 - 360 mm

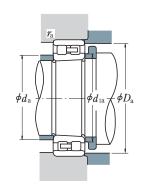


			ry Dimension	ons			ad Ratings	Limiting Speeds (min ⁻¹)		
d	D	B	γ min.	$F_{ m W}$	$E_{ m W}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	Oil	
150	210 225	60 56	2 2.1	167 —	 206	350 000 335 000	715 000 585 000	2 600 2 600	3 200 3 000	
160	220 240	60 60	2 2.1	177 —	 219	365 000 375 000	760 000 660 000	2 400 2 400	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		Ab	utment a	and Fillet (mm)	Dimensi	ons		Mass (kg)
Cylindrical Bore Tapered Bore(1)	min.	$d_{ m a}^{(2)}$ max.	$d_{ ext{1a}}$ min.	$d_{ m c}$ min.	max.	$D_{ m a}$ min.	${\it r}_{\rm a}$ max.	approx.
NNU 4930 NNU 4930 K NN 3030 NN 3030 K		166 —	162 162	171 —	201 214	 209	2 2	6.39 7.77
NNU 4932 NNU 4932 K NN 3032 NN 3032 K		176 —	172 172	182 —	211 229	 222	2 2	6.76 9.41
NNU 4934 NNU 4934 K NN 3034 NN 3034 K		186 —	182 183	192 —	221 249	 239	2 2	7.12 12.8
NNU 4936 NNU 4936 K NN 3036 NN 3036 K		199 —	193 193	205 —	241 269	 258	2 2	10.4 16.8
NNU 4938 NNU 4938 K NN 3038 NN 3038 K		211 —	203 203	217 —	251 279	 268	2 2	10.9 17.8
NNU 4940 NNU 4940 K NN 3040 NN 3040 K		222 —	214 214	228 —	269 299	 285	2 2	15.3 22.7
NNU 4944 NNU 4944 K NN 3044 NN 3044 K		242 —	234 236	248 —	289 327	313	2 2.5	16.6 29.6
NNU 4948 NNU 4948 K NN 3048 NN 3048 K	251 253	262 —	254 256	269 —	309 347	334	2 2.5	18 32.7
NNU 4952 NNU 4952 K NN 3052 NN 3052 K		288 —	275 278	295 —	349 384	 368	2 3	31.1 47.7
NNU 4956 NNU 4956 K NN 3056 NN 3056 K		308	295 298	315 —	369 404	388	2 3	33 51.1
NNU 4960 NNU 4960 K NN 3060 NN 3060 K		335 —	318 319	343 —	407 444	 422	2.5 3	51.9 70.7
NNU 4964 NNU 4964 K NN 3064 NN 3064 K		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 BEARINGS

INCITIO DEGIGIO IAI ENED	HOLLEH DEAHING	, O	
Bore Di	iameter 15 – 100r	mm	B120
Bore Di	iameter 105 – 240r	mm	B128
Bore Di	iameter 260 – 440r	mm	B134
INCH DESIGN TAPERED RO	OLLER BEARINGS		
Bore Di	iameter 12.000 -	47.625mm	B136
Bore Di	iameter 48.412 –	69.850mm	B150
Bore Di	iameter 70.000 –	206.375mm	B158
The index for inch design	tapered roller beari	rings is in Appendix 14 (Page C26).	
DOUBLE-ROW TAPERED R	ROLLER BEARINGS		
Bore Di	iameter 40 - 260r	mm	B172

Four-Row Tapered Roller Bearings are described on pages B334 to B339.



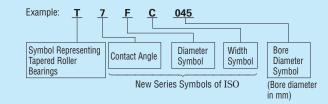
DESIGN, TYPES, AND FEATURES

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:

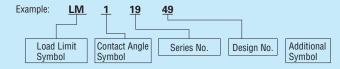


B 110 B 111





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.

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
	Face-to-face	HR30210JDF+KR	mating marks. Components with the same serial number can be assembled referring to the matching symbols.
	KBE Type	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 following precision classes apply. For more deta	, there are those to which the ails, please consult with NSK.

(1) J line bearings(in the bearing tables, bearings preceded by (1)

Table 2 Tolerances for Cones(CLASS K)

Units: µm

		F-					
(ore Diameter d (m)	4	dmp	$V_{d\mathrm{p}}$	$V_{d \mathrm{mp}}$	$K_{i\mathrm{a}}$	
over	incl.	high	low	max.	max.	max.	
10 18 30	18 30 50	0 0 0	- 12 - 12 - 12	12 12 12	9 9 9	15 18 20	
50 80 120	80 120 180	0 0 0	- 15 - 20 - 25	15 20 25	11 15 19	25 30 35	
180 250 315	180 250 250 315		-30 -35 -40	30 35 40	23 26 30	50 60 70	

Table 3 Tolerances for Cups(CALSS K)

Units: um

						στιιτο : μπ	
Dia	al Outside meter (mm)	4	<i>D</i> mp	$V_{D\mathrm{p}}$	$V_{D\mathrm{mp}}$	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	

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Table 4 Tolerances for Effective Widths of Cone Assemblies and Cups, and Overall Width (CLASS K)

Units: µm

	ore Diameter d	of Cone	idth Deviation Assembly $T_{1\mathrm{S}}$	Deviatio	re Width on of Cup T_{28}	Width D	erall Deviation Ts	
over	incl.	high	low	high	low high			
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

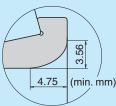
Units: µm

Nominal Bo	1		Bore Di Devia ⊿	ation	Overall Devia ⊿	ition
over (mm) 1/25.4	ir (mm)	ncl. 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

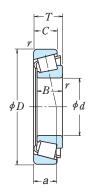
The limiting speeds listed in the bearing tables should be adjusted depending on the bearing load conditions. Also, higher speeds are attainable by making changes in the lubrication method, cage design, etc. Refer to Page A37 for detailed information.

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.

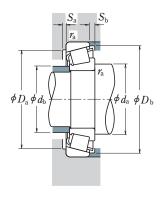
B 114 B 115

Bore Diameter 15 - 28 mm



		Bounda	ary Dimen	isions				Basic Load	Ratings		Limiting	Speeds
			(mm)		Cone	Cup	1)	۷)	{k	gf}	(mii	n ⁻¹)
d	D	T	В	С		r nin.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil
15	35 42	11.75 14.25	11 13	10 11	0.6 1	0.6 1	14 800 23 600	13 200 21 100	1 510 2 400	1 350 2 160	11 000 9 500	15 000 13 000
17	40 40 47 47	13.25 17.25 15.25 15.25	12 16 14 14	11 14 12 10.5	1 1 1	1 1 1	20 100 27 100 29 200 22 000	19 900 28 000 26 700 20 300	2 050 2 770 2 980 2 240	2 030 2 860 2 720 2 070	9 500 9 500 8 500 8 000	13 000 13 000 12 000 11 000
20	47 42 47 47	20.25 15 15.25 15.25	19 15 14 14	16 16 12 12 12	1 0.6 1 0.3	1 0.6 1	37 500 24 600 27 900 23 900	36 500 27 400 28 500 24 000	3 800 2 510 2 850 2 430	3 750 2 800 2 900 2 450	8 500 9 000 8 000 8 000	11 000 11 000 12 000 11 000 11 000
	47 47 52 52 52	19.25 19.25 16.25 16.25 22.25	18 18 15 15 21	15 15 13 12 18	1 1.5 1.5 1.5	1 1.5 1.5 1.5	35 500 31 500 35 000 25 300 45 500	37 500 33 500 33 500 24 500 47 500	3 650 3 200 3 550 2 580 4 650	3 850 3 400 3 400 2 490 4 850	8 500 8 000 7 500 7 100 8 000	11 000 11 000 10 000 10 000 11 000
22	44 50 50	15 15.25 15.25	15 14 14 18	11.5 12 12 15	0.6 1 1	0.6 1 1	25 600 29 200 27 200	29 400 30 500 29 500	2 610 2 980 2 780 3 750	3 000 3 150 3 000	8 500 7 500 7 500	11 000 10 000 10 000
	50 50 56 56	19.25 19.25 17.25 17.25	18 16 16	15 14 13	1 1 1.5 1.5	1 1 1.5 1.5	36 500 33 500 37 000 34 500	40 500 39 500 36 500 34 000	3 400 3 750 3 500	4 100 4 000 3 750 3 500	7 500 7 500 7 100 6 700	11 000 10 000 9 500 9 500
25	47 47 52 52	15 17 16.25 16.25	15 17 15 15	11.5 14 13 12	0.6 0.6 1	0.6 0.6 1	27 400 31 000 32 000 28 100	33 000 38 000 35 000 31 500	2 800 3 150 3 300 2 860	3 400 3 900 3 550 3 200	8 000 8 000 7 100 9 700	11 000 11 000 10 000 9 500
	52 52 52	19.25 19.25 22	18 18 22	16 15 18	1 1 1	1 1 1	40 000 35 000 47 500	45 000 42 000 56 500	4 050 3 550 4 850	4 600 4 250 5 750	7 100 7 100 7 500	10 000 9 500 10 000
	62 62 62	18.25 18.25 18.25	17 17 17	15 14 13	1.5 1.5 1.5	1.5 1.5 1.5	47 500 47 500 42 000 38 000	46 000 45 000 40 500	4 850 4 300 3 900	4 700 4 550 4 100	6 300 6 000 5 600	8 500 8 500 8 000
28	62 62 52	18.25 25.25 16	17 17 24 16	13 20 12	1.5 1.5 1.5	1.5 1.5 1.5	38 000 62 500 32 000	40 500 66 000 39 000	3 900 6 400 3 300	4 100 6 750 3 950	5 600 6 300 7 100	8 000 8 500 9 500
	58 58 58	17.25 17.25 20.25	16 16 19	14 12 16	1 1 1	1 1 1	39 500 34 000 47 500	41 500 38 500 54 000	4 050 3 450 4 850	4 200 3 900 5 500	6 300 6 300 6 300	9 000 8 500 9 000
	58 68 68	20.25 20.25 19.75 19.75	19 18 18	16 15 14	1 1.5 1.5	1 1.5 1.5	47 500 42 000 55 000 49 500	49 500 55 500 50 500	4 300 4 300 5 650 5 000	5 050 5 050 5 650 5 150	6 300 6 000 5 600	9 000 9 000 8 000 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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	Y_1

Static Equivalent Load

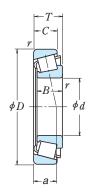
 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5 F_r + Y_0 F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Danier North	ISO355			Abutn		d Fillet C (mm))imens	ions			Eff. Load Centers	Constant	Axial Fact		Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.) _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	Cone C \mathcal{Y}_{a} max.	up	(mm) <i>a</i>	e	Y_1	Y_0	approx.
30202 HR 30302 J HR 30203 J HR 32203 J HR 30303 J	2FB 2DB 2DD 2FB	23 24 26 26 26	19 22 23 22 24	30 36 34 34 41	30 36 34 34 40	33 38.5 37.5 37 43	2 2 2 2 2	1.5 3 2 3 3	0.6 0.1 1 1 1 1 1 1 1 1 1 1	.6	8.2 9.5 9.7 11.2 10.4	0.32 0.29 0.35 0.31 0.29	1.9 2.1 1.7 1.9 2.1	1.0 1.2 0.96 1.1 1.2	0.053 0.098 0.079 0.103 0.134
30303 D HR 32303 J HR 32004 XJ HR 30204 J HR 30204 C-A-	2FD 3CC 2DB	29 28 28 29 29	23 23 24 27 26	41 41 37 41 41	34 39 35 40 37	44 43 40 44 44	2 2 3 2 2	4.5 4 3 3 3	1 1 1 1 0.6 0 1 1 0.3 1	.6	15.4 12.5 10.6 11.0 13.0	0.81 0.29 0.37 0.35 0.55	0.74 2.1 1.6 1.7 1.1	0.41 1.2 0.88 0.96 0.60	0.129 0.178 0.097 0.127 0.126
HR 32204 J HR 32204 CJ HR 30304 J 30304 D HR 32304 J	2DD 5DD 2FB — 2FD	29 29 31 34 33	25 25 27 26 26	41 41 44 43 43	38 36 44 37 42	44.5 44 47.5 49 48	3 2 2 2 3	4 4 3 4 4	1 1 1 1 1.5 1. 1.5 1. 1.5 1.	.5	12.6 14.5 11.6 16.7 13.9	0.33 0.52 0.30 0.81 0.30	1.8 1.2 2.0 0.74 2.0	1.0 0.64 1.1 0.41 1.1	0.161 0.166 0.172 0.168 0.241
HR 320/22 XJ HR 302/22 HR 302/22 C HR 322/22	_ _ 3CC	30 31 31 31	27 29 29 28	39 44 44 44	37 42 40 41	42 47 47 47	3 2 2 2	3.5 3 3	0.6 0. 1 1 1 1 1 1	.6	11.1 11.6 13.0 13.5	0.40 0.37 0.49 0.37	1.5 1.6 1.2 1.6	0.83 0.90 0.67 0.89	0.103 0.139 0.144 0.18
HR 322/22 C HR 303/22 HR 303/22 C HR 32005 XJ HR 33005 J	— — 4CC 2CE	31 33 33 33 33	29 30 30 30 29	44 47 47 42 42	39 46 44 40 41	48 50 52.5 45 44	2 2 3 3 3	4 3 4 3.5 3	1 1 1.5 1. 1.5 1. 0.6 0. 0.6 0.	.5	15.2 12.4 15.9 11.8 11.0	0.51 0.32 0.59 0.43 0.29	1.2 1.9 1.0 1.4 2.1	0.65 1.0 0.56 0.77 1.1	0.185 0.208 0.207 0.116 0.131
HR 30205 J HR 30205 C HR 32205 J HR 32205 C HR 33205 J	3CC — 2CD — 2DE	34 34 34 34 34	31 32 30 30 29	46 46 46 46	44 43 44 40 43	48.5 49.5 50 50 49.5	2 2 2 2 4	3 4 3 4	1 1 1 1 1 1 1 1		12.7 14.4 13.5 15.8 14.1	0.37 0.53 0.36 0.53 0.35	1.6 1.1 1.7 1.1	0.88 0.62 0.92 0.62 0.94	0.157 0.155 0.189 0.19 0.221
HR 30305 J HR 30305 C HR 30305 DJ HR 31305 J HR 32305 J HR 320/28 XJ HR 302/28	2FB — (7FB) 7FB 2FD 4CC	36 36 39 39 38 37 37	34 35 34 33 32 33 34	54 53 53 53 53 53 46 52	54 49 47 47 51 44 50	57 58.5 59 59 57 50 55	2 3 2 3 3 2	3 4 5 5 5 4 3	1.5 1. 1.5 1. 1.5 1. 1.5 1. 1.5 1. 1 1 1	.5 .5 .5	13.2 16.4 19.9 19.9 15.6 12.8 13.2	0.30 0.55 0.83 0.83 0.30 0.43 0.35	2.0 1.1 0.73 0.73 2.0 1.4 1.7	1.1 0.60 0.40 0.40 1.1 0.77 0.93	0.27 0.276 0.265 0.265 0.376 0.146 0.203
HR 302/28 C HR 322/28 HR 322/28 CJ HR 303/28 HR 303/28 C	— 5DD —	37 37 37 39 39	34 34 33 37 38	52 52 52 59 59	48 49 45 58 57	54 55 55 61 63	2 2 2 2 2 3	5 4 4 4.5 5.5	1 1 1 1 1 1 1.5 1.		16.9 14.6 16.8 14.5 17.4	0.64 0.37 0.56 0.31 0.52	0.94 1.6 1.1 1.9 1.2	0.52 0.89 0.59 1.1 0.64	0.198 0.243 0.251 0.341 0.335

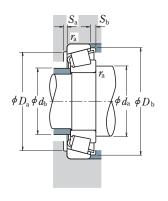
B 116 B 117

Bore Diameter 30 - 35 mm



	Boundary Dimensions (mm) Con							Basic Load	-		Limiting	
,			, ,		Cone	Cup		(N)		gf}	(mii	,
d	D	T	B	C	r	γ nin.	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	$C_{0\mathrm{r}}$	Grease	Oil
30	47	12	12	9	0.3	0.3	17 600	24 400	1 800	2 490	7 500	10 000
	55	17	17	13	1	1	36 000	44 500	3 700	4 550	6 700	9 000
	55	20	20	16	1	1	42 000	54 000	4 250	5 500	6 700	9 000
	62	17.25	16	14	1	1	43 000	47 500	4 400	4 850	6 000	8 000
	62	17.25	16	12	1	1	35 500	37 000	3 650	3 800	5 600	7 500
	62	21.25	20	17	1	1	52 000	60 000	5 300	6 150	6 000	8 500
	62	21.25	20	16	1	1	48 000	56 000	4 900	5 750	6 000	8 000
	62	25	25	19.5	1	1	66 500	79 500	6 800	8 100	6 000	8 000
	72	20.75	19	16	1.5	1.5	59 500	60 000	6 050	6 100	5 300	7 500
	72	20.75	19	14	1.5	1.5	56 500	55 500	5 800	5 650	5 300	7 100
	72	20.75	19	14	1.5	1.5	49 000	52 500	5 000	5 350	4 800	6 700
	72	20.75	19	14	1.5	1.5	49 000	52 500	5 000	5 350	4 800	6 800
	72	28.75	27	23	1.5	1.5	80 000	88 500	8 150	9 000	5 600	7 500
	72	28.75	27	23	1.5	1.5	76 000	86 500	7 750	8 800	5 600	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	3 800 4 150 4 950 4 650	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	22.25	21	18	1	1	56 000	65 000	5 700	6 650	6 000	8 000
	65	22.25	21	17	1	1	49 500	60 000	5 050	6 100	5 600	7 500
	65	26	26	20.5	1	1	70 000	86 500	7 150	8 850	5 600	8 000
	75	21.75	20	17	1.5	1.5	56 000	56 000	5 700	5 700	5 300	7 100
35	55	14	14	11.5	0.6	0.6	27 400	39 000	2 790	3 950	6 300	8 500
	62	18	18	14	1	1	43 500	55 500	4 400	5 650	5 600	8 000
	62	21	21	17	1	1	49 000	65 000	4 950	6 650	5 600	8 000
	72	18.25	17	15	1.5	1.5	54 000	59 500	5 500	6 050	5 300	7 100
	72	18.25	17	13	1.5	1.5	47 000	54 500	4 750	5 550	5 000	6 700
	72	24.25	23	19	1.5	1.5	70 500	83 500	7 150	8 550	5 300	7 100
	72	24.25	23	18	1.5	1.5	60 500	71 500	6 200	7 300	5 000	7 100
	72	28	28	22	1.5	1.5	86 500	108 000	8 850	11 100	5 300	7 100
	80	22.75	21	18	2	1.5	76 000	79 000	7 750	8 050	4 800	6 700
	80	22.75	21	16	2	1.5	68 000	70 500	6 900	7 200	4 800	6 300
	80	22.75	21	15	2	1.5	62 000	68 000	6 350	6 950	4 300	6 000
	80	22.75	21	15	2	1.5	62 000	68 000	6 350	6 950	4 300	6 000
	80	32.75	31	25	2	1.5	99 000	111 000	10 100	11 300	5 000	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

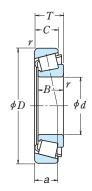
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

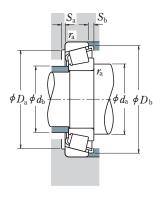
Decrine Musebore	ISO355			Abutn		d Fillet [(mm)	Dimens	ions	0	0	Eff. Load Centers	Constant	Axial Fac	Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	O _a min.	$D_{ m b}$ min.	S_{a} min.	$S_{ m b}$ min.	1	Cup ax.	(mm) <i>a</i>	e	Y_1	Y_0	approx.
HR 32906 J	2BD	34	34	44	42	44	3	3	0.3	0.3	9.2	0.32	1.9	1.0	0.074
HR 32006 XJ	4CC	39	35	49	47	53	3	4	1	1	13.5	0.43	1.4	0.77	0.172
HR 33006 J	2CE	39	35	49	48	52	3	4	1	1	13.1	0.29	2.1	1.1	0.208
HR 30206 J	3DB	39	37	56	52	58	2	3	1	1	13.9	0.37	1.6	0.88	0.238
HR 30206 C	—	39	36	56	49	59	2	5	1	1	17.8	0.68	0.88	0.49	0.221
HR 32206 J	3DC	39	36	56	51	58.5	2	4	1	1	15.4	0.37	1.6	0.88	0.297
HR 32206 C	—	39	35	56	48	59	2	5	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	16.1	0.34	1.8	0.97	0.355
HR 30306 J	2FB	41	40	63	62	66	3	4.5	1.5	1.5	15.1	0.32	1.9	1.1	0.403
HR 30306 C	—	41	38	63	59	67	3	6.5	1.5	1.5	18.5	0.55	1.1	0.60	0.383
HR 30306 DJ HR 31306 J HR 32306 J HR 32306 CJ	(7FB) 7FB 2FD 5FD	44 44 43 43	40 40 38 36	63 63 63	55 55 59 54	68 68 66 68	3 3 3	6.5 6.5 5.5 5.5	1.5 1.5 1.5 1.5	1.5 1.5 1.5 1.5	23.1 23.1 18.0 22.0	0.83 0.83 0.32 0.55	0.73 0.73 1.9 1.1	0.40 0.40 1.1 0.60	0.393 0.393 0.57 0.583
HR 320/32 XJ 330/32 HR 302/32 HR 302/32 C	4CC — — —	41 41 41 41	37 37 39 39	52 52 59 59	49 50 56 54	55 55 61 62	3 2 3 3	4 4 3 4	1 1 1	1 1 1	14.2 13.8 14.7 16.9	0.45 0.31 0.37 0.55	1.3 1.9 1.6 1.1	0.73 1.1 0.88 0.60	0.191 0.225 0.277 0.273
HR 322/32 HR 322/32 C HR 332/32 J 303/32	_ 2DE _	41 41 41 44	38 39 38 42	59 59 59 66	54 51 55 64	61 62 62 68	3 5 3	4 5 5.5 4.5	1 1 1 1.5	1 1 1 1.5	15.9 20.2 17.0 15.9	0.37 0.59 0.35 0.33	1.6 1.0 1.7 1.8	0.88 0.56 0.95 1.0	0.336 0.335 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	14.1	0.31	2.0	1.1	0.267
HR 30207 J	3DB	46	43	63	62	67	3	3	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	19.6	0.66	0.91	0.50	0.331
HR 32207 J	3DC	46	42	63	61	67.5	3	5	1.5	1.5	17.9	0.37	1.6	0.88	0.456
HR 32207 C	—	46	42	63	58	68.5	3	6	1.5	1.5	20.6	0.55	1.1	0.60	0.442
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 30307 J	2FB	47	45	71	69	74	3	4.5	2	1.5	16.7	0.32	1.9	1.1	0.538
HR 30307 C HR 30307 DJ HR 31307 J HR 32307 J	TFB 7FB 7FB 2FE	47 51 51 49	44 44 44 43	71 71 71 71	65 62 62 66	74 77 77 74	3 3 3	6.5 7.5 7.5 7.5	2 2 2 2	1.5 1.5 1.5 1.5	20.3 25.2 25.2 20.7	0.55 0.83 0.83 0.32	1.1 0.73 0.73 1.9	0.60 0.40 0.40 1.1	0.518 0.519 0.52 0.765

Bore Diameter 40 - 50 mm



	Boundary Dimensions (mm) Cone							Basic Load	•		Limiting	
					Cone	Cup		N)	{kg		(min	
d	D	T	B	C		r in.	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	Grease	Oil
40	62	15	15	12	0.6	0.6	34 000	47 000	3 450	4 800	5 600	7 500
40	68	19	19	14.5	1	1	53 000	71 000	5 400	7 250	5 300	7 100
	68 75	22 26	22 26	18 20.5	1 1.5	1 1.5	59 000 78 500	81 500 101 000	6 000 8 000	8 300 10 300	5 300 4 800	7 100 6 700
	80	19.75	18	16	1.5	1.5	63 500	70 000	6 450	7 150	4 800	6 300
	80 80	24.75 24.75	23 23	19 19	1.5 1.5	1.5 1.5	77 000 74 000	90 500 90 500	7 900 7 550	9 200 9 200	4 800 4 500	6 300 6 300
	80 90	32 25.25	32 23	25 20	1.5	1.5 1.5	107 000 90 500	137 000 101 000	10 900 9 250	14 000 10 300	4 800 4 300	6 300 5 600
	90	25.25	23	18	2	1.5	84 500	93 500	8 600	9 500	4 300	5 600
	90 90	25.25 25.25	23 23	17 17	2 2 2	1.5 1.5	80 000 80 000	89 500 89 500	8 150 8 150	9 150 9 150	3 800 3 800	5 300 5 300
	90	35.25	33	27		1.5	120 000	145 000	12 200	14 800	4 300	6 000
45	68 75	15 20	15 20	12 15.5	0.6 1	0.6 1	34 500 60 000	50 500 83 000	3 550 6 150	5 150 8 450	5 000 4 500	6 700 6 300
	75	24	24	19	1	1	69 000	99 000	7 050	10 100	4 800	6 300
	80 85	26 20.75	26 19	20.5 16	1.5 1.5	1.5 1.5	84 000 68 500	113 000 79 500	8 550 6 950	11 600 8 100	4 500 4 300	6 000 6 000
	85 85	24.75 24.75	23 23	19 19	1.5 1.5	1.5 1.5	83 000 75 500	102 000 95 500	8 500 7 700	10 400 9 750	4 300 4 300	6 000 5 600
	85	32 29	32 26.5	25 20	1.5 2.5	1.5 2.5	111 000 88 500	147 000	11 300	15 000 11 100	4 300	6 000 5 000
	95 95	29 36	26.5 35	30	2.5	2.5	139 000	109 000 174 000	9 050 14 200	17 800	3 600 4 000	5 300
	100 100	27.25 27.25	25 25	22 18	2	1.5 1.5	112 000 95 500	127 000 109 000	11 400 9 750	12 900 11 100	3 800 3 400	5 300 4 800
	100	27.25	25	18	2	1.5	95 500	109 000	9 750	11 100	3 400	4 800
50	100 100	38.25 36	36 35	30 30	2 2.5	1.5 2.5	144 000 144 000	177 000 185 000	14 700 14 600	18 000 18 800	3 800 3 800	5 300 5 000
50	72	15	15	12	0.6	0.6	36 000	54 000	3 650	5 500	4 500	6 300
	80 80	20 24	20 24	15.5 19	1 1	1 1	61 000 70 500	87 000 104 000	6 250 7 150	8 900 10 600	4 300 4 300	6 000 6 000
	85	26	26 20	20 17	1.5	1.5	89 000	126 000	9 100	12 800	4 300	5 600 5 300
	90 90	21.75 24.75	23	17	1.5 1.5	1.5 1.5	76 000 87 500	91 500 109 000	7 750 8 900	9 300 11 100	4 000 4 000	5 300
	90 90	24.75 32	23 32	18 24.5	1.5 1.5	1.5 1.5	77 500 118 000	102 000 165 000	7 900 12 100	10 400 16 800	3 800 4 000	5 300 5 300
	105	32	29	22	3	3	109 000	133 000	11 100	13 600	3 200	4 500
	110 110	29.25 29.25	27 27	23 19	2.5 2.5	2	130 000 114 000	148 000 132 000	13 300 11 700	15 100 13 400	3 400 3 200	4 800 4 300
	110	29.25	27	19	2.5	2	114 000	132 000	11 700	13 400 22 400	3 200	4 300
	110 110	42.25 42.25	40 40	33 33	2.5 2.5	2 2	176 000 164 000	220 000 218 000	17 900 16 800	22 200	3 600 3 400	4 800 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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

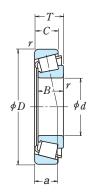
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

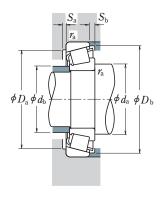
	ISO355			Abutn	nent ar	nd Fillet ((mm)	Dimens	sions		_	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	O _a min.	$D_{ m b}$ min.	S_{a} min.	$S_{ m b}$ min.	1	Cup a ax.	(mm) a	e	Y_1	Y_0	approx.
HR 32908 J	2BC	48	44	57	57	59	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



		Bounda	ary Dimens	ions				Basic Load	-		Limiting	
_			(mm)		Cone	Cup	1)			gf}	(mir	
d	D	T	В	С	n	r . nin.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	Grease	Oil
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	36	33	23	3	2.5	173 000	205 000	17 700	20 900	2 400	3 400
	140	51	48	39	3	2.5	267 000	340 000	27 300	35 000	2 800	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

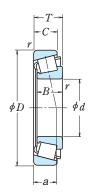
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

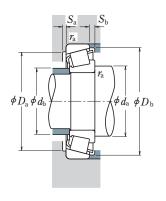
Danie a Norskara	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	sions		0	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	c Cup r _a ax.	(mm) a	e	Y_1	Y_0	approx.
HR 32911 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 HR 31312 J HR 32312 J 32312 C	7FB 7FB 2FD	84 84 81 81	74 74 74 74	118 118 118 116	103 103 107 102	125 125 120 125	4 4 4 4	11.5 11.5 11.5 13.5	2.5 2.5 2.5 2.5	2 2 2 2	40.3 40.3 31.4 39.9	0.83 0.83 0.35 0.58	0.73 0.73 1.7 1.0	0.40 0.40 0.96 0.57	1.98 1.98 2.96 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	7GB	89	80	128	111	133	4	13	2.5	2 2	43.2	0.83	0.73	0.40	2.43
HR 32313 J	2GD	86	80	128	116	130	4	12	2.5		34.0	0.35	1.7	0.96	3.6

Bore Diameter 70 - 80 mm



	Boundary Dimensions (mm) Cone							Basic Load	•		Limiting	•
,		_		_	Cone			۷)	{kg		(min	
d	D	T	B	C			$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	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
	150 150 150 150	38 38 54 54	35 35 51 51	25 25 42 42	3 3 3	2.5 2.5 2.5 2.5	192 000 192 000 300 000 280 000	229 000 229 000 390 000 390 000	19 600 19 600 30 500 28 600	23 300 23 300 39 500 39 500	2 200 2 200 2 600 2 400	3 200 3 200 3 400 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
	170 170 170 170	42.5 42.5 61.5 61.5	39 39 58 58	27 27 48 48	3 3 3	2.5 2.5 2.5 2.5	235 000 235 000 385 000 365 000	283 000 283 000 505 000 530 000	24 000 24 000 39 000 37 500	28 900 28 900 51 500 54 000	2 000 2 000 2 200 2 200	2 800 2 800 3 000 3 000

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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	Y_1

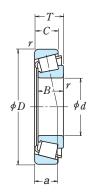
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

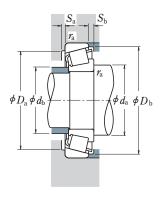
D : N .	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	ions			Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	S_{a} min.	$S_{ m b}$ min.	1	e Cup r _a lax.	(mm) a	e	Y_1	Y_0	approx.
HR 32914 J	2BC	79	76	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 HR 30216 J 30216 CA	3DE 3EB	82 95 95	88 91 92	121 130 130	113 124 122	126 132 133	6 4 4	8 6 8	2 2 2	1.5 2 2	30.4 28.1 33.8	0.42 0.42 0.58	1.4 1.4 1.0	0.79 0.79 0.57	1.88 1.68 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

Bore Diameter 85 – 100 mm



		Boun	dary Dimensi	ons				Basic Load	Ratings		Limiting	Speeds
			(mm)		Cone	Cup	1)	1)	{kg	gf}	(mir	ı ⁻¹)
d	D	T	В	С		rin.	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	Grease	Oil
85	120 130 130 140 150 150 150 180 180 180	23 29 36 41 30.5 30.5 38.5 49 44.5 44.5 63.5	23 29 36 41 28 28 36 49 41 41 41 60	18 22 29.5 32 24 22 30 37 34 28 28	1.5 1.5 1.5 2.5 2.5 2.5 2.5 2.5 4 4 4	1.5 1.5 1.5 2 2 2 2 2 3 3 3	93 500 143 000 180 000 230 000 184 000 171 000 210 000 281 000 261 000 410 000	157 000 231 000 305 000 365 000 233 000 226 000 277 000 415 000 375 000 315 000 535 000	9 550 14 600 18 400 23 500 18 700 17 500 21 400 28 700 31 500 26 600 42 000	16 000 23 600 31 000 37 000 23 800 23 000 28 200 42 500 38 000 32 000 54 500	2 800 2 600 2 600 2 400 2 400 2 200 2 200 2 400 2 000 1 900 1 900 2 000	3 800 3 600 3 600 3 400 3 200 3 200 3 200 2 800 2 800 2 800 2 800 2 800
90	125 140 140 150 160 160 190 190 190	23 32 39 45 32.5 42.5 46.5 46.5 46.5 67.5	23 32 39 45 30 40 43 43 43 64	18 24 32.5 35 26 34 36 30 30 53	1.5 2 2 2.5 2.5 2.5 2.5 4 4 4	1.5 1.5 1.5 2 2 2 3 3 3	97 000 170 000 220 000 259 000 256 000 345 000 264 000 450 000	167 000 273 000 360 000 405 000 256 000 350 000 425 000 315 000 315 000 590 000	9 850 17 300 22 400 26 500 20 500 26 100 35 500 26 900 26 900 46 000	17 000 27 800 37 000 41 500 26 100 35 500 43 000 32 000 32 000 60 500	2 600 2 400 2 400 2 400 2 200 2 200 1 900 1 800 2 800	3 600 3 200 3 200 3 200 3 000 3 000 2 600 2 400 2 600
95	130 145 145 160 170 170 200 200 200 200 200	23 32 39 46 34.5 45.5 49.5 49.5 49.5 71.5	23 32 39 46 32 43 45 45 45 45	18 24 32.5 38 27 37 38 36 32 32 55	1.5 2 3 3 3 4 4 4 4	1.5 1.5 1.5 3.5 2.5 3.3 3.3 3.3	98 000 173 000 231 000 283 000 283 000 289 000 370 000 310 000 310 000 525 000	172 000 283 000 390 000 445 000 286 000 400 000 455 000 435 000 375 000 375 000 710 000	10 000 17 600 23 500 28 800 29 500 38 000 35 500 31 500 31 500 53 500	17 500 28 900 39 500 45 500 29 200 40 500 46 500 44 000 38 500 72 500	2 400 2 400 2 400 2 200 2 200 2 200 1 900 1 800 1 700 1 700 1 900	3 400 3 200 3 200 3 000 2 800 2 800 2 600 2 400 2 400 2 400 2 600
100	140 145 150 150 165 180 180 215 215 215	25 24 32 39 52 37 49 63 51.5 56.5 77.5	25 22.5 32 39 52 34 46 63 47 51 73	20 17.5 24 32.5 40 29 39 48 39 35 60	1.5 3 2 2.5 3 3 4 4	1.5 3 1.5 1.5 2.5 2.5 2.5 3 3	117 000 113 000 176 000 235 000 315 000 255 000 325 000 410 000 425 000 385 000 565 000	205 000 163 000 294 000 405 000 515 000 450 000 635 000 525 000 505 000 755 000	12 000 11 500 17 900 24 000 32 500 26 000 33 000 42 000 43 000 39 000 57 500	20 900 16 600 30 000 41 500 52 500 34 000 46 000 65 000 53 500 51 500 77 000	2 200 2 200 2 200 2 200 2 200 2 000 2 000 2 000 1 700 1 500 1 700	3 200 3 000 3 000 3 000 2 800 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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

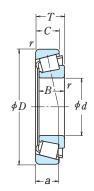
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

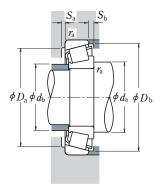
When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Danis a Novakasa	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.	Cone Cup $oldsymbol{\mathcal{Y}}_{\mathrm{a}}$ 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 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 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 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 2	33.9	0.42	1.4	0.79	2.64
HR 33217 J	3EE	100	95	140	129	144	7	12	2 2	37.3	0.42	1.4	0.79	3.57
HR 30317 J	2GB	106	108	166	157	167	5	10.5	3 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	3 2.5	55.4	0.83	0.73	0.40	4.88
HR 32317 J	2GD	110	104	166	151	167	5	14.5	3 2.5	43.6	0.35	1.7	0.96	7.31
HR 32918 J	2BC	101	97	116	116	120	5	5	1.5 1.5	22.0	0.34	1.8	0.96	0.838
HR 32018 XJ	3CC	102	99	131	124	134	6	8	2 1.5	29.7	0.42	1.4	0.78	1.78
HR 33018 J	2CE	102	99	131	129	135	7	6.5	2 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	35.2	0.40	1.5	0.83	3.14
HR 30218 J	3FB	105	103	150	141	150	5	6.5	2 2	31.7	0.42	1.4	0.79	2.6
HR 32218 J	3FC	105	102	150	139	152	5	8.5	2 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	3 2.5	58.7	0.83	0.73	0.40	5.52
HR 31318 J	7GB	118	110	176	152	179	6	16.5	3 2.5	58.7	0.83	0.73	0.40	5.52
HR 32318 J	2GD	115	109	176	158	177	5	14.5	3 2.5	46.5	0.35	1.7	0.96	8.6
HR 32919 J	2BC	106	102	121	121	125	5	5	1.5 1.5	23.2	0.36	1.7	0.92	0.877
HR 32019 XJ	4CC	107	104	136	131	140	6	8	2 1.5	31.2	0.44	1.4	0.75	1.88
HR 33019 J	2CE	107	103	136	133	139	7	6.5	2 1.5	28.6	0.28	2.2	1.2	2.3
T 2 ED095	2ED	113	108	146	141	152	6	8	2.5 2.5	34.5	0.34	1.8	0.97	3.74
HR 30219 J	3FB	113	110	158	150	159	5	7.5	2.5 2	33.7	0.42	1.4	0.79	3.13
HR 32219 J	3FC	113	108	158	147	161	5	8.5	2.5 2	39.3	0.42	1.4	0.79	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	3 2.5	48.6	0.54	1.1	0.61	6.71
HR 30319 DJ	7GB	123	115	186	158	187	6	17.5	3 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	3 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 1.5	24.2	0.33	1.8	1.0	1.18
T 4 CB100	4CB	118	108	135	135	142	6	6.5	2.5 2.5	30.1	0.47	1.3	0.70	1.18
HR 32020 XJ	4CC	112	109	141	136	144	6	8	2 1.5	32.5	0.46	1.3	0.72	1.95
HR 33020 J	2CE	112	107	141	137	143	7	6.5	2 1.5	29.3	0.29	2.1	1.2	2.38
HR 33120 J	3EE	115	110	155	144	159	8	12	2 2	40.5	0.41	1.5	0.81	4.32
HR 30220 J	3FB	118	116	168	158	168	5	8	2.5 2	36.1	0.42	1.4	0.79	3.78
HR 32220 J	3FC	118	115	168	155	171	5	10	2.5 2	41.5	0.42	1.4	0.79	5.05
HR 33220 J	3FE	118	113	168	152	172	10	15	2.5 2	46.0	0.40	1.5	0.82	6.76
HR 30320 J	2GB	121	128	201	185	197	5	12.5	3 2.5	41.4	0.35	1.7	0.96	8.41
HR 31320 J	7GB	136	125	201	169	202	7	21.5	3 2.5	67.7	0.83	0.73	0.40	9.02
HR 32320 J	2GD	125	125	201	178	200	5	17.5	3 2.5	53.2	0.35	1.7	0.96	12.7

Bore Diameter 105 – 130 mm



		Bound	ary Dimen	sions				Basic Load F	-		Limiting	
d	D	T	В	С		e Cup <i>Y</i> nin.	$C_{\rm r}$	N) $C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(mir 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 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	72	66	44	5	4	625 000	820 000	63 500	83 500	1 200	1 700
	280	98.75	93	78	5	4	830 000	1 150 000	84 500	117 000	1 300	1 800



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	r _r e	$F_{\rm a}/I$	$r_{\rm r}$ e
X	Y	X	Y
1	0	0.4	Y_1

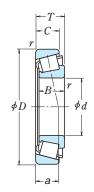
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

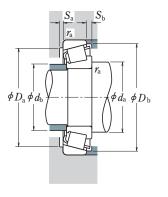
When $F_{\rm r}=0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

D : N .	ISO355			Abutn	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.	<i>1</i> max.	D _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	approx.
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	3	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		142	141	171	168	175	6	6	2	1.5	34.7	0.36	1.7	0.92	2.25
HR 32926 J	2CC	142	140	170	168	173	6	7	2	1.5	31.4	0.34	1.8	0.97	2.46
T 4 CB130	4CB	148	141	171	171	179	8	8	2.5	2.5	37.5	0.47	1.3	0.70	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	7GB	174	159	262	220	261	9	28	4	3	87.1	0.83	0.73	0.40	18.8
32326	—	162	165	262	233	263	8	20.5	4		69.2	0.36	1.7	0.92	26.6

Bore Diameter 140 – 170 mm



	Boundary Dimensions (mm) Cou							Basic Load F	-	_	Limiting	
d	D	T	В	С		Cup r nin.	$C_{\rm r}$	N) $C_{0\mathrm{r}}$	$C_{ m r}$	gf} $C_{0\mathrm{r}}$	(mir Grease	n) Oil
140	190	32	32	25	2	1.5	206 000	390 000	21 000	39 500	1 700	2 200
	210	45	45	34	2.5	2	325 000	555 000	33 000	57 000	1 600	2 200
	210	56	56	44	2.5	2	410 000	770 000	42 000	78 500	1 600	2 200
	250	45.75	42	36	4	3	390 000	515 000	40 000	52 500	1 400	1 900
	250	71.75	68	58	4	3	610 000	915 000	62 000	93 500	1 400	1 900
	300	67.75	62	53	5	4	740 000	945 000	75 500	96 500	1 200	1 700
	300	77	70	47	5	4	695 000	955 000	71 000	97 500	1 100	1 500
	300	107.75	102	85	5	4	985 000	1 440 000	101 000	147 000	1 200	1 600
150	210	38	36	31	2.5	2	247 000	440 000	25 200	45 000	1 500	2 000
	210	38	38	30	2.5	2	281 000	520 000	28 600	53 000	1 500	2 000
	225	48	48	36	3	2.5	375 000	650 000	38 000	66 500	1 400	2 000
	225	59	59	46	3	2.5	435 000	805 000	44 000	82 000	1 400	2 000
	270	49	45	38	4	3	485 000	665 000	49 000	67 500	1 300	1 800
	270	77	73	60	4	3	705 000	1 080 000	71 500	110 000	1 300	1 800
	320 320 320 320	72 72 82 114	65 65 75 108	55 55 50 90	5 5 5 5	4 4 4 4	690 000 825 000 790 000 1 120 000	860 000 1 060 000 1 100 000 1 700 000		87 500 108 000 112 000 174 000	1 100 1 100 1 000 1 100	1 500 1 600 1 400 1 500
160	220	38	38	30	2.5	2	296 000	570 000	30 000	58 000	1 400	1 900
	240	51	51	38	3	2.5	425 000	750 000	43 500	76 500	1 300	1 800
	290	52	48	40	4	3	530 000	730 000	54 000	74 500	1 200	1 600
	290 340 340	84 75 75	80 68 68	67 58 58	4 5 5	3 4 4	795 000 765 000 870 000	1 220 000 960 000 1 110 000	78 000	125 000 98 000 113 000	1 200 1 000 1 100	1 600 1 400 1 400
	340	75	68	48	5	4	675 000	875 000	69 000	89 000	950	1 300
	340	121	114	95	5	4	1 210 000	1 770 000	123 000	181 000	1 000	1 400
170	230	38	36	31	2.5	2.5	258 000	485 000	26 300	49 500	1 300	1 800
	230	38	38	30	2.5	2	294 000	560 000	30 000	57 000	1 400	1 800
	260	57	57	43	3	2.5	505 000	890 000	51 500	90 500	1 200	1 700
	310 310 360	57 91 80	52 86 72	43 71 62	5 5 5	4 4 4	630 000 930 000 845 000	885 000 1 450 000 1 080 000		90 000 148 000 110 000	1 100 1 100 950	1 500 1 500 1 300
	360 360 360	80 80 127	72 72 120	62 50 100	5 5 5	4 4 4	960 000 760 000 1 370 000	1 230 000 1 040 000 2 050 000		125 000 106 000 209 000	1 000 900 1 000	1 300 1 200 1 300



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	Y_1

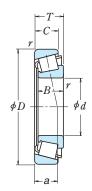
Static Equivalent Load $P_0 = 0.5F_{\rm r} + Y_0 F_{\rm a}$

When $F_{
m r}\!>\!$ 0.5 $F_{
m r}\!+\!Y_0F_{
m a}$, use $P_0\!=\!F_{
m r}$ The values of \emph{e} , \emph{Y}_1 , and \emph{Y}_0 are given in the table below.

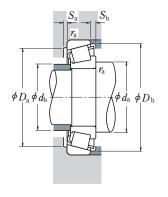
Pagring Numbers	ISO355			Abutr	nent ar	nd Fillet (mm)	Dimens	sions	Can	. Cun	Eff. Load Centers	Constant		Load tors	Mass (kg)
Bearing Numbers	Dimension Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	e Cup r _a nax.	(mm) a	e	Y_1	Y_0	approx.
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		22.5	4	3	76.4	0.37	1.6	0.88	33.9
32930 HR 32930 J HR 32030 XJ	2DC 4EC	165 165 168	162 163 164	200 198 213	195 196 202	201 202 216	7 7 8	7 8 12	2 2 2.5	2 2 2	36.7 36.5 49.8	0.33 0.33 0.46	1.8 1.8 1.3	1.0 1.0 0.72	3.8 4.05 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 HR 30330 J HR 31330 J 32330	— 2GB 7GB	177 177 194 182	193 190 187 191	302 302 302 302	275 276 253 262	292 292 300 297	8 8 9 8	17 17 32 24	4 4 4	3 3 3	61.4 60.0 99.3 81.5	0.36 0.35 0.83 0.37	1.7 1.7 0.73 1.6	0.92 0.96 0.40 0.88	24.2 25 28.5 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 131 B 130

Bore Diameter 180 – 240 mm



	Boundary Dimensions (mm) Cone						,	Basic Load R	-	f)	Limiting	
d	D	Т	В	С		Cup r nin.	$C_{\rm r}$	N) $C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(mir 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	146 000	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	Y_1

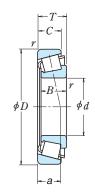
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

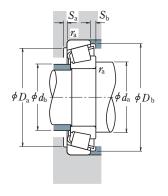
When $F_r > 0.5 F_r + Y_0 F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearing Numbers	ISO355 Dimension			Abutn	nent ar	d Fillet (mm)	Dimens	ions	Coro	: Cup	Eff. Load Centers (mm)	Constant	Axial I Fact		Mass (kg)
•	Series approx.	$d_{ m a}$ min.	$d_{ m b}$ max.	$_{ m max.}$) _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	r _a ax.	a	e	Y_1	Y_0	approx.
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 30336 30336 D 32336	4GD — — —	207 207 216 212	205 233 229 225	302 362 362 362	270 324 304 310	303 345 352 353	10 10 10 10	20 19 30 28	4 4 4	3 3 3 3	78.9 72.5 113.1 96.6	0.45 0.36 0.81 0.37	1.3 1.7 0.74 1.6	0.73 0.92 0.41 0.88	29.8 39.3 38.5 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 HR 32940 J HR 32040 XJ	3EC 4FD	218 218 218	217 216 221	268 268 298	256 258 277	269 271 297	9 9 11	10 12 17	2.5 2.5 2.5	2 2 2	53.4 54.2 67.4	0.37 0.39 0.43	1.6 1.5 1.4	0.88 0.84 0.77	9.26 9.65 18.9
HR 30240 J	4GB	227	236	342	318	336	10	16	4	3	69.1	0.44	1.4	0.76	25.5
HR 32240 J	3GD	227	230	342	305	340	11	22	4	3	85.1	0.41	1.5	0.81	42.6
30340	—	233	253	398	346	368	11	22	5	4	81.4	0.37	1.6	0.88	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



		Boun	dary Dimen	sions				Basic Load F	-		Limiting	•
d	D	T	В	С		Cup Y nin.	$C_{\rm r}$	$C_{0 m r}$	$C_{ m r}$	$C_{0\mathrm{r}}$	(min 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	190 000	335 000 269 000 490 000	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		162 000 228 000 194 000	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		355 000 550 000	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	103 000	186 000 214 000 275 000	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		214 000 380 000	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	106 000	192 000 227 000 297 000	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	107 000	197 000 226 000 345 000	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	110 000	214 000 239 000 355 000	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		276 000 415 000	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		287 000 430 000	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$					
X	Y	X	Y				
1	0	0.4	Y_1				

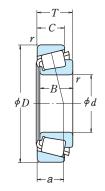
Static Equivalent Load

 $P_0 = 0.5F_r + Y_0 F_a$

When $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Decring Numbers	ISO355			Abutn	nent ar	nd 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.	<i>1</i> max.	D _a min.	$D_{ m b}$ min.	$S_{ m a}$ min.	$S_{ m b}$ min.	1	r _a ax.	(mm) a	e	Y_1	Y_0	approx.
HR 32952 J	3EC	278	278	348	333	347	11	15.5	2.5	2	69.8	0.41	1.5	0.81	18.6
HR 32052 XJ	4FC	287	287	382	357	383	14	22	4	3	86.3	0.43	1.4	0.76	38.5
30252	—	293	316	458	421	447	12	22	5	4	94.6	0.44	1.4	0.74	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	_	333	355	518	470	499	14	25	5	4	105.1	0.44	1.4	0.74	80.6
32260		333	352	518	458	514	15	34	5	4	131.7	0.46	1.3	0.72	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	4FD	361	364	446	426	446	13	13	3	2.5	89.2	0.41	1.5	0.80	33.6
HR 32968 J		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 HR 32972 J 32072	4FD —	381 381 393	386 381 402	466 466 518	445 445 480	465 466 514	14 13 5.5	14 19 22	3 3 5	2.5 2.5 4	91.4 96.8 108.6	0.40 0.46 0.38	1.5 1.3 1.6	0.82 0.72 0.86	35.8 36.1 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

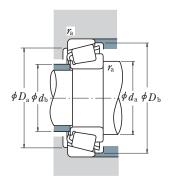
Bore Diameter 12.000 - 22.225 mm



			Dimension	S				Basic Loa	d Ratings		Limiting	Speeds
		(m	nm)		Cone	Cup	(N)	{k	gf}	(mi	n ⁻¹)
d	D	T	В	С	r ∂ mi	•	C_{r}	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	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



B 137



Dynamic Equivalent Load

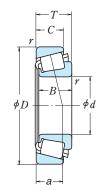
Static Equivalent Load

 $P_0=0.5F_r+Y_0F_a$ 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	outment	and Fille (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 γ	a	(mm) a	e	Y_1	Y_0	app CONE	rox. 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	† LM 11710	23	21.5	34	37	1.3	1.3	8.7	0.29	2.1	1.2	0.055	0.028
05068	05185	23	22.5	40.5	42.5	0.8	1.3	10.1	0.36	1.7	0.93	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	0.038
*† LM 12749	† LM 12711	27.5	26	40	42.5	1.3	1.3	10.0	0.31	2.0	1.1	0.078	0.043
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

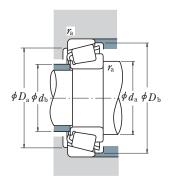
- The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- † The tolerances for the bore diameter and overall bearing width differ from the standard (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				Basic L		Limiting Speeds		
		(n	nm)		Cone	Cup	(1	N)	{k	gf}	(mi	n ⁻¹)
d	D	T	В	С	<i>1</i> mi		$C_{\rm r}$	C_{0r}	$C_{ m r}$	C_{0r}	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

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	r _r ≦e	$F_{\rm a}/F_{\rm r} > e$					
X	Y	X	Y				
1	0	0.4	<i>Y</i> ₁				

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

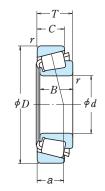
Bearing Nu	mbers	Al	outment	and Fille (mm)				Eff. Load Centers	Constant	Axial Fac	Load tors	Mass (kg)	3
CONE	CUP	d_{a}	$d_{ ext{b}}$	D_{a}	$D_{ ext{b}}$	Cone (${m \gamma}_{ m a}$ max.	·	(mm) <i>a</i>	e	Y_1	Y_0	approx CONE C	CUP
LM 72849	LM 72810	29	27	40.5	44.5	1.5	1	12.2	0.47	1.3	0.70	0.086 0.	.046
† L 44640 1779	† L 44610 1729	30.5 29.5	28.5 28.5	44.5 49	47 51		1.3 1.3	10.9 12.2	0.37 0.31	1.6 2.0	0.88 1.1		.039 .102
▲JHM 33449	▲JHM 33410	35	30	47	52	2	2	15.8	0.35	1.7	0.93	0.181 0.	.107
07098 07098 17098	07204 07205 17244	31 31 33	29 29 30.5	45 44.5 54	48 48 57	1.5	1.3 2 1.5	12.1 12.1 12.8	0.40 0.40 0.38	1.5 1.5 1.6	0.82 0.82 0.86	0.085 0.	.061 .061 .091
07097 07097	07196 07204	31 31	29 29	44.5 45	47 48		1 1.3	10.6 12.1	0.40 0.40	1.5 1.5	0.82 0.82		.035 .061
07100 SA 07100 † L 44643	07196 07196 † L 44610	35 30.5 31.5	29.5 29.5 29.5	44.5 44.5 44.5	47 47 47	1	1 1 1.3	10.6 10.6 10.9	0.40 0.40 0.37	1.5 1.5 1.6	0.82 0.82 0.88	0.084 0.	.035 .035 .039
15578 M 84548 M 84249	15520 M 84510 M 84210	32.5 36 36	30.5 33 32.5	51 48.5 49.5	53 54 56	1.5	1.5 1.5 1.5	12.4 16.1 18.3	0.35 0.55 0.55	1.7 1.1 1.1	0.95 0.60 0.60	0.156 0.	.070 .089 .13
15101 15100 M 86643	15245 15250 X M 86610	32.5 38 38	31.5 31.5 36.5	55 55 54	58 59 61	3.5	1.3 1.5 1.5	13.3 14.9 17.7	0.35 0.35 0.55	1.7 1.7 1.1	0.94 0.94 0.60	0.22 0.	.081 .113 .128
23100 02473 HM 88630 41100	23256 02420 HM 88610 41286	39 34.5 39.5 41	34.5 33.5 39.5 36.5	53 59 60 61	61 63 69 68	8.0 8.0	1.5 1.5 2.3 1.5	20.0 16.9 20.7 20.7	0.73 0.42 0.55 0.60	0.82 1.4 1.1 1.0	0.45 0.79 0.60 0.55	0.28 0. 0.398 0.	.142 .152 .188 .177
† L 44649 1997 X 15580 15106	† L 44610 1922 15523 15245	37.5 37.5 38.5 33.5	31 31.5 32 33	44.5 51 51 55	47 53.5 54 58	3.3 3.5	1.3 1.5 1.5 1.3	10.9 13.9 14.7 13.3	0.37 0.33 0.35 0.35	1.6 1.8 1.7 1.7	0.88 1.0 0.95 0.94	0.152 0. 0.141 0.	.039 .077 .123 .081
1988 † LM 67043 15112	1922 † LM 67010 15245	39.5 40 40	33.5 33.5 34	51 52 55	53.5 56 58	3.5	1.5 1.3 1.3	13.9 12.6 13.3	0.33 0.41 0.35	1.8 1.5 1.7	1.0 0.80 0.94	0.147 0.	.077 .062 .081
15113 M 86647 02474	15245 M 86610 02420	34.5 40 36.5	34 38 36	55 54 59	58 61 63	1.5	1.3 1.5 1.5	13.3 17.7 16.9	0.35 0.55 0.42	1.7 1.1 1.4	0.94 0.60 0.79	0.223 0.	.081 .128 .152
41125 41126 02872	41286 41286 02820	48 41.5 37.5	36.5 36.5 37	61 61 62	68 68 68	1.5 0.8	1.5 1.5 3.3	20.7 20.7 18.3	0.60 0.60 0.45	1.0 1.0 1.3	0.55 0.55 0.73	0.295 0. 0.321 0.	.177 .177 .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.

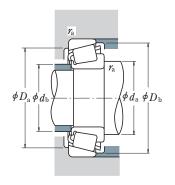
SINGLE-ROW TAPERED ROLLER BEARINGS (INCH DESIGN)

Bore Diameter 29.000 - 32.000 mm



			Dimension	S				Basic Loa	d Ratings		Limiting	Speeds
		(m	nm)		Cone	Cup	(N)	{k	gf}	(mir	n ⁻¹)
d	D	T	В	С	1	r in.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	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

 $P = XF_r + YF_a$ $F_c / F_c \le e$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$					
X	Y	X	Y				
1	0	0.4	Y_1				

Static Equivalent Load

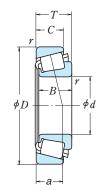
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

† L 45449 † L 45410 39.5 33 44.5 48 3.5 1.3 10.8 0.37 1.6 0.89 0.079 0.0 2690 2631 41 35 58 60 3.5 1.3 10.8 0.37 1.6 0.89 0.079 0.0 * 17118 17244 37 34.5 54 57 1.5 1.5 12.8 0.38 1.6 0.86 0.136 0.0 * 15117 15245 36.5 35 55 58 1.3 1.3 13.3 0.35 1.7 0.94 0.189 0.0 * 15117 15250 36.5 35 56 59 1.3 1.3 14.9 0.35 1.7 0.94 0.189 0.0 * 26118 26283 38 36 62 65 1.5 1.5 14.8 0.36 1.7 0.94 0.189 0.0 15116 15245 36 35.5 55<	Mass (kg)	
2690 2631 41 35 58 60 3.5 1.3 14.3 0.25 2.4 1.3 0.242 0.7 * 17118 17244 37 34.5 54 57 1.5 1.5 12.8 0.38 1.6 0.86 0.136 0.0 * 15117 15245 36.5 35 55 58 1.3 1.3 13.3 0.35 1.7 0.94 0.189 0.0 * 15117 15250 36.5 35 56 59 1.3 1.3 14.9 0.35 1.7 0.94 0.189 0.0 * 26118 26283 38 36 62 65 1.5 1.5 14.8 0.36 1.7 0.94 0.189 0.0 15116 15245 36 35.5 55 58 0.8 1.3 13.3 0.35 1.7 0.94 0.189 0.0 15116 15245 36 35.5 55 58 0.8 1.3 13.3 0.35 1.7 0.94 0.189 0.0	UP	
* 15117 15245 36.5 35 55 58 1.3 1.3 1.3 0.35 1.7 0.94 0.189 0.0 * 15117 15250 36.5 35 56 59 1.3 1.3 1.4 0.35 1.7 0.94 0.189 0.0 * 26118 26283 38 36 62 65 1.5 1.5 1.5 1.4 0.36 1.7 0.94 0.189 0.0 15116 15245 36 35.5 55 58 0.8 1.3 13.3 0.35 1.7 0.94 0.189 0.0 08118 08231 41.5 35 52 55 3.5 1 13.3 0.35 1.7 0.94 0.189 0.0 M 86649 M 86610 41 38 54 61 1.5 1.5 1.7 0.55 1.1 0.60 0.211 0.2 M 88043 M 88010 43.5 39.5 58 65 2.3 1.5 19.1 0.55 1.1 0.60 0.263	036 165	
08118 08231 41.5 35 52 55 3.5 1 13.3 0.47 1.3 0.70 0.12 0.6 M 86649 M 86610 41 38 54 61 1.5 1.5 1.7 0.55 1.1 0.60 0.211 0.7 M 88043 M 88010 43.5 39.5 58 65 2.3 1.5 19.1 0.55 1.1 0.60 0.263 0.7 2558 2523 40 36.5 61 64 2.3 1.3 14.5 0.27 2.2 1.2 0.297 0.2 2559 2523 37 36.5 61 64 0.8 1.3 14.5 0.27 2.2 1.2 0.298 0.2	091 081 113 163	
M 86649 M 88043 M 86610 M 88010 41 43.5 38 39.5 54 58 61 65 1.5 2.3 1.5 1.5 17.7 1.5 0.55 1.1 1.1 0.60 0.211 0.263 0.2 0.263 0.2 0.263 2558 2523 40 36.5 37 61 36.5 36.5 61 36.5 36.5 64 36.5 36.5 61 36.5 36.5 64 36.5 36.5 61 36.5 36.5 64 36.5 36.5 61 36.5 36.5 64 36.5 36.5 61 36.5 36.5 64 36.5 36.5 61 36.5 36.5 64 36.5 36.5 64 36.5 36.5 36.5 64 36.5 36.5 36.5 64 36.5 36.5 36.5 64 36.5 36.5 36.5 64 36.5 36.5 36.5 36.5 36.5 64 36.5 36.5 36.5 36.5 36.5 36.5 36.5 36.5	081	
2559 2523 37 36.5 61 64 0.8 1.3 14.5 0.27 2.2 1.2 0.298 0.7	057 128 146	
10110 10 12 07 70 1.0 0.0 0.40 0.00 0.40 0.00 0.40	169 169 146	
	081 081 081	
M 86648 A M 86610 42 38 54 61 1.5 1.5 17.7 0.55 1.1 0.60 0.205 0.1	128	
† LM 67048 † LM 67010 42.5 36 52 56 3.5 1.3 12.6 0.41 1.5 0.80 0.127 0.0	057 062 081	
15125 15245 42.5 36.5 55 58 3.5 1.3 13.3 0.35 1.7 0.94 0.174 0.0	081 081 113	
M 88046 M 88010 43 40.5 58 65 1.5 1.5 19.1 0.55 1.1 0.60 0.25 0.15 0.15	152 146 135	
2580 2523 38.5 37.5 61 64 0.8 1.3 14.5 0.27 2.2 1.2 0.282 0.1	132 169 169	
HM 88542 HM 88510 45.5 42.5 59 70 1.3 3.3 23.5 0.55 1.1 0.60 0.379 0.2	225 242 146	
*HM 88638 HM 88610 48.5 42.5 60 69 3.3 2.3 20.7 0.55 1.1 0.60 0.337 0.00	188	

Notes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

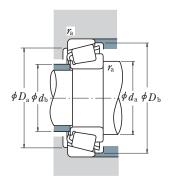
† The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).

Bore Diameter 33.338 - 35.000 mm



			Dimension	S				Basic Load	•		Limiting	
		(m	nm)		Cone	Cup	(N)	{k	cgf}	(mir	n ⁻¹)
d	D	T	В	С	<i>1</i> mi		C_{r}	C_{0r}	C_{r}	C_{0r}	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 50
	69.850	23.812	25.357	19.050	3.5	1.3	71 000	84 000	7 200	8 550	5 600	7 50
	72.000	19.000	18.923	15.875	3.5	1.5	52 000	56 000	5 300	5 700	5 600	7 50
	72.626	30.162	29.997	23.812	0.8	3.3	79 500	90 000	8 100	9 200	5 300	7 50
	73.025	29.370	27.783	23.020	0.8	3.3	74 000	100 000	7 550	10 200	5 000	7 10
	76.200	29.370	28.575	23.020	3.8	0.8	78 500	106 000	8 000	10 800	4 800	6 70
	76.200	29.370	28.575	23.020	0.8	3.3	78 500	106 000	8 000	10 800	4 800	6 70
	79.375	25.400	24.074	17.462	3.5	1.5	67 500	69 500	6 850	7 100	5 000	6 70
34.925	65.088	18.034	18.288	13.970	spec.	1.3	47 500	57 500	4 850	5 900	5 600	7 50
	65.088	20.320	18.288	16.256	spec.	1.3	47 500	57 500	4 850	5 900	5 600	7 50
	66.675	20.638	20.638	16.670	3.5	2.3	53 000	62 500	5 400	6 400	5 600	7 50
	69.012	19.845	19.583	15.875	3.5	1.3	47 000	56 000	4 800	5 700	5 600	7 50
	69.012	19.845	19.583	15.875	1.5	1.3	47 000	56 000	4 800	5 700	5 600	7 50
	72.233	25.400	25.400	19.842	2.3	2.3	63 500	83 500	6 500	8 500	5 000	7 10
	73.025	22.225	22.225	17.462	0.8	3.3	54 500	64 500	5 550	6 600	5 300	7 10
	73.025	22.225	23.812	17.462	3.5	3.3	63 500	77 000	6 500	7 850	5 300	7 10
	73.025	23.812	24.608	19.050	1.5	0.8	71 000	86 000	7 250	8 750	5 300	7 10
	73.025	23.812	24.608	19.050	3.5	2.3	71 000	86 000	7 250	8 750	5 300	7 10
	76.200	29.370	28.575	23.020	0.8	0.8	78 500	106 000	8 000	10 800	4 800	6 70
	76.200	29.370	28.575	23.020	3.5	0.8	78 500	106 000	8 000	10 800	4 800	6 70
	76.200	29.370	28.575	23.020	3.5	3.3	78 500	106 000	8 000	10 800	4 800	6 70
	76.200	29.370	28.575	23.812	1.5	3.3	80 500	96 500	8 200	9 850	5 000	6 70
	79.375	29.370	29.771	23.812	3.5	3.3	88 000	106 000	8 950	10 800	4 800	6 70
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 10
	72.085	22.385	19.583	18.415	1.3	2.3	47 000	56 000	4 800	5 700	5 600	7 50
	80.000	21.006	20.940	15.875	1.5	1.5	56 500	64 500	5 750	6 600	5 000	6 70
35.000	59.131	15.875	16.764	11.938	spec.	1.3	35 000	47 000	3 550	4 750	6 000	8 00
	59.975	15.875	16.764	11.938	spec.	1.3	35 000	47 000	3 550	4 750	6 000	8 00
	62.000	16.700	17.000	13.600	spec.	1.0	38 000	50 000	3 900	5 100	5 600	8 00
	62.000	16.700	17.000	13.600	spec.	1.5	38 000	50 000	3 900	5 100	5 600	8 00
	65.987	20.638	20.638	16.670	3.5	2.3	53 000	62 500	5 400	6 400	5 600	7 50
	73.025	26.988	26.975	22.225	3.5	0.8	75 500	88 500	7 650	9 050	5 300	7 50





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	<i>Y</i> ₁

Static Equivalent Load

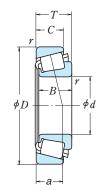
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearing Nu	ımbers	Al	outment	and Fille (mm)			0	Eff. Load Centers	Constant	Axial Fac	Load tors		ass g)
CONE	CUP	d_{a}	$d_{ m b}$	$D_{\rm a}$	$D_{ m b}$	Cone $\gamma_{\rm a}$ max	1	(mm) a	e	Y_1	Y_0	app CONE	rox. CUP
1680	1620	44.5	38.5	58	61	3.5	1.5	15.2	0.37	1.6	0.89	0.196	0.121
M 88048	M 88010	42.5	41	58	65	0.8	1.5	19.0	0.55	1.1	0.60	0.236	0.146
14130	14274	45	38.5	59	63	3.5	3.3	15.3	0.38	1.6	0.86	0.207	0.132
14131	14276	39.5	38.5	60	63	0.8	1.3	15.3	0.38	1.6	0.86	0.209	0.135
2585	2523	45	39	61	64	3.5	1.3	14.5	0.27	2.2	1.2	0.263	0.169
26131	26283	44.5	38.5	62	65	3.5	1.5	14.7	0.36	1.7	0.92	0.20	0.163
3197	3120	41.5	40.5	61	67	0.8	3.3	19.6	0.33	1.8	0.99	0.348	0.225
HM 88547	HM 88510	45.5	42.5	59	70	0.8	3.3	23.5	0.55	1.1	0.60	0.362	0.242
HM 89444	HM 89411	53	44.5	65	73	3.8	0.8	23.6	0.55	1.1	0.60	0.419	0.261
HM 89443	HM 89410	46.5	44.5	62	73	0.8	3.3	23.6	0.55	1.1	0.60	0.421	0.257
43131	43312	51	42	67	74	3.5	1.5	23.7	0.67	0.90	0.49	0.348	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	0.172	0.108
M 38549	M 38510	46.5	40	58	62	3.5	2.3	15.2	0.35	1.7	0.94	0.194	0.112
14138 A	14276	46	40	60	63	3.5	1.3	15.3	0.38	1.6	0.86	0.194	0.135
14137 A	14276	42	40	60	63	1.5	1.3	15.1	0.38	1.6	0.86	0.196	0.135
HM 88649	HM 88610	48.5	42.5	60	69	2.3	2.3	20.7	0.55	1.1	0.60	0.307	0.188
02878	02820	42.5	42	62	68	0.8	3.3	18.3	0.45	1.3	0.73	0.266	0.16
2877	2820	47	41.5	63	68	3.5	3.3	16.1	0.37	1.6	0.90	0.291	0.15
25877	25821	43	40.5	65	68	1.5	0.8	15.7	0.29	2.1	1.1	0.306	0.167
25878	25820	47	40.5	64	68	3.5	2.3	15.7	0.29	2.1	1.1	0.304	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	0.403	0.261
HM 89446	HM 89411	53	44.5	65	73	3.5	0.8	23.6	0.55	1.1	0.60	0.40	0.261
HM 89446	HM 89410	53	44.5	62	73	3.5	3.3	23.6	0.55	1.1	0.60	0.40	0.257
31594	31520	46	43.5	64	72	1.5	3.3	21.6	0.40	1.5	0.82	0.404	0.235
3478	3420	50	43.5	67	74	3.5	3.3	20.0	0.37	1.6	0.90	0.448	0.259
19138	19268	42.5	40.5	61	65	1.5	1.5	14.5	0.44	1.4	0.74	0.196	0.073
14139	14283	41.5	40	60	65	1.3	2.3	17.7	0.38	1.6	0.87	0.198	0.21
28138	28315	43.5	41	69	73	1.5	1.5	16.0	0.40	1.5	0.82	0.308	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	0.117	0.064
* LM 78349	** LM 78310	46	40	55	59	3.5	1	14.4	0.44	1.4	0.74	0.137	0.074
* LM 78349	** LM 78310 A	46	40	54	59	3.5	1.5	14.4	0.44	1.4	0.74	0.138	0.073
M 38547	M 38511	46	39.5	59	61	3.5	2.3	15.2	0.35	1.7	0.94	0.193	0.103
23691	23621	49	42	63	68	3.5	0.8	18.1	0.37	1.6	0.89	0.309	0.212

Notes

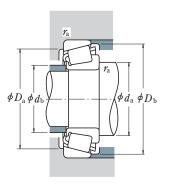
- The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- † The tolerances for the bore diameter and overall bearing width differ from the standard (See Table 5 on Page B114).
- * † The tolerance for the bore diameter is 0 to –20 μm , and for overall bearing width is +356 to 0 μm .

Bore Diameter 35.717 - 41.275 mm



	Boundary Dimensions (mm)							d Ratings		Limiting		
d	D	T	В	С	Cone 1 mi	•	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	gf} $C_{0\mathrm{r}}$	(mir 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

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

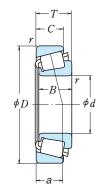
							-						
Bearing	Numbers	Ab	outment	and Fille (mm)				Eff. Load Centers	Constant	Axial Fac		Ma (k	iss g)
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone C $\gamma_{\rm a}$ max.	up	(mm) <i>a</i>	e	Y_1	Y_0	app CONE	rox. CUP
HM 88648 25880	HM 88610 25821	52 44	43 42	60 65	69 68		2.3	20.7 15.7	0.55 0.29	1.1 2.1	0.60 1.1	0.298 0.291	0.188 0.167
HM 89449 3479 44143 46143	HM 89410 3420 44348 46368	54 45.5 54 48.5	44.5 44.5 50 46.5	62 67 75 79	73 74 84 87	0.8 3 2.3 1	3.3 3.3 1.5 3.3	23.6 20.0 27.9 24.0	0.55 0.37 0.78 0.40	1.1 1.6 0.77 1.5	0.60 0.90 0.42 0.82	0.38 0.429 0.502 0.765	0.257 0.259 0.245 0.405
▲ JL 69349	▲ JL 69310	49	42.5	56	60	3.5 1	1.3	14.6	0.42	1.4	0.79	0.132	0.071
13889	13830	45	42.5	59	60	2.3 1	0.8	11.9	0.35	1.7	0.95	0.109	0.046
LM 29749	LM 29710	46	42.5	59	62		1.3	13.7	0.33	1.8	0.99	0.16	0.079
LM 29748	LM 29710	49	42.5	59	62		1.3	13.7	0.33	1.8	0.99	0.158	0.079
LM 29749	LM 29711	46	42.5	58	62	1.5 1	1.3	15.5	0.33	1.8	0.99	0.16	0.094
19150	19268	45	43	61	65		1.5	14.5	0.44	1.4	0.74	0.173	0.073
13687	13621	46.5	43	61	65		2.3	15.8	0.40	1.5	0.82	0.193	0.104
13685	13620	49.5	43	62	65	3.5 1	0.8	15.8	0.40	1.5	0.82	0.191	0.105
16150	16284	49.5	43	63	67		1.3	16.0	0.40	1.5	0.82	0.212	0.146
2788	2735 X	50	43.5	66	69		0.8	15.9	0.30	2.0	1.1	0.312	0.135
2788	2720	50	43.5	66	70	3.5 0	3.3	15.9	0.30	2.0	1.1	0.312	0.187
2788	2729	50	43.5	68	70		0.8	15.9	0.30	2.0	1.1	0.312	0.191
3490	3420	52	45.5	67	74		3.3	20.0	0.37	1.6	0.90	0.404	0.259
27880	27820	48	47	68	75	0.8 3	1.5	21.5	0.56	1.1	0.59	0.362	0.209
HM 801346	HM 801310	51	49	68	78		3.3	24.2	0.55	1.1	0.60	0.483	0.282
44150	44348	55	51	75	84		1.5	27.9	0.78	0.77	0.42	0.484	0.245
418	414	51	44.5	77	80		1.5	17.1	0.26	2.3	1.3	0.50	0.329
53150	53375	55	53	81	89).8	30.7	0.74	0.81	0.45	0.665	0.365
M 201047	M 201011	45.5	48	64	69	3.5 3	2.3	19.7	0.33	1.8	0.99	0.266	0.169
2789	2720	52	45	66	70		3.3	15.9	0.30	2.0	1.1	0.292	0.187
3386	3320	46.5	45.5	70	75		3.3	18.4	0.27	2.2	1.2	0.442	0.217
344	332	52	45.5	73	75	0.8 1	1.3	14.5	0.27	2.2	1.2	0.338	0.146
344 A	332	46	45.5	73	75		1.3	14.5	0.27	2.2	1.2	0.339	0.146
44157	44348	56	51	75	84		1.5	27.9	0.78	0.77	0.42	0.463	0.245
* LM 300849	** LM 300811	52	45	61	65		1.5	13.9	0.35	1.7	0.95	0.16	0.082
18590	18520	53	46	66	69	3.5 0	1.5	14.0	0.35	1.7	0.94	0.199	0.086
LM 501349	LM 501310	53	46.5	67	70).8	16.3	0.40	1.5	0.83	0.226	0.108
LM 501349	LM 501314	53	46.5	66	70).8	18.2	0.40	1.5	0.83	0.226	0.129
Notes & 7	The maximum here diar	motor ic I	iotod one	1 ita tala	ranga ia	nogotivo	100	o Toblo	0 4 4	an Dogg	ACO\		

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.

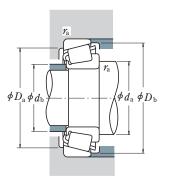
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Bore Diameter 41.275 – 44.450 mm



			Dimension	S					ad Ratings		Limiting	
		(m	nm)		Cone	Cun	1)	۷)	{k	gf}	(mir	n ⁻¹)
d	D	T	В	С	≯ mi	•	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil
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

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

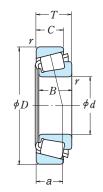
Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

Bearing Nur	nbers	Al	outment	and Fille (mm)				Eff. Load Centers	Constant		Load tors	Mass (kg)	
CONE	CUP	d_{a}	$d_{ ext{b}}$	$D_{\rm a}$	$D_{ ext{b}}$	Cone γ_z 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

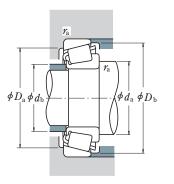
Note * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

Bore Diameter 44.450 - 47.625 mm



			Dimension	S			ļ ,	Basic Loa	ad Ratings {kgf}	Limiting (mir	
d	D	T	В	С	Cone 1 mi		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$ $C_{0 m r}$	Grease	Oil
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 30
	95.250	30.958	28.301	20.638	3.5	0.8	87 500	97 000	8 950 9 850	3 600	5 30
	95.250	30.958	28.301	20.638	1.3	0.8	87 500	97 000	8 950 9 850	3 600	5 30
	95.250	30.958	28.301	20.638	2.0	0.8	87 500	97 000	8 950 9 850	3 600	5 30
	95.250	30.958	28.301	22.225	1.3	0.8	100 000	122 000	10 200 12 500	3 600	5 00
	95.250	30.958	28.575	22.225	3.5	0.8	100 000	122 000	10 200 12 500	3 600	5 00
	98.425	30.958	28.301	20.638	3.5	0.8	87 500	97 000	8 950 9 850	3 600	5 30
	103.188	43.658	44.475	36.512	1.3	3.3	178 000	238 000	18 100 24 300	3 800	5 00
	104.775	36.512	36.512	28.575	3.5	3.3	139 000	192 000	14 200 19 600	3 400	4 80
	107.950	27.783	29.317	22.225	3.5	0.8	116 000	149 000	11 800 15 200	3 400	4 80
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450 11 200	3 200	4 30
	114.300	44.450	44.450	34.925	3.5	3.3	172 000	205 000	17 500 20 900	3 600	4 80
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 00
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 30
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 00
45.242	73.431	19.558	19.812	15.748	3.5	0.8	53 500	75 000	5 450 7 650	4 800	6 30
	77.788	19.842	19.842	15.080	3.5	0.8	56 000	71 000	5 700 7 250	4 500	6 30
	77.788	21.430	19.842	16.667	3.5	0.8	56 000	71 000	5 700 7 250	4 500	6 30
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 00
	82.931	26.988	25.400	22.225	3.5	2.3	76 500	99 000	7 800 10 100	4 500	6 00
46.000 46.038	75.000 79.375 80.962 85.000	18.000 17.462 19.050 20.638	18.000 17.462 17.462 21.692	14.000 13.495 14.288 17.462	2.3 2.8 0.8 2.3	1.5 1.5 1.5 1.3	51 000 46 000 45 000 71 500	71 500 57 000 57 000 81 500	5 200 7 300 4 700 5 800 4 600 5 800 7 300 8 300	4 500 4 500 4 300 4 300	6 30 6 00 6 00 6 00
	85.000	25.400	25.608	20.638	3.5	1.3	79 500	105 000	8 100 10 700	4 300	6 00
	95.250	27.783	29.901	22.225	3.5	0.8	106 000	126 000	10 800 12 900	4 300	5 60
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 60
	88.900	25.400	25.400	19.050	3.5	3.3	86 000	107 000	8 750 10 900	4 000	5 60
	95.250	30.162	29.370	23.020	3.5	3.3	106 000	143 000	10 800 14 500	3 800	5 30
	101.600	34.925	36.068	26.988	3.5	3.3	137 000	169 000	14 000 17 200	3 800	5 00
	111.125	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450 11 200	3 200	4 30
	112.712	30.162	26.909	20.638	3.5	3.3	92 500	110 000	9 450 11 200	3 200	4 30
	117.475	33.338	31.750	23.812	3.5	3.3	137 000	156 000	13 900 15 900	3 200	4 30
	123.825	36.512	32.791	25.400	3.5	3.3	143 000	160 000	14 600 16 400	3 000	4 00





Dynamic Equivalent Load

P = X	$F_{\rm r} + YF_{\rm a}$		
$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

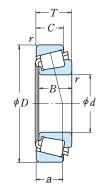
 $P_0=0.5F_r+Y_0F_a$ When $F_r>0.5F_r+Y_0F_a$, use $P_0=F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearing N	'umbers	Al	butment	t and Fille (mm				Eff. Load Centers	Constant		Load		ass <g)< th=""></g)<>
CONE	CUP	d_{a}	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone γ ma	a	(mm) a	e	Y_1	Y_0	app CONE	prox. 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	
376	374	54	54	85	88	0.8	1.3	17.1	0.34	1.8	0.97	0.492	
17887	17831	57	52	68	74	2	1.3	15.9	0.37	1.6	0.90	0.274	
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).

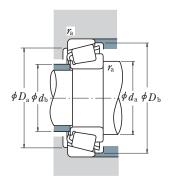
** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).

Bore Diameter 48.412 - 52.388 mm



			Dimension	S				Basic Loa		Limiting Speeds		
		(m	nm)		Cone	Cup	1)	N)	{k	gf}	(mir	n ⁻¹)
<i>d</i>	D	T	В	С	1 mi	, ''	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{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
	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	36.512	36.512	28.575	3.5	0.8	139 000	192 000	14 200	19 600	3 400	4 800
	114.300	44.450	44.450	36.068	3.5	3.3	196 000	243 000	20 000	24 800	3 400	4 800
50.000	82.000	21.500	21.500	17.000	3.0	0.5	71 000	96 000	7 250	9 800	4 300	5 600
	82.550	21.590	22.225	16.510	0.5	1.3	71 000	96 000	7 250	9 800	4 300	5 600
	88.900	20.638	22.225	16.513	2.3	1.3	73 000	85 000	7 450	8 650	4 000	5 600
	90.000	28.000	28.000	23.000	3.0	2.5	104 000	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	18.258	18.258	14.288	1.5	1.5	53 000	81 000	5 400	8 250	4 300	5 600
	82.550	23.622	22.225	18.542	3.5	0.8	71 000	96 000	7 250	9 800	4 300	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	17.462	17.462	13.495	3.5	1.5	48 500	63 000	4 950	6 450	4 300	5 600
	85.725	19.050	18.263	12.700	1.5	1.5	42 500	54 000	4 350	5 500	4 000	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	20.638	22.225	16.513	1.5	1.3	73 000	85 000	7 450	8 650	4 000	5 600
	92.075	24.608	25.400	19.845	3.5	0.8	84 500	117 000	8 600	11 900	4 000	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	30.162	30.302	23.812	3.5	0.8	103 000	136 000	10 500	13 900	3 800	5 300
	95.250	27.783	28.575	22.225	3.5	2.3	110 000	144 000	11 200	14 700	3 800	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	34.925	36.068	26.988	0.8	3.3	137 000	169 000	14 000	17 200	3 800	5 000
	101.600	34.925	36.068	26.988	3.5	3.3	137 000	169 000	14 000	17 200	3 800	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	36.512	28.575	3.5	3.3	139 000	192 000	14 200	19 600	3 400	4 800
	108.966	34.925	36.512	26.988	3.5	3.3	145 000	181 000	14 700	18 500	3 600	4 800
	111.125	30.162	26.909	20.638	3.5	3.3	113 000	152 000	11 500	15 400	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	36.512	32.791	25.400	3.5	3.3	162 000	199 000	16 500	20 300	2 800	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
	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
52.388	92.075	24.608	25.400	19.845	3.5	0.8	84 500	117 000	8 600	11 900	4 000	5 300
	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

 $P = XF_{\rm r} + YF_{\rm a}$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

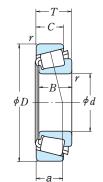
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

Bearing N	lumbers	A	butmen	t and Fille (mm			0	Eff. Load Centers	Constant		Load tors		ass <g)< th=""></g)<>
CONE	CUP	$d_{ m a}$	$d_{ m b}$	D_{a}	$D_{ m b}$	Cone γ	 a	(mm) a	e	Y_1	Y_0	app CONE	prox. 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	0.40	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	3	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).

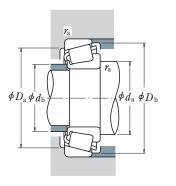
The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 53.975 - 58.738 mm



	Boundary Dimensions (mm)								ad Ratings	0	Limiting Speeds (min ⁻¹)		
d	D	T	В	С	Cone	Cup	$C_{\rm r}$	N) C_{0r}	$C_{\rm r}$	gf} C_{0r}	Grease	Oil	
и	D	1	D	C	mii		C _r	c_{0r}	$c_{\rm r}$	c_{0r}	dicaso	OII	
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

 $P = XF_r + YF_a$

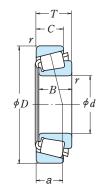
$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$						
X	Y	X	Y					
1	0	0.4	<i>Y</i> ₁					

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

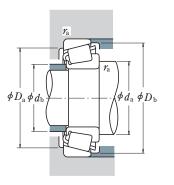
Bearing N	umbers	Ai	butmeni	t and Fille (mm			Cun	Eff. Load Centers	Constant	Axial Fact	Load tors		ass kg)
CONE	CUP	$d_{\scriptscriptstyle \mathrm{a}}$	$d_{ m b}$	D_{a}	$D_{ m b}$	Cone γ	a	(mm) a	e	Y_1	Y_0	app CONE	prox. CUP
4595	4535	70	63	90	99	3.5	3.3	27.4	0.34	1.79	0.98	0.989	0.589
539	532 X	68	61	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	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	
469	453 X	70	63	92	98	3.5	3.3	23.1	0.34	1.8	0.98	0.692	
462	453 X	67	63	92	98	2.3	3.3	23.1	0.34	1.8	0.98	0.694	
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	3.3	28.7	0.40	1.5	0.82	0.899	0.541

Bore Diameter 60.000 - 64.963 mm



	Boundary Dimensions							Basic Load	l Ratings		Limiting Speeds		
		(m	nm)		Cone	Cup	1)	N)	{k	gf}	(min	n ⁻¹)	
d	D	T	B	С	ν min	•	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil	
60.000	95.000	24.000	24.000	19.000	5.0	2.5	86 500	125 000	8 800	12 800	3 600	5 000	
	104.775	21.433	22.000	15.875	2.3	2.0	83 500	107 000	8 500	10 900	3 400	4 500	
	110.000	22.000	21.996	18.824	0.8	1.3	85 500	113 000	8 750	11 500	3 200	4 300	
	122.238	33.338	31.750	23.812	3.5	3.3	135 000	156 000	13 800	15 900	3 000	4 000	
60.325	100.000	25.400	25.400	19.845	3.5	3.3	91 000	135 000	9 250	13 700	3 400	4 800	
	101.600	25.400	25.400	19.845	3.5	3.3	91 000	135 000	9 250	13 700	3 400	4 800	
	122.238	38.100	36.678	30.162	2.3	3.3	161 000	221 000	16 400	22 500	3 000	4 000	
	122.238	38.100	38.354	29.718	8.0	1.5	188 000	245 000	19 200	25 000	3 000	4 000	
	122.238	43.658	43.764	36.512	0.8	3.3	198 000	292 000	20 200	29 700	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	
	130.175	41.275	41.275	31.750	3.5	3.3	195 000	263 000	19 800	26 800	2 800	3 800	
	135.755	53.975	56.007	44.450	3.5	3.3	264 000	355 000	27 000	36 000	2 800	3 800	
61.912	136.525	46.038	46.038	36.512	3.5	3.3	233 000	370 000	23 800	37 500	2 600	3 400	
	146.050	41.275	39.688	25.400	3.5	3.3	193 000	225 000	19 700	22 900	2 400	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	
63.500	94.458	19.050	19.050	15.083	1.5	1.5	59 000	100 000	6 050	10 200	3 600	4 800	
	104.775	21.433	22.000	15.875	2.0	2.0	83 500	107 000	8 500	10 900	3 400	4 500	
	107.950	25.400	25.400	19.050	1.5	3.3	90 000	138 000	9 150	14 100	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	
	110.000	22.000	21.996	18.824	1.5	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	30.162	23.812	3.5	3.3	142 000	202 000	14 500	20 600	3 200	4 300	
	112.712	33.338	30.048	26.988	3.5	3.3	120 000	173 000	12 200	17 700	3 200	4 300	
	122.238	38.100	38.354	29.718	7.0	3.3	188 000	245 000	19 200	25 000	3 000	4 000	
	122.238	38.100	38.354	29.718	7.0	1.5	188 000	245 000	19 200	25 000	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	43.658	43.764	36.512	3.5	3.3	198 000	292 000	20 200	29 700	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	
	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	3.5	3.3	195 000	263 000	19 800	26 800	2 800	3 800	
	136.525	36.512	33.236	23.520	2.3	3.3	152 000	183 000	15 500	18 700	2 600	3 600	
	136.525	41.275	41.275	31.750	3.5	3.3	195 000	263 000	19 800	26 800	2 800	3 800	
	140.030	36.512	33.236	23.520	2.3	2.3	152 000	183 000	15 500	18 700	2 600	3 600	
64.963	127.000	36.512	36.170	28.575	3.5	3.3	166 000	234 000	16 900	23 900	2 800	3 800	





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

 $P_0 = 0.5F_r + Y_0 F_a$ When $F_{\rm r}\!>\!0.5F_{\rm r}\!+\!Y_0F_{\rm a}$, use $P_0\!=\!F_{\rm r}$ The values of $e,\,Y_1$, and Y_0 are given in the table below.

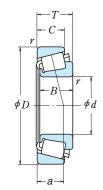
Bearing N	umbers	Al	butmen	t and Fille (mm	et Dimer	nsions Cone	Cup	Eff. Load Centers (mm)	Constant		Load tors		ass (g)
CONE	CUP	$d_{ m a}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	ra ma	a	a (mm)	e	Y_1	Y_0	app CONE	orox. CUP
▲ JLM 508748	▲ JLM 508710	75	66	85	91	5	2.5	21.6	0.40	1.5	0.82	0.43	0.20
* 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	563	81	74	112	120	3.5	3.3	28.3	0.36	1.6	0.91	1.41	0.655

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.

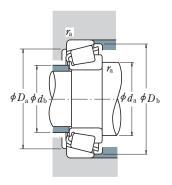
B 155 B 154

Bore Diameter 65.000 - 69.850 mm



	Boundary Dimensions (mm)							Basic Loa		Limiting Speeds		
			,		Cone	Cup	1)			gf}	(mir	
d	D	T	В	С	∤ mi		$C_{\rm r}$	C_{0r}	C_{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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$					
X	Y	X	Y				
1	0	0.4	Y_1				

Static Equivalent Load

given in the table below.

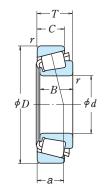
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are

Bearing N	umbers	A	butment	t and Fill (mm			Centers	Constant		Load tors		ass (g)
CONE	CUP	$d_{ m a}$	$d_{\scriptscriptstyle m b}$	D_{a}	$D_{ m b}$	Cone Cu $oldsymbol{\mathcal{Y}}_{\mathrm{a}}$ max.	p (mm) a	e	Y_1	Y_0	app CONE	orox. CUP
▲ JLM 710949	▲ JLM 710910	77	71	96	101	3 1	3 24.3	0.45	1.3	0.73	0.526	0.237
▲ JM 511946	▲ JM 511910	78	72	99	105	3 2.		0.40	1.5	0.82	0.72	0.342
478	472 A	77	73	106	114	2.3 3.		0.38	1.6	0.86	0.942	0.466
▲ JH 211749	▲ JH 211710	80	74	107	114	3 2.		0.34	1.8	0.98	1.25	0.625
6379	6320	84	77	117	126	3.5 3.		0.32	1.8	1.0	2.25	1.39
H 715340	H 715311	88	82	118	132	3.5 3.		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.		0.40	1.5	0.82	0.524	0.263
3984	3920	80	74	99	106	3.5 3.		0.40	1.5	0.82	0.712	0.454
3994	3920	84	74	99	106	5.5 3.	8 23.5	0.40	1.5	0.82	0.706	0.454
39590	39521	80	74	103	107	3.5 0.		0.34	1.8	0.97	0.822	0.365
39590	39520	80	74	101	107	3.5 3.		0.34	1.8	0.97	0.822	0.359
33262	33462	81	75	104	112	3.5 3.	3 28.8	0.44	1.4	0.76	0.911	0.442
560	553 X	81	75	108	115	3.5 3.		0.35	1.7	0.95	1.14	0.692
HM 212049	HM 212010	82	75	110	116	3.5 1.		0.34	1.8	0.98	1.25	0.604
HM 212049	HM 212011	81	74	108	116	3.5 3.	3 28.8	0.34	1.8	0.98	1.25	0.598
560	552 A	81	75	109	116	3.5 3.		0.35	1.7	0.95	1.14	0.764
H 715341	H 715311	89	83	118	132	3.5 3.		0.47	1.3	0.70	2.34	0.961
399 A	394 A	78	74	101	104	2.3 1.	25.1	0.40	1.5	0.82	0.497	0.263
480	472	83	76	106	113	3.5 2		0.38	1.6	0.86	0.862	0.493
560 S	553 X	83	76	108	115	3.5 3.		0.35	1.7	0.95	1.09	0.692
570 H 414245 H 715343 9185	563 H 414210 H 715311 9121	83 86 90 94	77 82 84 81	112 121 118 130	120 129 132 145	3.5 3. 3.5 3. 3.5 3. 3.5 3.	3 30.6 3 37.1	0.36 0.36 0.47 0.66	1.6 1.7 1.3 0.92	0.91 0.92 0.70 0.50	1.32 1.95 2.28 2.53	0.655 0.796 0.961 1.21
LM 613449	LM 613410	78	76	104	107	1.5 0.	3 26.3	0.42	1.4	0.79	0.562	0.238
29675	29620	80	77	101	109	1.5 3.		0.49	1.2	0.68	0.695	0.273
33275	33462	84	77	104	112	3.5 3.		0.44	1.4	0.76	0.83	0.442
47487	47420	84	78	107	114	3.5 3.	3 26.3	0.36	1.7	0.92	1.02	0.477
29675	29630	79	78	105	113	1.5 3.		0.49	1.2	0.68	0.695	0.489
566	563 X	85	78	114	120	3.5 0.		0.36	1.6	0.91	1.27	0.658
643	633	86	80	116	124	3.5 3.	3 44.4	0.36	1.7	0.91	1.56	0.712
H 913849	H 913810	95	82	124	138	3.5 3.		0.78	0.77	0.42	1.95	0.898
655	653	88	82	131	139	3.5 3.		0.41	1.5	0.81	2.35	0.891
6454	6420	94	85	129	140	5 3.	3 32.5	0.36	1.7	0.91	2.95	1.63
745 A	742	88	82	134	142	3.5 3.		0.33	1.8	1.0	2.82	1.07

B 156 B 157

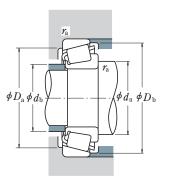
SINGLE-ROW TAPERED ROLLER BEARINGS (INCH DESIGN)

Bore Diameter 70.000 - 76.200 mm



	Boundary Dimensions (mm)							Basic Load	l Ratings		Limiting	Speeds
		(m	nm)		Cone	Cup	1)	V)	{k	gf}	(mir	n ⁻¹)
d	D	T	В	С	r min		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	Grease	Oil
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
	161.925 161.925 161.925	53.975 53.975 53.975	55.100 55.100 55.100	42.862 42.862 42.862	3.5 6.4 6.4	3.3 3.3 0.8	325 000 325 000 325 000	480 000 480 000 480 000	33 000 33 000 33 000	49 000 49 000 49 000	2 200 2 200 2 200	3 000 3 000





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

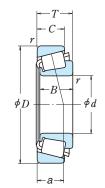
given in the table below.

 $P_0=0.5F_r+Y_0F_a$ When $F_r>0.5F_r+Y_0F_a$, use $P_0=F_r$ The values of $e,\ Y_1$, and Y_0 are

Bearing Nu	umbers	Al	butment	t and Fille (mm	et Dimen			Eff. Load Centers	Constant		Load		ass <g)< th=""></g)<>
CONE	CUP	d_{a}	$d_{ m b}$	D_{a}	$D_{ m b}$	Cone Y ma	a	(mm) a	e	Y_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	0.304
▲ JM 612949	▲ JM 612910	83	77	103	110	3	2.5	26.4	0.43	1.4	0.77	0.800	0.362
484	472	80	78	106	113	2	2	25.1	0.38	1.6	0.86	0.822	0.493
33281	33462	85	79	104	112	3.5	3.3	26.8	0.44	1.4	0.76	0.789	0.442
47490	47420	86	79	107	114	3.5	3.3	26.0	0.36	1.7	0.92	0.983	0.477
567 S	563	92	80	112	120	6.4	3.3	28.3	0.36	1.6	0.91	1.21	0.655
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		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

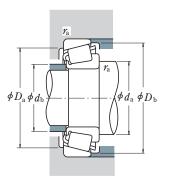
SINGLE-ROW TAPERED ROLLER BEARINGS (INCH DESIGN)

Bore Diameter 76.200 - 83.345 mm



Boundary Dimensions (mm)								Basic Load	•		Limiting Speeds		
		•	,		Cone	Cup		N)		gf}	(mir		
d	D	T	В	С	∤ mi		$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{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

 $P = XF_r + YF_a$

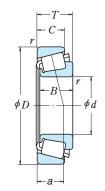
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

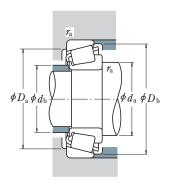
Bearing Numb	ers	Al	outment	and Fille				Eff. Load Centers	Constant	Axial Fac			ass (g)
CONE	CUP	d_{a}	$d_{\scriptscriptstyle m b}$	$D_{\rm a}$	$D_{ m b}$	Cone γ	a	(mm) a	e	Y_1	Y_0	app CONE	orox. CUP
843	832	101	89	149	155	6.4	3.3	35.2	0.30	2.0	1.1	4.11	1.74
837	832	90	89	149	155	0.8	3.3	35.2	0.30	2.0	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 27689	27620 27620 erances are liste	96 90	90 90	115 115	120 120	3.5 0.8	1.5 1.5	25.7 25.7	0.42 0.42	1.4 1.4	0.79 0.79	0.727 0.732	0.348 0.348

Bore Diameter 84.138 - 90.488 mm



			Dimension	s				Basic Loa	nd Ratings		Limiting	Speeds
		(mm) D T B C				Cup	1)	1)	{k	gf}	(mir	n ⁻¹)
d	D	T	В	С	γ mir	•	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	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

Static Equivalent Load

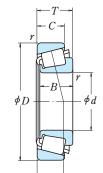
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearii	ng Numbers	ŀ	Abutmen	t and Fil	let Dimer	nsions		Eff. Load Centers	Constant		Load tors		ass (q)
CONE	CUP	$d_{ m a}$	$d_{ m b}$	$D_{ m a}$,	1	Cup Ya ax.	(mm)	e	Y_1	Y_0		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 716610	104	92	117	125	6	2.5	29.5	0.44	1.4	0.74	0.931	0.461
▲ JM 716649	▲ JM 716610	98	92	117	125	3	2.5	29.5	0.44	1.4	0.74	0.943	0.461
▲ JHM 516849	▲ JHM 516810	100	94	125	134	3	2.5	33.3	0.41	1.5	0.81	1.55	0.768
▲ JH 217249	▲ JH 217210	101	95	134	142	3	2.5	33.9	0.33	1.8	0.99	2.29	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 A	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 A	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	▲ JM 718110	105	99	131	139	3	2.5	33.0	0.44	1.4	0.74	1.49	0.66
*HM 218248	**HM 218210	111	98	133	141	7	3.5	30.8	0.33	1.8	0.99	1.77	0.796
▲ JHM 318448	▲ JHM 318410	106	100	140	148	3	2.5	34.1	0.34	1.7	0.96	2.32	1.01
760	752 The maximum hore dia	107	101	144	150	3.5	3.3	35.6	0.34	1.8	0.97	2.38	1.61

otes * The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

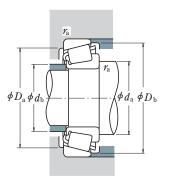
- ** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).
- The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 92.075 - 100.012 mm



	Boundary Dimensions (mm)								d Ratings		Limiting	Speeds
		(1	mm)		Cone	Cup	1)	V)	{k	gf}	(mir	n ^{−1})
<i>d</i>	D	T	В	С	<i>1</i> mi	,	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	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

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

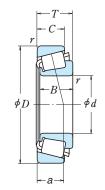
Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

Bearir	ng Numbers	Д	butmen		let Dimer	sions		Eff. Load	Constant		Load		ass
CONE	CUP	d_{a}	$d_{ ext{b}}$	(mn $D_{ m a}$	$D_{ m b}$	1	Cup r _a	(mm) a	e	Y_1	etors Y_0		kg) 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 /	A 592 A 672 854	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	47820	110	103	131	140	3.5	3.3	32.3	0.45	1.3	0.74	1.33	0.664
42375	42584	108	103	134	142	3	3	31.8	0.49	1.2	0.67	1.18	0.553
42376	42587	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	77675 772 854 HH 221410	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	42584	110	104	134	142	3.5	3	31.8	0.49	1.2	0.67	1.13	0.553
42381	42587	111	105	135	143	3.5	3.3	34.9	0.49	1.2	0.67	1.13	0.711
52387	52637	114	108	144	154	3.5	3.3	36.1	0.47	1.3	0.69	1.89	0.942
685	672	116	109	149	160	3.5	3.3	38.3	0.47	1.3	0.70	2.32	1.24
779	772	116	110	161	168	3.5	3.3	39.1	0.39	1.6	0.86	3.06	1.99
866	854	118	111	170	174	3.5	3.3	41.8	0.33	1.8	0.99	4.38	2.55
HH 221442	HH 221410	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	Å JLM 820012	111	107	135	144	2.3	2.3	36.8	0.50	1.2	0.66	1.27	0.616
▲ JM 720249	Å JM 720210	115	109	140	149	3	2.5	36.8	0.47	1.3	0.70	1.68	0.772
▲ JHM 720249	Å JHM 720210	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
Note A	The tolerances are liste	d in Tabl	es 2. 3	and 4 or	Pages E	113 a	nd B1 1	4					

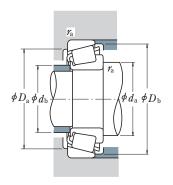
SINGLE-ROW TAPERED ROLLER BEARINGS (INCH DESIGN)

Bore Diameter 101.600 - 117.475 mm



	Boundary Dimensions (mm)							Basic Loa	d Ratings		Limiting	Speeds
		(1	mm)		Cone	Сир	1)	۷)	{kg	gf}	(mir	∩ ⁻¹)
d	D	T	В	С	r min		$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	Grease	Oil
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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

Bearing	Numbers	Å	Abutmen	t and Fil (mn	llet Dimer			Eff. Load Constant Centers			Load		l ass kg)
CONE	CUP	$d_{\scriptscriptstyle m a}$	$d_{ m b}$	D_{a}	$D_{ m b}$	1	e Cup r _a nax.	(mm) a	e	Y_1	Y_0	apı CONE	prox. 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 Notes **	71750 68712	133 132	126 125	171 163	181 172	3.5 3.5	3.3 3.3	40.1 40.0	0.42 0.50	1.4 1.2	0.79 0.66	3.31 1.73	1.71 1.05

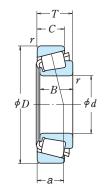
** The maximum outside diameter is listed and its tolerance is negative (See Table 8.4.2 on Pages A68 and A69).

▲ The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

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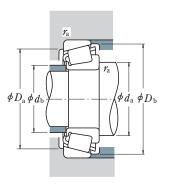
SINGLE-ROW TAPERED ROLLER BEARINGS (INCH DESIGN)

Bore Diameter 120.000 - 165.100 mm



	Boundary Dimensions (mm)							Basic Loa	•		Limiting Speeds		
		,	,		Cone	Cup	,	۷)		gf}	(mii	,	
<i>d</i>	D	T	В	С	γ mir		$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	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

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

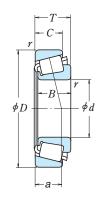
 $P_0=0.5F_{\rm r}+Y_0F_{\rm a}$ When $F_{\rm r}>0.5F_{\rm r}+Y_0F_{\rm a}$, use $P_0=F_{\rm r}$ The values of $e,~Y_1$, and Y_0 are given in the table below.

Bearing	Numbers	ŀ	Abutmen	Abutment and Fillet Dimensions (mm) Cone Cup						t Axial Load Factors		Mass (kg)	
CONE	CUP	d_{a}	$d_{ m b}$	D_{a}	$D_{ m b}$	1	e Cup r _a nax.	(mm) a	e	Y_1	Y_0	ap CONE	oprox. 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	46720	176	169	209	218	3.5	3.3	44.3	0.38	1.6	0.86	3.69	1.66
67780	67720	185	179	229	240	3.5	3.3	52.4	0.44	1.4	0.75	5.83	2.33

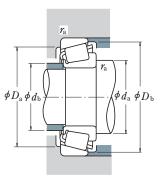
* The maximum bore diameter is listed and its tolerance is negative (See Table 8.4.1 on Page A68).

▲ The tolerances are listed in Tables 2, 3 and 4 on Pages B113 and B114.

Bore Diameter 170.000 - 206.375 mm



			Dimensio	ns			,	Basic Load	~f)	Limiting Speeds (min ⁻¹)		
d	D	T	В	С	Cone Cup r min.		$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	gf} $C_{0\mathrm{r}}$	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

 $P = XF_{\rm r} + YF_{\rm a}$

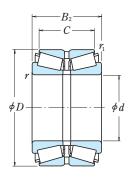
$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	0	0.4	<i>Y</i> ₁

Static Equivalent Load

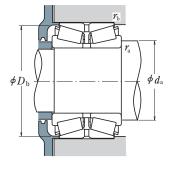
 $P_0=0.5F_r+Y_0F_a$ When $F_r>0.5F_r+Y_0F_a$, use $P_0=F_r$ The values of e, Y_1 , and Y_0 are given in the table below.

Bearing	Numbers	Α	Abutmen	t and Fil	let Dimer	sions		Eff. Load Centers	Constant	Axial Load Factors		Mass (kg)	
CONE	CUP	d_{a}	$d_{\scriptscriptstyle m b}$	$D_{ m a}$	$D_{ m b}$	1	Cup r _a ax.	(mm) a	e	Y_1	Y_0		orox. 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

Bore Diameter 40 – 90 mm



			Dimensions	3		Basic Loa	d Ratings	Limiting Spe	eds (min-1)
		(r	mm)			1)	1)		
d	D	B_2	С	γ min.	${m \gamma}_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$				
X	Y	X	Y			
1	Y_3	0.67	Y_2			

Static Equivalent Load

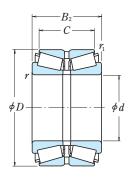
 $P_0 = F_r + Y_0 F_a$

The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

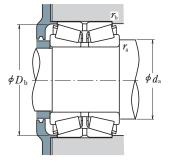
D : N .	Abutme	ent and F (m		ensions	Constant	F	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	${\pmb{\gamma}}_a$ max.	$ m \emph{r}_b$ max.	e	Y_2	Y_3	Y_0	approx.
HR 40 KBE 42+L	51	75	1.5	0.6	0.37	2.7	1.8	1.8	0.97
HR 45 KBE 42+L	56	81	1.5	0.6	0.40	2.5	1.7	1.6	1.08
HR 45 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.

Bore Diameter 90 – 120 mm



			y Dimension	18			oad Ratings	Limiting Spe	eds (min ⁻¹)
d	D	B_2	С	γ min.	${m \gamma}_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$			
X	Y	X	Y		
1	Y_3	0.67	Y_2		

Static Equivalent Load

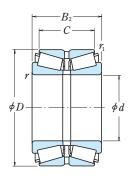
 $P_0 = F_r + Y_0 F_a$

The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Decide a Novelle and	Abutme	ent and F (m		ensions	Constant	F	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$m{\gamma}_{\mathrm{a}}$ max.	${m \gamma}_{ m b}$ max.	e	Y_2	Y_3	Y_0	approx.
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 KBE2001+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

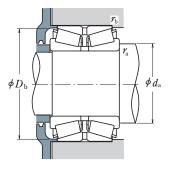
Remarks For other double-row tapered roller bearings not listed above, please contact NSK.

Bore Diameter 125 - 150 mm



			y Dimensions mm)	3			oad Ratings	Limiting Spe	eds (min ⁻¹)
d	D	B_2	С	γ min.	${m \gamma}_1$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	r≤e	$F_{\rm a}/F_{\rm r} > e$			
X	Y	X	Y		
1	Y_3	0.67	Y_2		

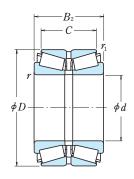
Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

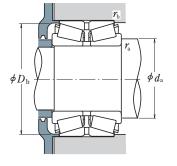
The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Desvine Numbers	Abutme	ent and Fi (m		ensions	Constant	Α	xial Load Factors	t	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$m{\gamma}_{\mathrm{a}}$ max.	${m \gamma}_{ m b}$ 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 KBE2101+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 KBE2502+L	168	238	2.5	1	0.37	2.7	1.8	1.8	20.9
150 KBE2601+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	

Bore Diameter 160 - 200 mm



			y Dimensio	ns			ad Ratings	Limiting Spe	eds (min ⁻¹)
<i>d</i>	D	B_2	С	γ min.	$m{\mathscr{V}}_1$ min.	C_{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
	280 280 280 310	88 110 150 192	78 88 130 152	3 3 5	1 1 1 1.5	630 000 820 000 1 110 000 1 590 000	1 040 000 1 450 000 2 160 000 2 910 000	900 900 1 000 900	1 300 1 300 1 300 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



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r} > e$			
X	Y	X Y			
1	Y_3	0.67	Y_2		

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

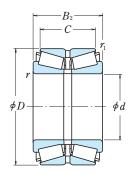
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Bearing Numbers	Abutme	ent and F (m	illet Dime m)	ensions	Constant	F	Axial Load Factors	d	Mass (kg)
bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$m{\gamma}_{a}$ max.	$m{\gamma}_{ m b}$ max.	e	Y_2	Y_3	Y_0	approx.
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 KBE2401+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 KBE2701+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.

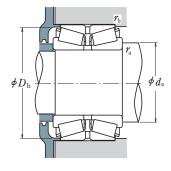


Bore Diameter 206 - 260 mm



			y Dimensior mm)	18			oad Ratings	Limiting Spe	eds (min ⁻¹)
d	D	B_2	С	γ min.	${m \gamma}_1$ 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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	r≤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 $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Decring Mumbers	Abutm	ent and F		ensions	Constant		xial Load Factors	d	Mass (kg)
Bearing Numbers	$d_{ m a}$ min.	$D_{ m b}$ min.	$m{\gamma}_{\mathrm{a}}$ max.	${m \gamma}_{ m b}$ 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.



Table 2 Number of Oil Holes

PERMISSIBLE MISALIGNMENT

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.



C and CD

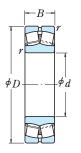
	allu nules	•	Units : mm			
lominal Outer over	Ring Width <i>C</i>	Oil Groove Width W	Hole Diameter $d_{ extsf{OH}}$		er Ring Dia D \mathbf{nm})	Number
18	30	5	2.5	over	incl.	of Holes
30 40	40 50	6 7	3 4	180	180 250	4 6 6
50 65	65 80	8 10	5	250	315	
80	100	12	6 8	315 400	400 500	6 6 8
100 120	120 160	15 20	10 12	500	630	
160	200	25	15	630 800	800 1000	8 8
200 250	250 315	30 35	20 20	1000	1250	8
315 400	400 —	40 40	25 25	1250 1600	1600 2000	8

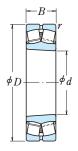
And if the load on spherical roller bearings becomes too small during operation or if the ratio of axial and radial loads is larger than the value of 'e'(listed in the bearing tables), slippage occurs between the rollers and raceways, which may result in smearing. The higher the weight of the rollers 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

B 182 B 183

Bore Diameter 20 - 55 mm







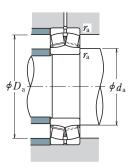
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Вс	oundary (m	Dimensi	ons		Basic Load	Ratings {kg	afl	Limiting (mir		Bearing
d	D	В	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e		
X	Y	X	Y		
1	Y_3	0.67	Y ₂		

Static Equivalent Load

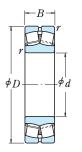
 $P_0 = F_r + Y_0 F_a$

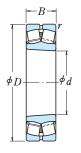
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Numbers	Д	butment	and Fillet Dir (mm)	nensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{\scriptscriptstyle ext{min.}}$	max.	$D_{ m a}$	min.	${\pmb{\gamma}}_a$ 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	31	31	46	45	1	0.35	2.9	1.9	1.9	0.17
21305CDKE4	32	34	55	51		0.29	3.4	2.3	2.3	0.26
22206CKE4	36	37	56	54	1	0.33	3.1	2.1	2.0	0.27
21306CDKE4	37	40	65	59		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

- The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
 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_r); Normal Loads (0.05 to 0.10 C_r); and Heavy Loads (>0.10 C_r). 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B358 B359, and B366.

Bore Diameter 60 - 85 mm







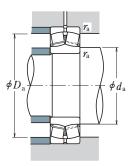
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Вс	oundary (m	Dimensi nm)	ons	(1	Basic Load	•	gf}	Limiting (mir	•	Bearing	
d	D	В	γ min.	$C_{ m r}$	C_{0r}	C_{r}	C_{0r}	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	





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y_3	0.67	<i>Y</i> ₂

Static Equivalent Load

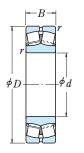
 $P_0 = F_r + Y_0 F_a$

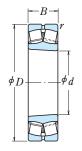
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Numbers	ı	Abutment	and Fillet Dia	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d	a max.	$_{ m max.}$ D	a min.	${\pmb{\gamma}}_a$ 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

- The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
 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_r); Normal Loads (0.05 to 0.10 C_r); and Heavy Loads (>0.10 C_r). 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages **B359 B361**, and **B366**.

Bore Diameter 90 – 110 mm







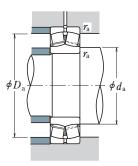
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

Вс		Dimensio nm)	ins	(Basic Load I	v	gf}	Limiting (mir		Bearing
d	D	B	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y_3	0.67	Y_2

Static Equivalent Load

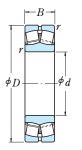
 $P_0 = F_r + Y_0 F_a$

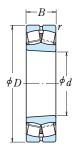
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

Numbers	Å	Abutment a		Constant		xial Loa Factors		Mass (kg)		
Tapered Bore(1)	d_{i} min.	a max.	$D_{ m max}$	a min.	${\pmb{\gamma}}_a$ 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	110	—	155	143	2	0.35	2.9	1.9	1.9	5.42
*22220EAKE4	112	119	168	160	2	0.24	4.3	2.9	2.8	4.84
23220CKE4	112	118	168	155	2	0.32	3.2	2.1	2.1	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

- The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
 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_r); Normal Loads (0.05 to 0.10 C_r); and Heavy Loads (>0.10 C_r). 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages **B360 B361**, and **B366 B367**.

Bore Diameter 120 - 150 mm





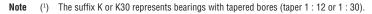


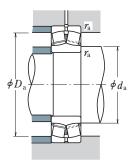
Cylindrical Bore

Tapered Bore

Without an Oil Groove or Holes

В		Dimensi	ons		Basic Load	0	:gf}	Limiting (mir		Bearing
d	D	В	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	$C_{0\mathrm{r}}$	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

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y_3	0.67	<i>Y</i> ₂

Static Equivalent Load

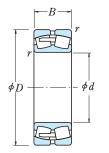
 $P_0 = F_r + Y_0 F_a$

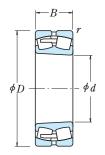
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

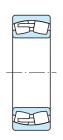
Numbers	,	Abutment	and Fillet Dir	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d min.	a max.	$D_{ m a}$	a min.	r a max.	e	Y_2	Y_3	Y_0	approx.
23024CDKE4	130	134	170	163	2	0.22	4.5	3.0	2.9	4.11
24024CK30E4	130	131	170	158	2	0.32	3.2	2.1	2.1	5.33
23124CKE4	130	138	190	175	2	0.29	3.5	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

- The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
 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_r); Normal Loads (0.05 to 0.10 C_r); and Heavy Loads (>0.10 C_r). 3. For the dimensions of adapters and withdrawal sleeves, refer to Pages B361 B362, and B367 B368.

Bore Diameter 160 - 190 mm







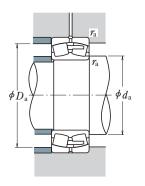
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

В		Dimensi	ions	,	Basic Load	•		Limiting		Bearing
d	$D^{''}$	В	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	gf} $C_{0\mathrm{r}}$	(mii 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





Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/I$	r > e
X	Y	X	Y
1	Y_3	0.67	Y_2

Static Equivalent Load

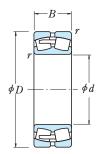
 $P_0 = F_r + Y_0 F_a$

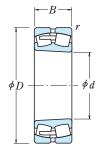
The values of \emph{e} , \emph{Y}_{2} , \emph{Y}_{3} , and \emph{Y}_{0} are given in the table below.

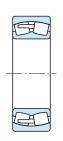
Numbers	ı	Abutment	and Fillet Dir	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d min.	a max.	$D_{ m max}$	a min.	γ _a max.	e	Y_2	Y_3	Y_0	approx.
23932CAKE4	170	—	210	203	2	0.18	5.6	3.8	3.7	4.97
23032CDKE4	172	179	228	216	2	0.22	4.5	3.0	2.9	9.66
24032CK30E4	172	177	228	212	2	0.30	3.4	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	188	201	292	261	3	0.34	2.9	2.0	1.9	36.4
22334CAKE4	188		342	304	3	0.35	2.9	1.9	1.9	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**.

Bore Diameter 200 - 260 mm







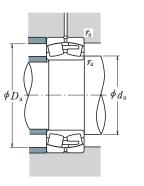
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Во		Dimensi nm)	ons	(1	Basic Load	•	gf}	Limiting (mir		Bearing
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}	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

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/F$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$				
X	Y	X	Y			
1	Y_3	0.67	Y_2			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

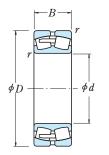
The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

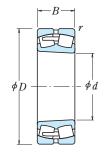
Numbers	,	Abutment	and Fillet Dir (mm)	mensions		Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	d min.	a max.	\mathcal{D} max.	a min.	${m \gamma}_{\rm a}$ max.	e	Y_2	Y_3	Y_0	approx.
23940CAKE4	212		268	258	2	0.20	5.1	3.4	3.3	11
23040CAKE4	212		298	279	2	0.25	4.0	2.7	2.6	22.6
24040CK30E4	212	223	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

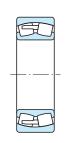
Remarks For the dimensions of adapters and withdrawal sleeves, refer to Pages **B363** and **B369**.

B 194 B 195

Bore Diameter 280 - 340 mm







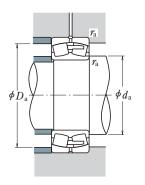
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Во	oundary (r	Dimensi nm)	ions	(1	Basic Load	•	gf}	Limiting (Bearing
d	D	В	γ min.	C_{r}	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	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

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$				
X	Y	X	Y			
1	Y_3	0.67	Y_2			

Static Equivalent Load

 $P_0 = F_r + Y_0 F_a$

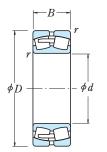
The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

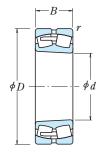
Numbers	Abutme	nt and Fille (mm		ons	Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	\mathcal{D} max.) _a min.	${m \gamma}_{ m a}$ max.	e	Y_2	Y_3	Y_0	approx.
23956CAKE4	292	368	351	2	0.18	5.7	3.9	3.8	24.5
23056CAKE4	298	402	377	3	0.24	4.2	2.8	2.7	50.5
24056CAK30E4	298	402	369	3	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	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	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







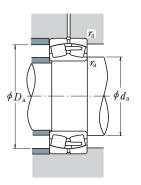
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

Во		Dimensi	ons	(1	Basic Load	Ü	gf}	Limiting S		Bearing
d	D	В	γ min.	$C_{ m r}$	C_{0r}	$C_{ m r}$	C_{0r}	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		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 7 610 000 7 705 000	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

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F$	r > e		
X	Y	X	Y		
1	Y_3	0.67	Y_2		

Static Equivalent Load

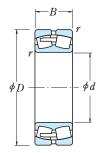
 $P_0 = F_r + Y_0 F_a$

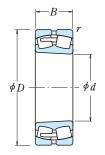
The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Numbers	Abutment and Fillet Dimensions (mm)						xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	L max.) _a min.	r 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







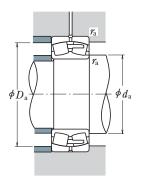
Cylindrical Bore

Tapered Bore

Without an Oil Groove and Holes

E	Boundary (r	Dimens nm)	ions	(Basic Load	•	kgf}	Limiting S	•	Bearing
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	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

Note (1) The suffix K or K30 represents bearings with tapered bores (taper 1:12 or 1:30).



Dynamic Equivalent Load

 $P = XF_r + YF_a$

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$			
X	Y	X	Y		
1	Y_3	0.67	Y_2		

Static Equivalent Load

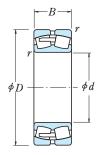
 $P_0 = F_r + Y_0 F_a$

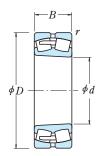
The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Numbers	Abutme	ent and Fille (mm	et Dimensi	ons	Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	L max.) _a min.	${\pmb{\gamma}}_{\rm a}$ 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.

Bore Diameter 600 - 800 mm

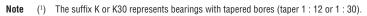


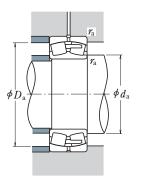


Cylindrical Bore

Tapered Bore

E	Boundary		ions		Basic Load	•		Limiting S	•	Bearing
		nm)		(1)			gf}	(min ⁻		
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	$C_{0\mathrm{r}}$	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

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$				
X	Y	X	Y			
1	Y_3	0.67	Y_2			

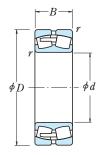
Static Equivalent Load

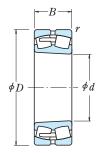
 $P_0 = F_r + Y_0 F_a$

The values of $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

Numbers	Abutm	ent and Fil (mr	l et Dimens n)	ions	Constant		xial Loa Factors		Mass (kg)
Tapered Bore(1)	$d_{ m a}$ min.	max.	$D_{ m a}$ min.	${m \gamma}_{\rm a}$ max.	e	Y_2	Y_3	Y_0	approx.
239/600CAKE4	622	778	745	4	0.17	5.9	3.9	3.9	205
230/600CAKE4	628	842	794	5	0.21	4.8	3.3	3.2	389
240/600CAK30E4	628	842	772	5	0.30	3.3	2.2	2.2	529
231/600CAKE4	636	944	856	6	0.30	3.4	2.3	2.2	898
241/600CAK30E4	636	944	836	6	0.39	2.6	1.8	1.7	1 050
232/600CAKE4	644	1 046	923	8	0.36	2.8	1.9	1.8	1 590
239/630CAKE4	658	822	786	5	0.18	5.6	3.8	3.7	259
230/630CAKE4	666	884	835	6	0.22	4.7	3.1	3.1	468
240/630CAK30E4	666	884	815	6	0.30	3.3	2.2	2.2	637
231/630CAKE4	666	994	900	6	0.30	3.4	2.3	2.2	1 040
241/630CAK30E4	666	994	876	6	0.38	2.7	1.8	1.7	1 250
232/630CAKE4	684	1 096	970	10	0.36	2.8	1.9	1.8	1 850
239/670CAKE4 230/670CAKE4 240/670CAK30E4 231/670CAKE4	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
241/670CAK30E4	706	1 054	934	6	0.37	2.7	1.8	1.8	1 440
232/670CAKE4	724	1 166	1 024	10	0.37	2.7	1.8	1.8	2 210
239/710CAKE4	738	922	883	5	0.17	5.8	3.9	3.8	352
230/710CAKE4	746	994	936	6	0.22	4.6	3.1	3.0	647
240/710CAK30E4	746	994	916	6	0.29	3.4	2.3	2.2	861
241/710CAK30E4	754	1 106	981	8	0.38	2.6	1.8	1.7	1 730
232/710CAKE4	764	1 226	1 080	10	0.36	2.8	1.9	1.8	2 470
239/750CAKE4	778	972	931	5	0.17	6.0	4.1	4.0	398
230/750CAKE4	786	1 054	990	6	0.22	4.6	3.1	3.0	768
240/750CAK30E4	786	1 054	969	6	0.29	3.4	2.3	2.2	1 030
232/750CAKE4	814	1 296	1 148	12	0.36	2.8	1.9	1.8	2 980
239/800CAKE4	828	1 032	987	5	0.17	6.0	4.0	3.9	462
230/800CAKE4	836	1 114	1 045	6	0.21	4.7	3.2	3.1	870
240/800CAK30E4	836	1 114	1 029	6	0.27	3.7	2.5	2.5	1 130
231/800CAKE4	844	1 236	1 127	8	0.28	3.6	2.4	2.3	1870
232/800CAKE4	864	1 356	1 208	12	0.35	2.8	1.9	1.9	3 250

Bore Diameter 850 - 1400 mm

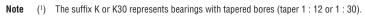


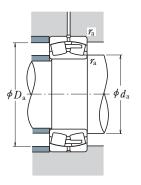


Cylindrical Bore

Tapered Bore

Е	Boundary	Dimens	ions	(1)	Basic Load	•	f)	Limiting S	•	Bearing
d	$D^{(i)}$	В	r	$C_{\rm r}$	C_{0r}	$C_{ m r}$	gf} $C_{0\mathrm{r}}$	(min ⁻ Grease	Oil	Cylindrical Bore
			min.							
850	1 120	200	6	6 100 000	15 200 000	620 000	1 550 000	190	240	239/850CAE4
	1 220	272	7.5	9 300 000	21 400 000	945 000	2 190 000	180	220	230/850CAE4
	1 220	365	7.5	11 600 000	28 300 000	1 180 000	2 890 000	150	190	240/850CAE4
	1 500	515	15	22 300 000	45 500 000	2 270 000	4 650 000	120	160	232/850CAE4
900	1 180	206	6	6 600 000	16 700 000	670 000	1 700 000	180	220	239/900CAE4
	1 280	280	7.5	9 850 000	22 800 000	1 000 000	2 330 000	160	200	230/900CAE4
	1 280	375	7.5	12 800 000	31 500 000	1 300 000	3 250 000	140	180	240/900CAE4
	1 580	515	15	23 400 000	47 500 000	2 380 000	4 850 000	110	140	232/900CAE4
950	1 250	224	7.5	7 600 000	19 900 000	775 000	2 030 000	160	200	239/950CAE4
	1 360	300	7.5	11 300 000	26 500 000	1 160 000	2 710 000	150	190	230/950CAE4
	1 360	412	7.5	14 500 000	36 500 000	1 480 000	3 700 000	120	160	240/950CAE4
	1 660	530	15	24 700 000	50 500 000	2 520 000	5 150 000	100	130	232/950CAE4
1 000	1 320	236	7.5	8 200 000	21 700 000	835 000	2 210 000	150	190	239/1000CAE4
	1 420	308	7.5	11 900 000	28 100 000	1 210 000	2 860 000	140	170	230/1000CAE4
	1 420	412	7.5	15 300 000	38 500 000	1 560 000	3 950 000	110	150	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	345	9.5	15 400 000	38 000 000	1 570 000	3 850 000	110	140	230/1120CAE4
	1 580	462	9.5	18 700 000	49 500 000	1 910 000	5 050 000	95	120	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

$F_{\rm a}/I$	$r \leq e$	$F_{\rm a}/F_{\rm r}{>}e$				
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 $e,\,Y_2$, Y_3 , and Y_0 are given in the table below.

N	lumbers	Abutm	ent and Fil (mr	let Dimens n)	ions	Constant		xial Loa Factors		Mass (kg)
	Tapered Bore(1)	$d_{ m a}$ min.	max.	$D_{ m a}$ min.	${\pmb{\gamma}}_a$ max.	e	Y_2	Y_3	Y_0	approx.
	239/850CAKE4	878	1 092	1 046	5	0.16	6.2	4.2	4.1	523
	230/850CAKE4	886	1 184	1 109	6	0.21	4.8	3.2	3.1	1 020
	240/850CAK30E4	886	1 184	1 093	6	0.28	3.6	2.4	2.4	1 350
	232/850CAKE4	914	1 436	1 274	12	0.35	2.8	1.9	1.9	3 890
	239/900CAKE4	928	1 152	1 103	5	0.16	6.4	4.3	4.2	591
	230/900CAKE4	936	1 244	1 169	6	0.20	4.9	3.3	3.2	1 160
	240/900CAK30E4	936	1 244	1 147	6	0.28	3.6	2.4	2.4	1 520
	232/900CAKE4	964	1 516	1 354	12	0.33	3.0	2.0	2.0	4 300
	239/950CAKE4	986	1 214	1 169	6	0.16	6.3	4.2	4.1	732
	230/950CAKE4	986	1 324	1 241	6	0.21	4.8	3.2	3.2	1 400
	240/950CAK30E4	986	1 324	1 219	6	0.28	3.6	2.4	2.3	1 880
	232/950CAKE4	1 014	1 596	1 428	12	0.32	3.1	2.1	2.1	4 800
2	239/1000CAKE4	1 036	1 284	1 229	6	0.16	6.4	4.3	4.2	881
	230/1000CAKE4	1 036	1 384	1 298	6	0.20	4.9	3.3	3.2	1 560
	240/1000CAK30E4	1 036	1 384	1 275	6	0.27	3.7	2.5	2.4	2 010
2	239/1060CAKE4	1 096	1 364	1 302	6	0.16	6.1	4.1	4.0	1 030
	230/1060CAKE4	1 104	1 456	1 368	8	0.21	4.9	3.3	3.2	1 790
	240/1060CAK30E4	1 104	1 456	1 346	8	0.28	3.6	2.4	2.4	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
2	240/1180CAK30E4	1 224	1 616	1 494	8	0.27	3.7	2.5	2.4	3 180
2	240/1250CAK30E4	1 294	1 706	1 579	8	0.25	4.0	2.7	2.6	3 700
2	240/1320CAK30E4	1 374	1 796	1 656	10	0.26	3.9	2.6	2.6	4 400
2	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 – 100mm ·····	B210
	Bore Diameter	110 – 360mm ·····	B214
DOUBLE-DIRECTION THRUST BALL BEARINGS			
With Flat Seat, Aligning Seat, or Aligning Seat Washer	Bore Diameter	10 – 190mm ·····	B218
THRUST CYLINDRICAL ROLLER BEARINGS	Bore Diameter	35 – 320mm ·····	B224
TUDIET COUEDICAL DOLLED DEADINGS	Para Diameter	60 500mm	פסס

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- Direction	522	542	542U				
	523	543	543U				
	524	544	544U				
_							

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	T.I. 0.0 (D
According t	` = '
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 washer.

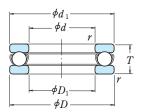
PERMISSIBLE MISALIGNMENT

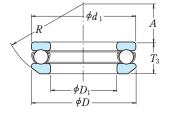
The permissible misalignment of thrust spherical roller bearings varies depending on the size, but it is approximately 0.018 to 0.036 radian (1° to 2°) with average loads.

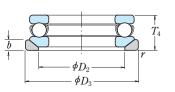
MINIMUM AXIAL LOAD

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 Bore Diameter 10 - 50 mm



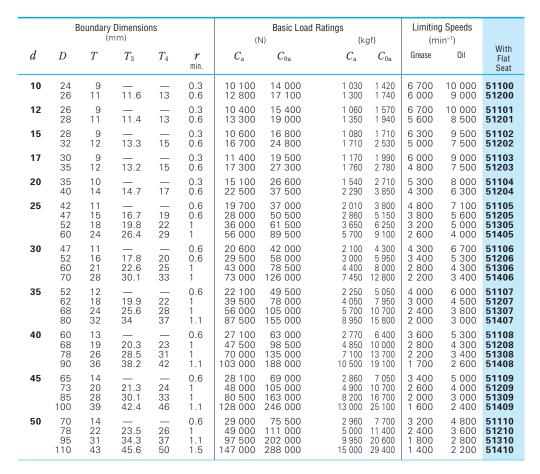


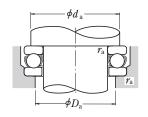


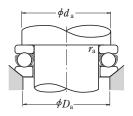
With Flat Seat

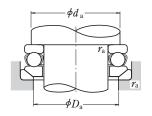
With Aligning Seat

With Aligning Seat Washer





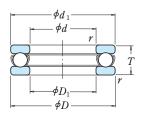


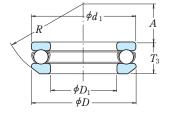


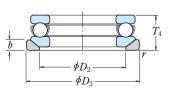
Bearing N	umbers	Dimensions (mm)								nent and		Mass(kg) approx.		
With Aligning Seat	With Aligning Seat Washer	d_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	γ _a max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53200	53200 U	24 26	11 12	— 18	 28	 3.5	— 8.5	 22	18 20	16 16	0.3 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 0.6	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		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	
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	
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





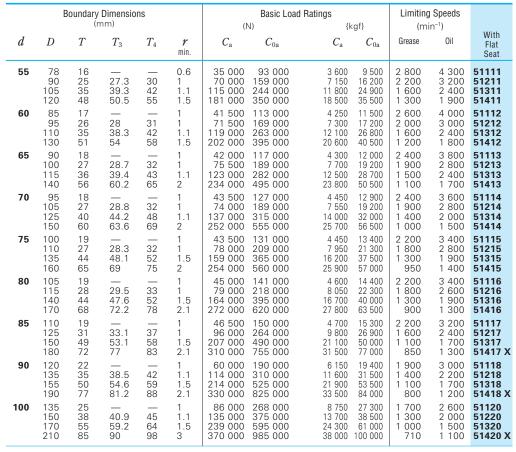


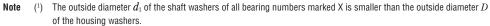


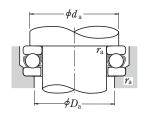
With Flat Seat

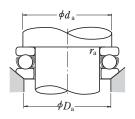
With Aligning Seat

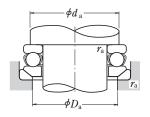
With Aligning Seat Washer





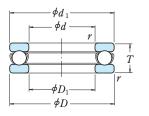


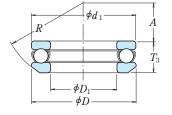


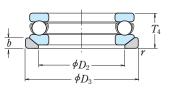


Bearing N	umbers(1)	Dimensions (mm)						Abutment and Fillet Dimensions (mm)			Mass(kg) approx.			
With Aligning Seat	With Aligning Seat Washer	d_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	γ _a max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53211 53311 53411	53211 U 53311 U 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	
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		 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





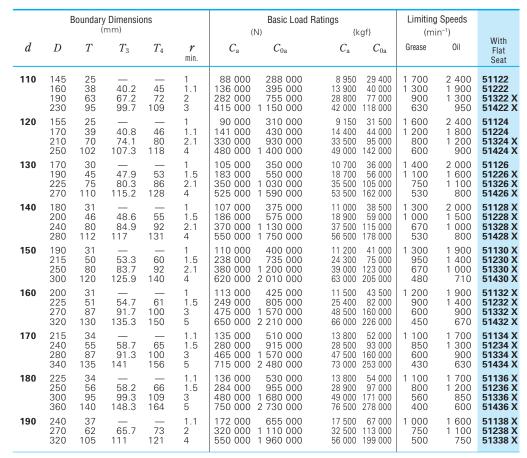


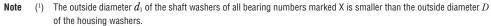


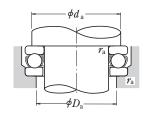
With Flat Seat

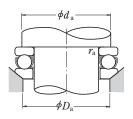
With Aligning Seat

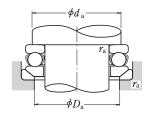
With Aligning Seat Washer







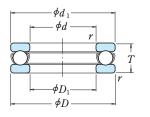


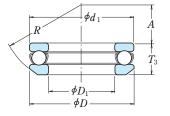


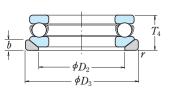
Bearing Numbers ⁽¹⁾				Dimens (mm					nent and			Mass(kg) approx.	
With With Aligning Aligning Seat Seat Washer	d_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	D_{a} max.	γ _a max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53222 53222 U 53322 X 53322 XU 53422 X 53422 XU	145 160 187 225	112 113 113 113	— 135 150 170	— 165 195 240	— 14 20.5 29	— 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	 2.65 7.55 20.5	 3.2 9.1 24.3
53224 53224 U 53324 X 53324 XU 53424 X 53424 XU	155 170 205 245	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		— 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	5.33 15.8 38.8
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	 5.89 19.5 41.4
53230 X 53230 XU 53330 X 53330 XU 53430 X 53430 XU	188 212 245 295	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	 7.82 20.5 51.9
53232 X 53232 XU 53332 X 53332 XU 53432 X 53432 XU	198 222 265 315	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

B 214 B 215

Bore Diameter 200 - 360 mm







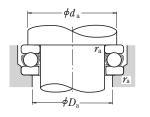
With Flat Seat

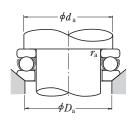
With Aligning Seat

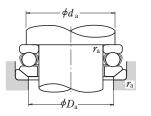
With Aligning Seat Washer

			y Dimensio	ons			Basic Load R	-			Speeds	
d	D	T	T_3	T_4	γ min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	$C_{ m a}$	C_{0a}	Grease	in ⁻¹) 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	32 500 1	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		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		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		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		134 000 199 000	710 530	1 000 800	51156 X 51256 X
300	380 420	62 95	 100.5	<u> </u>	2	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	365 000 585 000	1 660 000 2 680 000	37 500 1 59 500 2	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		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.



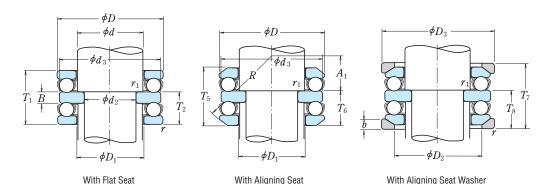


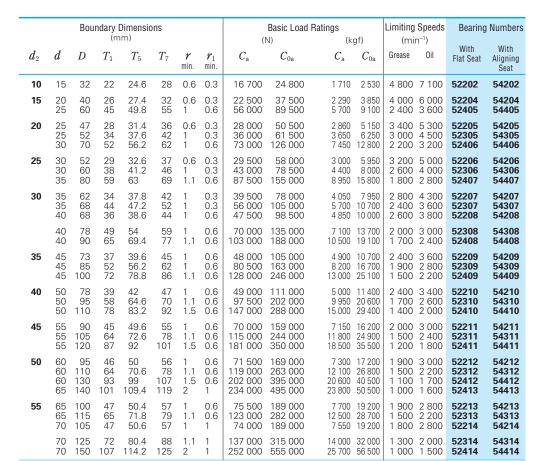


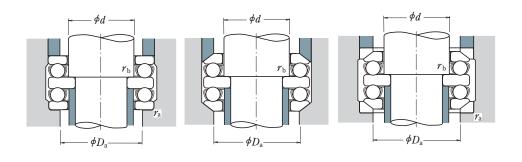
Bearing Numbers ⁽¹⁾					Dimensi (mm					nent and nsions (Mass(kg) approx.	
With With Aligning Aligning Seat Seat Wash		l_1	D_1	D_2	D_3	b	A	R	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{\gamma}_{\mathrm{a}}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
53240 X 53240 X 53340 X 53340 X		77	203 204 205	 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 X	U 29		223 224	 260	310	 25	 118	 225	250 268	240 252	1 2	4.09 13.6	 14.9	 18
 53248 X 53248 X	29 U 33		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 X	31 U 35		263 264	305	 370	30	 152	 280	296 319	284 301	1.5 2	7.01 25.1	 27.3	 33.2
53256 X 53256 X	U 34		283 284	 325	390	 31	 143	 280	322 339	308 321	1.5 2	12 27.1	30.3	 37
53260 X 53260 X	37 U 41		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 X	39 U 43		324 325	380	— 450	 36	 157	 320	368 391	352 369	2 2.5	18.6 45	— 49.9	— 59.4
53268 X 53268 X	41 U 45		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 X	U 43		364 365	— 430	 510	— 43	 172	 360	408 442	392 418	2 3	21.5 68.8	— 76.3	90.9

B 216 B 217

Bore Diameter 10 – 55 mm

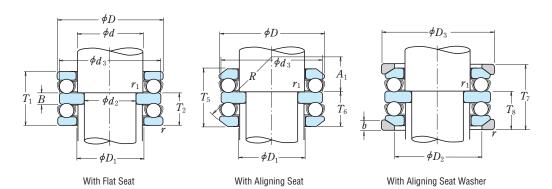






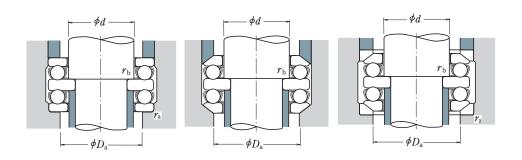
					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	I	Mass(kg approx.	
With Aligning Seat Washer	d_3	D_1	D_2	D_3	T_2	T_6	T_8	В	b	A_1	R	$D_{ m a}$ max.	∤ ′ _a max.	$ m \emph{r}_{b}$ max.	With Flat Seat	With Aligning Seat	With Aligning Seat Washer
54202 U	32	17	24	35	13.5	14.8	16.5	5	4	10.5	28	24	0.6	0.3	0.081	0.090	0.113
54204 U	40	22	30	42	16	16.7	19	6	5	16	36	30	0.6	0.3	0.148	0.151	0.185
54405 U	60	27	42	62	28	30.4	33	11	8	15	50	42	1	0.6	0.641	0.68	0.825
54205 U	47	27	36	50	17.5	19.2	21.5	7	5.5	16.5	40	36	0.6	0.3	0.213	0.236	0.293
54305 U	52	27	38	55	21	22.8	25	8	6	18	45	38	1	0.3	0.324	0.35	0.434
54406 U	70	32	50	75	32	34.1	37	12	9	16	56	50	1	0.6	0.978	1.01	1.27
54206 U	52	32	42	55	18	19.8	22	7	5.5	20	45	42	0.6	0.3	0.254	0.288	0.345
54306 U	60	32	45	62	23.5	25.1	27.5	9	7	19.5	50	45	1	0.3	0.483	0.511	0.621
54407 U	80	37	58	85	36.5	38.5	41.5	14	10	18.5	64	58	1	0.6	1.43	1.47	1.83
54207 U	62	37	48	65	21	22.9	25	8	7	21	50	48	1	0.3	0.406	0.447	0.57
54307 U	68	37	52	72	27	28.6	31	10	7.5	21	56	52	1	0.3	0.71	0.744	0.915
54208 U	68	42	55	72	22.5	23.8	26.5	9	7	25	56	55	1	0.6	0.543	0.581	0.713
54308 U	78	42	60	82	30.5	33	35.5	12	8.5	23.5	64	60	1	0.6	1.04	1.13	1.38
54408 U	90	42	65	95	40	42.2	46	15	12	22	72	65	1	0.6	1.98	2.02	2.54
54209 U	73	47	60	78	23	24.3	27	9	7.5	23	56	60	1	0.6	0.606	0.652	0.823
54309 U	85	47	65	90	32	34.1	37	12	10	21	64	65	1	0.6	1.28	1.34	1.71
54409 U	100	47	72	105	44.5	47.9	51.5	17	12.5	23.5	80	72	1	0.6	2.71	2.85	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 95	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	125	72	98	130	44	48.2	52	16	13	39	100	98	1	1	3.67	4.07	4.95
54414 U	150	73	110	155	65.5	69.1	74.5	24	19.5	28.5	112	110	2	1	8.99	9.12	11.3

Bore Diameter 60 – 130 mm



		Bou		Dimensio	ns			,,	Basic Load R	Ü	f)	_		Bearing N	umbers(1)
d_2	d	D	T_1	T_5	T_7	γ min.	${m r}_1$ min.	$C_{\rm a}$	C_{0a}	$C_{ m a}$	C_{0a}	(mi) Grease	Oil	With Flat Seat	With Aligning Seat
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		52315	54215 54315 54415
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	1 300	52316	54216 54316 54416 54417 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	1 600		54217 54317 54418 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	1 600		54218 54318 54420 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	1 500		54220 54320 —
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	1 200 850 560	1 300	52222 52322 X 52424 X	54222 54322 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		1 100	52224 52324 X 52426 X	54224 54324 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 52326 X 52428 X	54226 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 52328 X 52430 X	54228 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		900 630 430	950	52230 X 52330 X 52432 X	54230 X — —

Note (1) The outside diameter d_3 of the central washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.

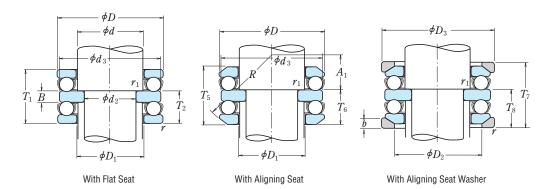


					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	ı	Mass (kg approx.)
With Aligning Seat Washer	d_3	D_1	D_2	D_3	T_2	T_6	T_8	В	b	A_1	R	$D_{ m a}$ max.	γ _a max.	$ m \emph{r}_{b}$ max.	With Flat Seat		With Aligning Seat Washer
54215 U 54315 U 54415 U	110 135 160	77 77 78	105	115 140 165	28.5 48.5 70.5	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	98 110 125 130	175	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			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	110 120 155	160	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		155 175 —	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 —		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 —	175 220 —	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

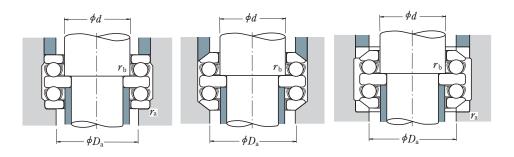


Bore Diameter 135 – 190 mm



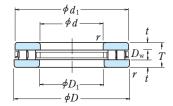
		Bou		Dimensio	ns				Basic Load R	•	gf}	Limiting (mi)		Bearing N	lumbers(1)
d_2	d	D	T_1	T_5	T_7	γ min.	${m r}_1$ min.	C_{a}	C_{0a}	$C_{\rm a}$	C_{0a}	Grease	Oil	With Flat Seat	With Aligning Seat
135	170	340	236	_	_	5	2.1	715 000	2 480 000	73 000	253 000	400	600	52434 X	_
140	160 160 180	225 270 360	90 153 245	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 48 500 76 500	82 000 160 000 278 000	850 600 380	900	52232 X 52332 X 52436 X	54232 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 3	280 000 465 000 284 000 480 000	915 000 1 570 000 955 000 1 680 000	28 500 47 500 28 900 49 000	93 000 160 000 97 000 171 000	800 560 800 530	850 1 200	52334 X	54234 X — 54236 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 56 000	113 000 199 000	710 480		52238 X 52338 X	54238 X —
170	200 200	280 340	109 192	115.6 —	133	2 4	2	315 000 600 000	1 110 000 2 220 000	32 500 61 500	113 000 227 000	710 450		52240 X 52340 X	54240 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

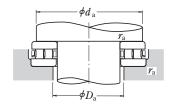
Note (1) The outside diameter d_3 of the central washers of all bearing numbers marked X is smaller than the outside diameter D of the housing washers.



					Di	mensio (mm)	ns						nent an nsions	d Fillet (mm)	ı	Mass(kç 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.	γ _a max.	$ m \emph{r}_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		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





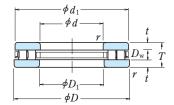
	Boundary D				ad Ratings N)	٧ -	Speeds in ⁻¹)
d	D	T	∤ min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	Grease	Oil
35	80	32	1.1	95 500	247 000	1 000	3 000
40	78	22	1	63 000	194 000	1 200	3 600
45	65	14	0.6	33 000	100 000	1 700	5 000
	85	24	1	71 000	233 000	1 100	3 400
50	110	27	1.1	139 000	470 000	900	2 800
	95	27	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

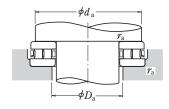
Bearing Numbers			ensions nm)			ment and I ensions (m		Mass (kg)
bearing Numbers	$d_{\scriptscriptstyle 1}$	D_1	$D_{ m w}$	t	$d_{ m a}$ min.	D_{a} max.	$m{\gamma}_{\mathrm{a}}$ max.	approx.
35 TMP 14	80	37	12	10	71	46	1	0.97
40 TMP 93	78	42	8	7	71	48	1	0.525
45 TMP 11	65	47	6	4	60	49	0.6	0.144
45 TMP 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.

B 224 B 225

Bore Diameter 140 – 320 mm





	Boundary [(m	Dimensions m)			ad Ratings	1	Speeds in ⁻¹)
d	D	T	γ min.	C_{a}	$C_{0\mathrm{a}}$	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	62	2	795 000	4 000 000	300	900
	420	95	3	1 390 000	6 250 000	220	670
320	400	63	2	820 000	4 250 000	300	900
	440	95	3	1 420 000	6 550 000	220	670

Bearing Numbers			ensions mm)			tment and f nensions (m		Mass (kg)
bearing Numbers	$d_{\scriptscriptstyle 1}$	D_1	$D_{ m w}$	t	$d_{ m a}$ min.	$D_{ m a}$ max.	$m{\gamma}_{\mathrm{a}}$ 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

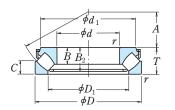
Remarks For cylindrical roller thrust bearings not listed adove, please contact NSK.

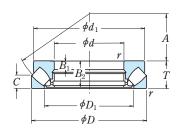
B 226 B 227

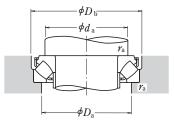
Mass

(kg)

Bore Diameter 60 – 200 mm

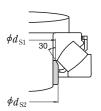






Dimensions

(mm)



Spacer Sleeve

Dimensions (mm)

 $\begin{aligned} & \textbf{Dynamic Equivalent Load} \\ & P = 1.2F_r + F_a \\ & \textbf{Static Equivalent Load} \\ & P_0 = 2.8F_r + F_a \\ & \textbf{However}, F_r/F_a \leqq 0.55 \text{ must be} \\ & \textbf{satisfied}. \end{aligned}$

Abutment and Fillet

Dimensions (mm)

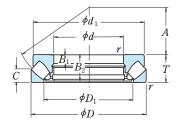
		Dimensior nm)	ıs	(Basic Load	•	gf}	Limiting Speeds	Bearing
d	D	T	γ min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	C_{a}	C_{0a}	(min ⁻¹) Oil	Numbers
60	130	42	1.5	330 000	885 000	33 500	90 000	2 600	29412 E
65	140	45	2	405 000	1 100 000	41 500	112 000	2 400	29413 E
70	150	48	2 2	450 000	1 240 000	46 000	126 000	2 400	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	48	2	530 000	1 710 000	54 000	174 000	1 800	29322 E
	230	73	3	1 010 000	2 930 000	103 000	299 000	1 500	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

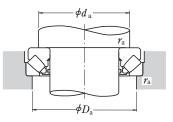
d_1	D_1	B,B_1	B_2	С	A	$d_{\scriptscriptstyle \mathrm{S1}}$ max.	$d_{ ext{S2}}$ max.	$d_{ m a}^{(1)}$ min.	$D_{ m a}$ max.	$D_{ m b}$ min.	$m{\gamma}_{\mathrm{a}}$ max.	approx.
114.5	89	27	38	20	38	67	67	90	108	133	1.5	2.55
121.5	93	29.5	40.5	22	42	72	72	100	115	143	2	3.2
131.5	102	31	43	24	44	78	78	105	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	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	3	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 $P_0 = 2.8F_r + F_a$ However, $F_{\rm r}/F_{\rm a} \le 0.55$ must be satisfied.

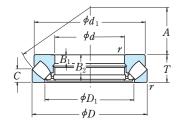
		Dimension	1S		Basic Load		gf}	Limiting Speeds	Bearing
d	D	T	γ min.	$C_{\rm a}$	C_{0a}	$C_{\rm a}$	C_{0a}	(min ⁻¹) Oil	Numbers
220	300 360 420	48 85 122	2 4 6	560 000 1 340 000 2 350 000	2 500 000 5 200 000 8 650 000	57 000 137 000 240 000	255 000 530 000 880 000	1 400 950 800	29244 29344 29444
240	340 380 440	60 85 122	2.1 4 6	800 000 1 360 000 2 420 000	3 450 000 5 400 000 9 100 000	82 000 139 000 247 000	350 000 550 000 930 000	1 200 950 750	29248 29348 29448
260	360 420 480	60 95 132	2.1 5 6	855 000 1 700 000 2 820 000	3 850 000 6 800 000 10 700 000	87 500 173 000 287 000	395 000 695 000 1 090 000	1 200 800 710	29252 29352 29452
280	380 440 520 520	60 95 145 145	2.1 5 6 6	885 000 1 830 000 3 400 000 3 950 000	4 100 000 7 650 000 13 100 000 14 900 000		420 000 780 000 1 330 000 1 520 000	1 100 800 630 630	29256 29356 29456 29456 EM
300	420 480 540	73 109 145	3 5 6	1 160 000 2 190 000 3 500 000	5 150 000 9 100 000 13 700 000	118 000 224 000 355 000	525 000 925 000 1 390 000	950 710 630	29260 29360 29460
320	440 500 580	73 109 155	3 5 7.5	1 190 000 2 230 000 3 650 000	5 450 000 9 400 000 14 600 000	122 000 227 000 370 000	555 000 960 000 1 490 000	950 670 560	29264 29364 29464
340	460 540 620	73 122 170	3 5 7.5	1 230 000 2 640 000 4 400 000	5 750 000 11 200 000 17 400 000		590 000 1 140 000 1 780 000	900 630 530	29268 29368 29468
360	500 560 640 640	85 122 170 170	4 5 7.5 7.5	1 550 000 2 670 000 4 200 000 5 450 000	7 300 000 11 500 000 17 200 000 20 400 000	430 000	745 000 1 180 000 1 750 000 2 800 000	800 600 500 500	29272 29372 29472 29472 EM
380	520 600 670	85 132 175	4 6 7.5	1 620 000 3 300 000 4 800 000	7 800 000 14 500 000 19 500 000		795 000 1 480 000 1 990 000	800 560 480	29276 29376 29476
400	540 620 710	85 132 185	4 6 7.5	1 640 000 3 250 000 5 400 000	8 000 000 14 500 000 22 100 000		815 000 1 480 000 2 250 000	750 530 450	29280 29380 29480
420	580 650 730	95 140 185	5 6 7.5	2 010 000 3 500 000 5 650 000	9 800 000 15 700 000 23 500 000	355 000	1 000 000 1 600 000 2 400 000	670 500 450	29284 29384 29484

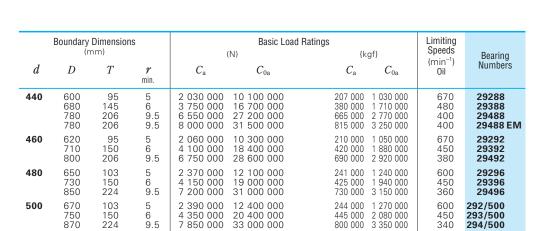
		Dime r (m	n sions m)			ment and ensions (r		Mass (kg)	
d_1	D_1	B_1	B_2	С	A	$d_{ m a}^{(1)}$ min.	D_{a} max.	${\pmb{\gamma}}_a$ max.	approx.
285	254	15	46	24	117	260	275	2	9.2
335	280	29	81	41	125	285	315	3	33
385	308	43	117	58	132	310	355	5	74
325	283	19	57	30	130	285	305	2	16.5
355	300	29	81	41	135	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

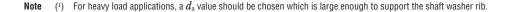
Note (1) For heavy load applications, a d_a value should be chosen which is large enough to support the shaft washer rib.

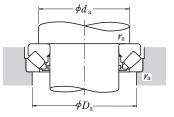
B 230 B 231

Bore Diameter 440 - 500 mm









 $\begin{aligned} & \textbf{Dynamic Equivalent Load} \\ & P = 1.2F_{\rm r} + F_{\rm a} \\ & \textbf{Static Equivalent Load} \\ & P_0 = 2.8F_{\rm r} + F_{\rm a} \\ & \textbf{However, } F_{\rm r} / F_{\rm a} \leqq 0.55 \text{ must be} \\ & \text{satisfied.} \end{aligned}$

		Dimer (m				Abuti Dime	Mass (kg)		
d_1	D_1	B_1	B_2	С	A	$d_{ m a}^{(1)}$ min.	D_{a} max.	$m{\gamma}_{a}$ 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 **BALL BEARINGS FOR BALL SCREWS**

Bore Diameter 35 – 280mm B238

Bore Diameter 15 – 60mm B242

DESIGN, TYPE, AND FEATURES

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.

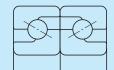
Compared with the Thrust Ball Bearings in the 511 Series, this type contains more balls of smaller diameter and has a contact angle of 60°. Consequently, the influence of centrifugal force is less and they can withstand higher speed

and have higher rigidity.

Bearings in Series 20 and 29 have the same inner and outer diameters as the 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.



ANGULAR CONTACT THRUST BALL BEARINGS FOR BALL SCREWS

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.

B 234 B 235



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

(re Diameter $m{l}$ m)	Δ_a	$l_{ m mp}$	$\Delta_{T\mathrm{s}}$		$K_{i\mathrm{a}}$ (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		$\Delta D_{ m s}$				
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

Unite : um

									Οπισ . μπ
Nominal Bore Diamete d (mm)		Δ_d	mp	$arDelta_{B ext{s}}$ (or $arDelta_{C ext{s}}$)		$V_{B{ m s}}$ (or $V_{C{ m s}}$)	$K_{i\mathrm{a}}$	S_d	S_{ia}
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 f6 to produce a loose fit.

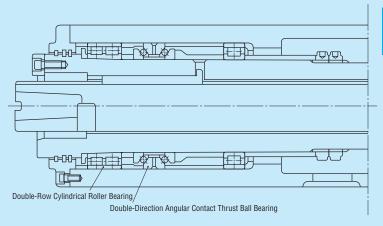
ANGULAR CONTACT THRUST BALL BEARINGS FOR BALL SCREWS

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.

DOUBI	LE-ROW ANGULAR CONTACT THRUST	
BALL E	BEARINGS	Clearance C7
ANGUI	LAR CONTACT THRUST BALL BEARINGS F	OR .
RALL S	SCREWS	Clearance C10



Example of Application of Double-Direction Angular Contact Thrust Ball Bearing (Main Spindle of Machine Tool)

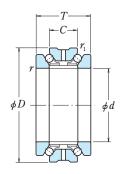
Table 2. 2 Tolerances and Running Accuracy of Housing Washer

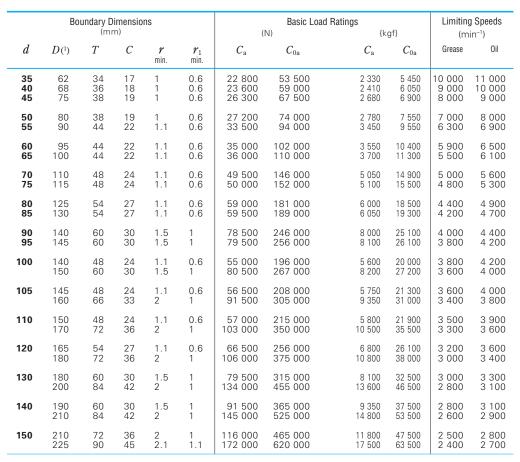
Unite : um

						Offits . µIII		
1	Nominal Outside Diameter $D \ (mm)$		Δ	$D_{ m s}$	$K_{ m ea}$	Sea		
	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		

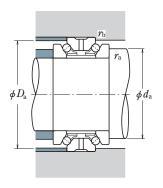
B 236 B 237

Bore Diameter 35 - 150 mm





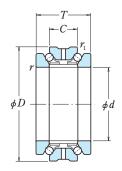




	Abutm	ent and F (m	illet Dime m)	nsions	Mass (kg)
Bearing Numbers	$d_{ m a}$	$D_{\rm a}$	r _a max.	$\pmb{\gamma}_{\mathrm{b}}$ max.	approx.
35 TAC 20X+L	46	58	1	0.6	0.375
40 TAC 20X+L	51	63	1	0.6	0.460
45 TAC 20X+L	57	70	1	0.6	0.580
50 TAC 20X+L	62	75	1	0.6	0.625
55 TAC 20X+L	69	84	1	0.6	0.945
60 TAC 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

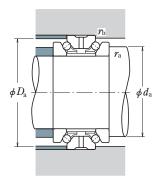
Remarks Nominal bearing bore and outside diameters for **20X · 20D** and **29X · 29D** bearing series are the same as those for the **NN30** and **NNU49 · NN49** bearing series respectively.

Bore Diameter 160 - 280 mm



	Вс	undary D (mr		ns		(Basic Load F	•	:gf}	Limiting Speeds (min ⁻¹)	
d	$D^{(1)}$	T	С	γ min.	${m \gamma}_1$ min.	$C_{\rm a}$	$C_{0\mathrm{a}}$	$C_{\rm a}$	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.



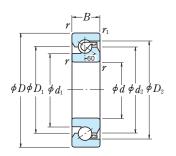
D : N .	Abutm	Abutment and Fillet Dimensions (mm)				
Bearing Numbers	$d_{\scriptscriptstyle m a}$	D_{a}	r a max.	${m \gamma}_{ m b}$ max.	approx.	
160 TAC 29D+L 160 TAC 20D+L	182 191	210 228	2 2	1 1	7.000 13.000	
170 TAC 29D+L 170 TAC 20D+L	192 206	219 245	2 2	1 1	7.350 17.700	
180 TAC 29D+L 180 TAC 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	

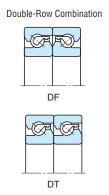
Remarks Nominal bearing bore and outside diameters for 20X · 20D and 29X · 29D bearing series are the same as those for the NN30 and NNU49 · NN49 bearing series respectively.

B 240 B 241

Bore Diameter 15 - 60 mm



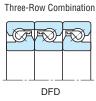


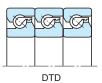


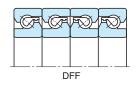
	Bounda	ı ry Dim (mm)	ensions	3			ensions mm)		Limiting S (min		Danis North	Mass (kg)
d	D	В	γ min.	${m \gamma}_1$ min.	d_1	d_2	D_1	D_2	Grease	Oil	Bearing Numbers	approx.
15 17 20 25	47 47 47 62	15 15 15 15	1 1 1 1	0.6 0.6 0.6 0.6	27.2 27.2 27.2 37	34 34 34 45	34 34 34 45	39.6 39.6 39.6 50.7	6 000 6 000 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.

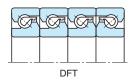








Four-Row Combination



Dynamic Equivalent Load

	$P_{\rm a} = XF_{\rm r} + YF_{\rm a}$	
_		Т

	Rows	Two Rows		Three Rows			Four Rows		
Combination		DF	DT	DFD D		DTD	DFT	DFF	DFT
	ial Load tained by	One Row	Two Rows	One Row	Two Rows	Three Rows	One Row	Two Rows	Three Rows
P /P <	Χ	1.9	_	1.43	2.33	_	1.17	2.33	2.53
$F_{\rm a}/F_{\rm r} \leq e^{-\epsilon}$	Υ	0.55	_	0.77	0.35	_	0.89	0.35	0.26
D /D>	Х	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
$F_{\rm a}/F_{\rm r} > e^{-r}$	Υ	1	1	1	1	1	1	1	1

	Basic Load Ratings $C_{\rm a}$			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	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
	35 500 3 650	47 500 4 850	26 600 2 710	53 000 5 400	79 500 8 150
	46 500 4 700	61 500 6 250	40 500 4 150	81 500 8 300	79 500 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

B 242 B 243



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 4 - 55mm B258

SOLID NEEDLE ROLLER BEARINGS

Inscribed Circle Diameter 8 - 55mm B258

THRUST NEEDLE ROLLER BEARINGS

Bore Diameter 10 - 100mm B274

CAM FOLLOWERS

Outside Diameter 16 - 90mm ... B276

ROLLER FOLLOWERS

Bore Diameter 5 - 50mm B278



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.

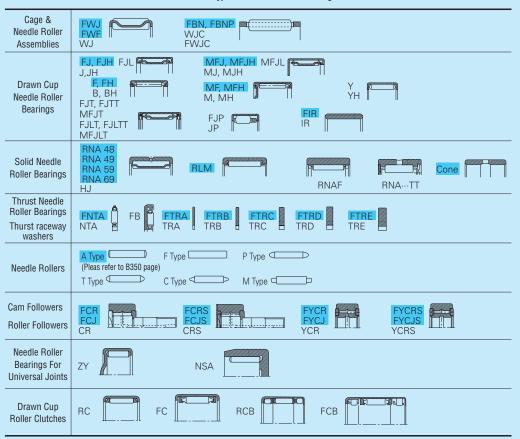
For bearing selection, please contact NSK.



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) E. FH. ME. MFH

			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	Tolerance for Roller Inscribed Circle Diameter, $F_{ m wmin}$ (1)			
Circle Diameter, $F_{ m w}$	of hilly dauge	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					

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 $F_{\rm wmin}$.

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

Ne	eule nuller bi	earniys	Units µm
Circle Dia	Inscribed meter, $F_{ m w}$	Deviation (F6) Diameter, $F_{ m wr}$ Inscribed Circle D $\Delta F_{ m v}$	$_{ m min}$, of Roller iameter $F_{ m wmin}$ $^{(1)}$
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_{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.)

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	nousing bore	
	High Accuracy, Oscillating Motion	js5 (j5)	h5		
	Normal	h5	g5	G6	
	High Temperature, Large Shaft Deflection	f6			
	and Mounting Error of Bearings				

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 Roller Inscribed Circle Diameter $F_{ m w}$ (mm)		C2	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 mm

Classification	Tuna	Cage or	Tolerance class or dimension tolerance		
Classification	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 Pooring Dings	FTRA to FTRE	Bore	h8	$D_{ m c}$ (1)+over 1.0	
Thrust Bearing Rings		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.

B 248 B 249



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

FCR. FCRS	Туре	Fitting Tolerance of Mounting Hole
FCJ, FCJS JS7 (J7)	FCR, FCRS FCJ, FCJS	JS7 (J7)

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			
Galegory	Raceway Surface	Fitting Surface	Raceway Surface	Fitting Surface		
Out-of-Roundness	$\frac{\text{IT3}}{2}$	IT3 L IT4	IT3	$\frac{\text{IT4}}{2}$ to $\frac{\text{IT5}}{2}$		
Tolerance	2	$\frac{\text{IT3}}{2}$ to $\frac{\text{IT4}}{2}$	2	${2}$ to ${2}$		
Cylindricity	$\frac{\text{IT3}}{2}$	IT3 L IT4	IT3	IT4 L IT5		
Tolerance	2	$\frac{\text{IT3}}{2}$ to $\frac{\text{IT4}}{2}$	$\frac{\text{IT3}}{2}$	$\frac{\text{IT}4}{2}$ to $\frac{\text{IT}5}{2}$		
Roughness	0.4	0.8	0.8	1.6		
$R_a(\mu m)$	0.4	0.8	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

8.0

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 $+110\,^{\circ}\mathrm{C}$. 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.

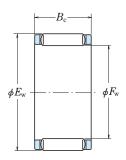
Since the stud of the cam follower receives bending stress and tensile stress from the bearing Load, the screw clamp torque should not exceed the value shown in the bearing table.

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.



FWF • FWJ
Inscribed Circle Diameter 5 – 22 mm



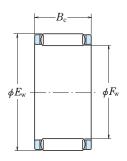
Bound	dary Dimen	sions			ad Ratings			Limiting Speeds		
	(mm)	-0.2		(N)		{ko	gf}	(mi	n ⁻¹)	
$F_{ m W}$	$E_{ m W}$	$B_{\rm C}^{-0.55}$	$C_{\rm r}$	$C_{0\mathrm{r}}$		$C_{\rm r}$	C_{0r}	Grease	Oil	
5 6	8 9 9	8 8 10	2 330 2 200 3 350	1 860 1 780 3 050		237 224 340	189 182 310	60 000 48 000 48 000	95 000 75 000 75 000	
7	10 10	8 10	2 840 3 650	2 560 3 550		290 375	261 360	40 000 40 000	67 000 67 000	
8	11 11	10 13	3 950 4 750	4 000 5 150		400 485	410 525	34 000 34 000	56 000 56 000	
9	12 12	10 13	3 750 5 100	3 850 5 750		380 520	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		405 550 660	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		445 605 750	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		690 820 1 370	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		720 860 1 370	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		750 895 1 500	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		780 1 040 1 540	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		805 965 1 770	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		815 990 1 830	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		880 1 050 1 760	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



Boun	dary Dimen	sions		Basic Load	•	· · · · · ·	Speeds
E		-0.2 -0.55		(N)	{kgf}	(mi	,
$F_{ m W}$	$E_{ m W}$	$B_{\rm C}^{-0.55}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$ $C_{0 m r}$	Grease	Oil
25	29	10	9 350	14 100	950 1 440	10 000	17 000
	29	13	11 300	18 000	1 150 1 830	10 000	17 000
28	31	17	19 200	26 800	1 950 2 740	9 500	17 000
	33	13	13 700	20 400	1 400 2 080	9 500	15 000
	33	17	17 600	28 300	1 800 2 890	9 500	15 000
	34	17	19 900	29 100	2 020 2 970	9 500	15 000
30	35	13	14 000	21 600	1 430 2 200	8 500	14 000
	35	17	18 700	31 500	1 910 3 200	8 500	14 000
	37	20	26 000	38 000	2 650 3 850	9 000	14 000
32	37	13	15 100	24 400	1 540 2 480	8 000	13 000
	37	17	18 500	31 500	1 880 3 200	8 000	13 000
	39	20	27 300	41 000	2 780 4 200	8 500	13 000
35	40	13	14 900	24 600	1 520 2 500	7 500	12 000
	40	17	20 500	37 000	2 090 3 750	7 500	12 000
	42	20	30 000	47 500	3 050 4 850	7 500	12 000
40	45 45 48	17 27 25	21 000 32 000 40 500	40 000 68 000 66 500	2 150	6 300 6 300 6 700	10 000 10 000 10 000
45	50	17	21 600	43 000	2 200 4 350	5 600	9 000
	50	27	34 000	77 500	3 500 7 900	5 600	9 000
	53	25	44 000	77 000	4 500 7 850	5 600	9 500
50	55	20	26 900	59 000	2 750 6 050	5 000	8 000
	55	27	35 000	83 000	3 600 8 450	5 000	8 000
	58	25	48 500	90 500	4 950 9 200	5 300	8 500
55	61	20	31 000	64 000	3 150 6 500	4 500	7 500
	61	30	47 000	109 000	4 750 11 100	4 500	7 500
	63	25	50 000	97 500	5 100 9 950	4 800	7 500
60	66	20	33 000	71 500	3 350 7 300	4 300	6 700
	66	30	50 000	122 000	5 100 12 400	4 300	6 700
	68	25	52 000	105 000	5 300 10 700	4 300	6 700
65	73	30	61 000	132 000	6 200 13 400	4 000	6 300
70	78	30	63 000	140 000	6 400 14 300	3 600	6 000
75	83	30	65 000	151 000	6 650 15 400	3 400	5 600
80	88	30	69 000	166 000	7 050 17 000	3 200	5 000
85	93	30	71 000	176 000	7 250 17 900	3 000	4 800
90	98	30	70 000	177 000	7 150 18 000	2 800	4 500
95	103	30	69 500	177 000	7 100 18 100	2 600	4 300
100	108	30	75 500	201 000	7 700 20 500	2 400	4 000

	Mass
Bearing Numbers	(g)
bearing Numbers	
	approx.
FWF-252910	6.9
FWF-252913 FWF-253117	8.9 18
FWF-283313	13
FWF-283317	16
FWF-283417	20
FWF-303513 FWF-303517A	14 18
FWF-303517A FWF-303720	30
FWF-323713	14
FWJ-323717	19
FWF-323920 FWF-354013	32 16
FWF-354013 FWF-354017	20
FWJ-354220	34
FWF-404517A FWF-404527	23
FWF-404825	36 56
FWF-455017	26
FWF-455027 FWF-455325	41 62
FWF-505520	37
FWF-505527	50
FWF-505825	77
FWF-556120 FWF-556130	53 81
FWF-556325	85
FWF-606620	57
FWF-606630 FWF-606825	87 91
FWF-657330	120
FWF-707830	125
FWF-758330	135
FWF-808830 FWF-859330	145 150
FWF-909830	160
FWF-9510330	175
FWF-10010830	185

12 14

15

16

18

20

22

23 24

25 28 29.75

30

32 35 36.75

37 38

16

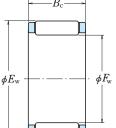
15 17 20

16 16 16.5

16 18



Cage & Needle Roller Assemblies for Large Ends of Connecting Rods Inscribed Circle Diameter 12 - 30 mm



Boundary Dimensions (mm) -0.2 -0.4				Basic Load	Bearing Numbers	Mass (g)	
$F_{ m W}$	$E_{ m W}$	$B_{\mathrm{C}}^{-0.4}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$ $C_{0 m r}$		approx.
12 14	16 19 20	10 10 12	6 100 7 800 8 900	6 500 8 050 8 600	620 665 795 820 910 880	FWF-121610-E FWF-141910-E FWF-142012-E	4.0 6.2 8.3
15	19 20 21	9 10 10	5 650 7 300 7 950	6 250 7 600 7 500	575 640 745 775 810 765	FWF-15199-E FWF-152010-E FWF-152110-E	4.1 6.0 8.5
16	21 22	11 12	8 650 9 500	9 600 9 600	880 980 965 980	FWF-162111-E FWF-162212-E	7.5 9.5
18	23 24	14 12	11 800 10 000	14 800 10 600	1 200 1 510 1 020 1 080	FWF-182314-E FWF-182412-E	10 11
20	26 26 28	12 17 18	12 200 16 800 18 100	14 100 21 200 19 400	1 250	FWF-202612-E FWF-202617-E FWF-202818-E	13 17 25
22	28 29 32	14 15 16	13 900 16 300 19 700	17 100 19 000 19 400	1 420 1 740 1 660 1 930 2 010 1 970	FWF-222814-E FWF-222915-E FWF-223216-E	14 19 31

1 800

1 590 1 830

2 200

1 810

1 880

1 990

2 230 2 600

1 980

2 070 2 480

2 840

2 230 2 410

2 650

3 100 3 450

FWF-233116-E

FWF-243015-E FWF-243017-E FWF-243120-E

FWF-253216-E FWF-283516-E FWF-293616Z-E

FWF-303716-E FWF-303818-E

24 25 28

29 35

19 400

20 300 24 300

27 800

21 900 23 700 26 000

30 500 34 000

17 600

15 600 17 900

21 600

17 700

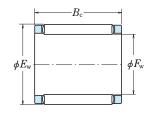
18 400

19 600

21 900

25 500





Воц	undary Dimen: (mm)	sions		Basic Lo	ad Ratings {kgf	n		Mass (g)
$F_{ m W}$	$E_{ m W}$	$B_{ m C}^{^{-0.2}}$	$C_{ m r}$	C_{0r}	$C_{\rm r}$	C_{0r}	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

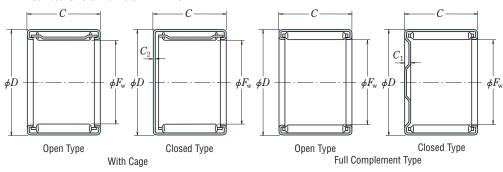
B 256 B 257



FJ • MFJ (With Cage)

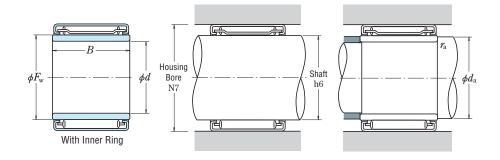
F • MF (Full Complement Type)

Inscribed Circle Diameter 4 – 16 mm



Воц		Dimens	ions	Basic Dynamic L	oad Ratings	Limiting (N)	Loads {kgf}	Limiting (mi	•		Bearing
$F_{ m W}$	D	$C^{-0.25}$	C_1, C_2 max.	$C_{\rm r}$		$P_{ m ma}$		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.



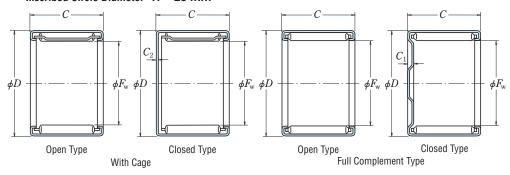
Numbers		In c		Mass Without Inner Ring (g)				
Full Comp Open	lement Type Closed	Bearing Numbers of Inner Ring Dimensions (mm) d B		Dimensi	t and Fillet ons (mm) \mathcal{Y}_a (max.)	approx. Open Closed		
=======================================	=======================================	=======================================	=	=	=======================================	=	1.3 1.7 2.2 2.3	— 1.9 2.4 2.7
<u>—</u> FH-810	<u>–</u> MFH-810	Ξ	_	_		_	2.7 5.2 6.0	3.2 5.5 6.3
— FH-910	<u></u> MFH-910	=	=	_	_	_	3.2 5.7 6.4	3.6 6.1 6.8
 FH-1010	<u>_</u> 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	<u>_</u> 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
<u></u> 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
<u></u> 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



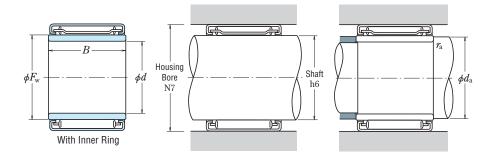
FJ • MFJ (With Cage)

F • MF (Full Complement Type)

Inscribed Circle Diameter 17 – 28 mm



Βοι		Dimens	ions	Basic Dynamic I	•	Limiting	Loads	Limiting			Bearing
	(1	mm) 0		(N)	{kgf}	(N)	{kgf}	(mii	n ^{−1})	14/:41-	0
$F_{ m W}$	D	$C^{-0.25}$		$C_{\rm r}$		$P_{ m ma}$	ix	Grease	Oil		Cage
			max.							Open	Closed
17	23 23	12 12	1.0 1.8	8 450 11 300	860 1 150	4 450 7 750	455 790	12 000 3 400	19 000 5 600	FJ-1712	MFJ-1712
	23	16	1.0	12 100	1 230	7 100	720	12 000	19 000	FJ-1716	MFJ-1716
	23	16	1.8	15 800	1 610	12 000	1 220	3 400	5 600	_	_
18	24	12	1.0	7 650	780	4 200	430	11 000	18 000	FJ-1812	MFJ-1812
	24 24	12 16	2.2 1.0	10 900 11 200	1 110 1 140	7 900 6 800	805 695	3 000 11 000	5 000 18 000	FJ-1816	MFJ-1816
	24	16	2.2	15 300	1 560	12 300	1 250	3 000	5 000	_	_
20	26	12	1.0	8 150	835	4 650	475	10 000	16 000	FJ-2012	MFJ-2012
	26 26	12 16	2.2 1.0	11 500 11 900	1 170 1 210	8 700 7 550	885 770	2 800 10 000	4 500 16 000	FJ-2016	MFJ-2016
	26	16	2.2	16 200	1 650	13 500	1 380	2 800	4 500		
	26	20	1.0	15 300	1 560	10 500	1 070	10 000	16 000	FJ-2020	MFJ-2020
	26	20	2.2	20 500	2 090	18 300	1 870	2 800	4 500	_	_
22	28	12	1.0	8 650	880	5 150	525	9 000	14 000	FJ-2212	MFJ-2212
	28 28	12 16	2.2 1.0	12 100 12 600	1 230 1 290	9 500 8 350	970 850	2 400 9 000	4 000 14 000	 FJ-2216	 MFJ-2216
	28	16	2.2	17 100	1 740	14 800	1 510	2 400	4 000		
	28	20	1.0	16 200	1 660	11 500	1 180	9 000	14 000	FJ-2220	MFJ-2220
	28	20	2.2	21 600	2 200	20 000	2 040	2 400	4 000	_	_
25	32	16	1.0	15 200	1 550	9 350	955	8 000	13 000	FJ-2516	MFJ-2516
	32 32	16 20	2.5 1.0	20 200 19 800	2 060 2 020	16 200 13 100	1 650 1 340	2 800 8 000	4 500 13 000	FJ-2520	MFJ-2520
	32	20	2.5	25 900	2 640	22 200	2 260	2 800	4 500		
	32	26	1.0	26 200	2 670	18 800	1 920	8 000	13 000	FJ-2526	MFJ-2526
	32	26	2.5	34 000	3 450	31 500	3 200	2 800	4 500	_	_
28	35	16	1.0	15 600	1 590	9 950	1 020	7 100	11 000	FJ-2816	MFJ-2816
	35 35	16 20	2.5 1.0	21 300 20 500	2 170 2 090	17 900 14 200	1 820 1 450	2 400 7 100	4 000 11 000	FJ-2820	MFJ-2820
	35	20	2.5	27 300	2 780	24 600	2 510	2 400	4 000	<u>_</u>	_
	35	26	1.0	26 900	2 750	20 200	2 060	7 100	11 000	FJ-2826	MFJ-2826
	35	26	2.5	35 500	3 650	34 500	3 550	2 400	4 000	_	_



Numbers		In c	ase of in	ner ring is	used		Mass Without Inner Ring (g)		
Full Compler Open	nent Type Closed	Bearing Numbers of Inner Ring		indary ions (mm) B	Dimens	nt and Fillet ions (mm) γ_a (max.)		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	

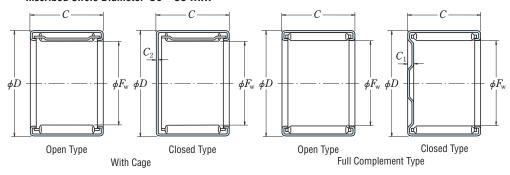
B 260 B 261



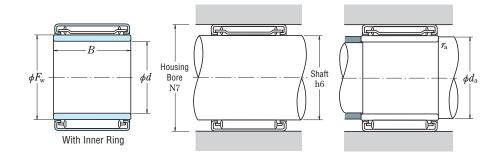
FJ • MFJ (With Cage)

F • MF (Full Complement Type)

Inscribed Circle Diameter 30 – 55 mm



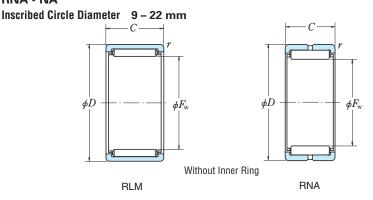
Вοι		Dimens	ions	Basic Dynamic L	•	Limiting		Limiting			Bearing
_		'n		(N)	{kgf}	(N)	{kgf}	(mii	1 ⁻¹)	With	Cane
$F_{ m W}$	D	$C^{-0.25}$	C_1, C_2 max.	$C_{\rm r}$		$P_{ m ma}$	ЭX	Grease	Oil	Open	Closed
30	37 37 37	16 16 20	1.0 2.5 1.0	15 600 22 100 19 400	1 590 2 250 1 970	10 100 18 900 13 300	1 030 1 930 1 360	6 700 2 400 6 700	10 000 3 800 10 000	FJ-3016L FJ-3020	MFJ-3016 MFJ-3020
	37 37 37	20 26 26	2.5 1.0 2.5	28 400 26 000 37 000	2 900 2 660 3 800	26 200 19 500 37 000	2 670 1 990 3 750	2 400 6 700 2 400	3 800 10 000 3 800	FJ-3026	MFJ-3026
35	42 42 42	16 16 20	1.0 2.5 1.0	18 100 24 000 23 600	1 850 2 450 2 410	12 800 22 000 17 900	1 300 2 240 1 830	5 600 2 000 5 600	9 000 3 400 9 000	FJ- <u>3</u> 516 FJ-3520	MFJ-3516 MFJ-3520
	42 42 42	20 26 26	2.5 1.0 2.5	31 000 31 500 40 000	3 150 3 200 4 100	30 000 25 800 42 500	3 100 2 630 4 350	2 000 5 600 2 000	3 400 9 000 3 400	FJ-3526	MFJ- <u>3</u> 526
40	47 47 47	16 16 20	1.0 2.5 1.0	18 600 25 700 23 500	1 890 2 620 2 400	13 600 24 900 18 500	1 390 2 540 1 890	4 800 1 800 4 800	7 500 3 000 7 500	FJ-4016 — FJ-4020	MFJ-4016 — MFJ-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 52 52	16 16 20 20	1.0 2.5 1.0 2.5	19 900 27 300 25 500 35 000	2 030 2 790 2 600 3 550	15 400 27 800 21 200 38 500	1 570 2 840 2 160 3 900	4 300 1 600 4 300 1 600	6 700 2 600 6 700 2 600	FJ-4516 FJ-4520	MFJ-4516 MFJ-4520
50	58 58 58 58	20 20 24 24	1.1 2.8 1.1 2.8	28 900 39 500 36 000 48 000	2 940 4 050 3 700 4 900	23 100 41 500 30 500 53 000	2 350 4 250 3 150 5 400	3 800 1 700 3 800 1 700	6 300 2 800 6 300 2 800	FJ-5020L — FJ-5024 —	MFJ-5020 — MFJ-5024 —
55	63 63 63	20 20 24 24	1.1 2.8 1.1 2.8	30 000 41 500 37 500 50 500	3 100 4 250 3 850 5 150	25 100 45 500 33 500 58 000	2 560 4 650 3 400 5 950	3 400 1 600 3 400 1 600	5 600 2 400 5 600 2 400	FJ-5520 FJ-5524	MFJ-5520 MFJ-5524

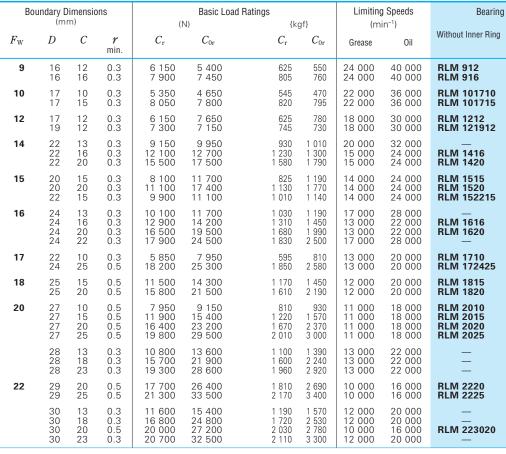


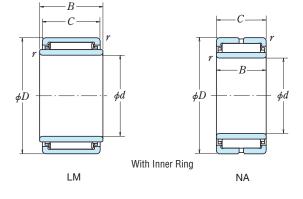
Numbers		In c		Mass Without Inner Ring (g)				
Full Compler Open	ment Type Closed	Bearing Numbers of Inner Ring		indary ions (mm) B	Dimensi	nt and Fillet ions (mm) γ_a (max.)		orox. Closed
F-3016	MF-3016	<u></u>	<u>_</u> 25	<u></u> 20.5	<u> </u>	0.3	26 35 35	31 40 39
F-3020 F-3026	MF-3020 MF-3026	FIR-253020 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	<u></u> FIR-303520	30	<u></u>	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	<u>-</u> FIR-354020	<u>-</u> 35	<u></u>	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		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-5520 F-5524	MF-5520 MF-5524	_ _ _	<u>-</u> <u>-</u> -	_ _ _ _	_ _ _	=	60 88 72 105	79 105 90 125

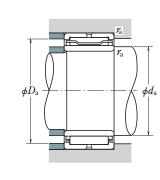


RLM • LM RNA • NA









Numbers	1			Boundary Dimensions (mm) Abutment and Fillet Dimensions (mm)		mensions	Mass (kg)	
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$\begin{array}{c} D_{\rm a} \\ {\rm max.} \end{array}$	$ m \emph{r}_a$ max.	appi 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	8	12.2	10	15	0.3	0.007	0.013
	LM 121912	8	12.2	10	17	0.3	0.011	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	10	15.2	12	18	0.3	0.011	0.022
	LM 1520	10	20.2	12	18	0.3	0.015	0.03
	LM 152215	10	15.2	12	20	0.3	0.016	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	12	10.2	14	20	0.3	0.008	0.017
	LM 172425	12	25.2	16	20	0.5	0.03	0.052
=	LM 1815	15	15.2	19	21	0.5	0.019	0.028
	LM 1820	15	20.2	19	21	0.5	0.025	0.037
= =	LM 2010	15	10.2	19	23	0.5	0.014	0.025
	LM 2015	15	15.2	19	23	0.5	0.021	0.037
	LM 2020	15	20.2	19	23	0.5	0.028	0.049
	LM 2025	15	25.2	19	23	0.5	0.035	0.061
RNA 4902	NA 4902	15	13	17	26	0.3	0.021	0.035
RNA 5902	NA 5902	15	18	17	26	0.3	0.032	0.051
RNA 6902	NA 6902	15	23	17	26	0.3	0.039	0.064
=	LM 2220	17	20.2	21	25	0.5	0.03	0.054
	LM 2225	17	25.2	21	25	0.5	0.038	0.068
RNA 4903 RNA 5903 	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

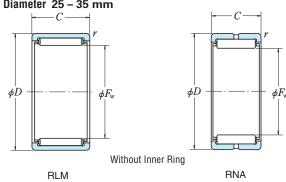
Remarks If a full complement roller bearing is required, please contact NSK.

B 264 B 265



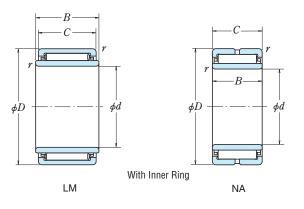
RLM • LM RNA • NA

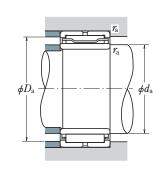
Inscribed Circle Diameter 25 – 35 mm



Воі	Boundary Dimensions (mm)			(1	Basic Load	Ratings {kg	af}		g Speeds in ⁻¹)	Bearing
$F_{ m W}$	D	С	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	Grease	Oil	Without Inner Ring
25	32 32 32	12 20 25	0.5 0.5 0.5	10 300 18 800 22 700	13 700 29 700 37 500	1 050 1 920 2 310	1 400 3 050 3 850	8 500 8 500 8 500	14 000 14 000 14 000	RLM 2512 RLM 2520 RLM 2525
	37 37 37	17 23 30	0.3 0.3 0.3	19 700 27 800 36 500	22 900 35 500 50 500	2 010 2 830 3 700	2 340 3 650 5 150	11 000 11 000 11 000	18 000 18 000 18 000	=
28	35 35 37	20 25 30	0.5 0.5 0.5	19 900 23 900 34 000	33 000 42 000 52 500	2 030 2 440 3 450	3 350 4 250 5 350	7 500 7 500 7 500	12 000 12 000 12 000	RLM 2820 RLM 2825 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 40 40	25 20 30	0.5 0.5 0.5	24 500 25 000 35 000	44 000 36 000 56 000	2 490 2 550 3 600	4 500 3 650 5 700	7 100 7 100 7 100	12 000 12 000 12 000	RLM 3025 RLM 304020 RLM 304030
	42 42 42	17 23 30	0.3 0.3 0.3	21 400 30 000 39 500	26 800 41 500 59 000	2 180 3 100 4 050	2 740 4 250 6 050	9 000 9 000 9 000	14 000 14 000 14 000	
32	42 42	20 30	0.5 0.5	25 800 36 500	38 000 59 000	2 630 3 700	3 900 6 050	6 700 6 700	11 000 11 000	RLM 3220 RLM 3230
	45 45 45	17 23 30	0.3 0.3 0.3	22 200 31 500 41 000	28 700 44 500 63 500	2 270 3 200 4 200	2 930 4 550 6 450	8 500 8 500 8 500	13 000 13 000 13 000	=
35	42 42	20 30	0.5 0.5	22 300 31 000	41 000 63 500	2 270 3 200	4 200 6 450	6 300 6 300	10 000 10 000	RLM 3520 RLM 3530
	45 45 45	20 25 30	0.5 0.5 0.5	27 500 33 000 38 500	42 500 54 500 66 000	2 800 3 400 3 950	4 350 5 550 6 750	6 300 6 300 6 300	10 000 10 000 10 000	RLM 354520 RLM 354525 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.



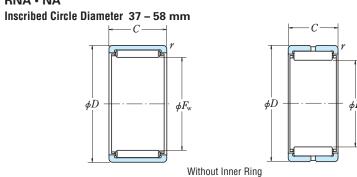


Numbers			Dimensions	Abutment	and Fillet Dir (mm)	mensions	Ma: (kg	
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$\begin{array}{c} D_{\rm a} \\ {\rm max.} \end{array}$	$oldsymbol{\gamma}_{\mathrm{a}}$ max.	appr Without Inner Ring	
=	LM 2512	20	12.2	24	28	0.5	0.02	0.036
	LM 2520	20	20.2	24	28	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
Ξ	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
Ξ	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

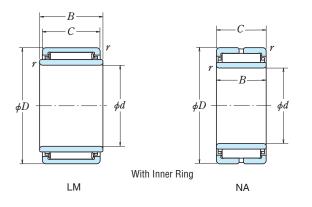


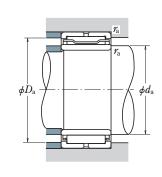
RLM

Во	undary D (mi		ons		Basic Lo	ad Ratings	:gf}	_ ~	Speeds n ⁻¹)	Bearin
$F_{ m W}$	D	С	γ min.	$C_{\rm r}$	C_{0r}	$C_{\rm r}$	C_{0r}	Grease	Oil	Without Inner Ring
37	47 47	20 30	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 48	20 30	0.6 0.6	29 000 41 000	47 000 73 000	2 960 4 150	4 800 7 450	5 600 5 600	9 000 9 000	RLM 3820 RLM 3830
40	50 50	20 30	0.6 0.6	29 700 42 000	49 000 76 500	3 050 4 250	5 000 7 800	5 300 5 300	9 000 9 000	RLM 4020 RLM 4030
	52 52 52	20 27 36	0.6 0.6 0.6	29 900 40 500 56 000	45 000 66 000 101 000	3 050 4 100 5 700	4 600 6 750 10 300	6 700 6 700 6 700	10 000 10 000 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	Ξ
45	55 55	20 30	0.6 0.6	31 000 43 500	53 500 83 500	3 150 4 450	5 500 8 500	4 800 4 800	8 000 8 000	RLM 4520 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 62	20 25	0.6 0.6	35 500 43 000	60 500 77 500	3 600 4 400	6 150 7 900	4 300 4 300	7 100 7 100	RLM 506220 RLM 506225
52	68 68 68	22 30 40	0.6 0.6 0.6	41 000 57 000 76 000	67 500 104 000 149 000	4 150 5 800 7 750	6 900 10 600 15 200	5 000 5 000 5 000	8 000 8 000 8 000	=
55	65 67	30 20	0.6 0.6	49 000 38 000	104 000 68 000	5 000 3 850	10 600 6 900	4 000 4 000	6 300 6 300	RLM 5530 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	=

RNA

Remarks If a full complement roller bearing is required, please contact NSK.

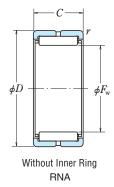




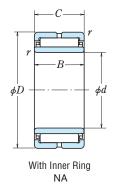
Numbers			Dimensions	Abutment	and Fillet Dir (mm)	mensions	Ma: (kg	
Without Inner Ring	With Inner Ring	d	В	$d_{ m a}$ min.	$\begin{array}{c} D_{\rm a} \\ {\rm max.} \end{array}$	$oldsymbol{\gamma}_{ m a}$ max.	appr Without Inner Ring	
Ξ	LM 3720	32	20.3	36	43	0.6	0.072	0.115
	LM 3730	32	30.3	36	43	0.6	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
Ξ	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
Ξ	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
Ξ	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

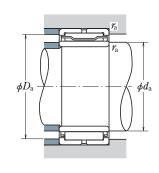


RNA • NA Inscribed Circle Diameter 63 – 120 mm



Во	oundary D		ons			oad Ratings		Limiting		Bearing
$F_{ m W}$	(mi	m) <i>C</i>	r	$C_{\rm r}$	C_{0r}	$C_{ m r}$	$C_{0 m r}$	(mir Grease	n ⁻¹) Oil	Without Inner Ring
_ v			min.	01	001	01	001	Grease	Oil	
63	80	25	1	53 500	87 500	5 450	8 950	4 000	6 700	RNA 4911
	80	34	1	73 500	133 000	7 500	13 600	4 000	6 700	RNA 5911
	80	45	1	93 500	181 000	9 550	18 500	4 000	6 700	RNA 6911
68	85	25	1	56 000	95 500	5 700	9 750	3 800	6 300	RNA 4912
	85	34	1	77 500	145 000	7 900	14 800	3 800	6 300	RNA 5912
	85	45	1	98 000	197 000	10 000	20 100	3 800	6 300	RNA 6912
72	90	25	1	58 500	103 000	5 950	10 500	3 600	5 600	RNA 4913
	90	34	1	81 000	157 000	8 250	16 000	3 600	5 600	RNA 5913
	90	45	1	103 000	213 000	10 500	21 800	3 600	5 600	RNA 6913
80	100	30	1	80 500	143 000	8 200	14 600	3 200	5 300	RNA 4914
	100	40	1	107 000	206 000	10 900	21 000	3 200	5 300	RNA 5914
	100	54	1	143 000	298 000	14 500	30 500	3 200	5 300	RNA 6914
85	105	30	1	84 000	155 000	8 600	15 800	3 000	5 000	RNA 4915
	105	40	1	112 000	222 000	11 400	22 700	3 000	5 000	RNA 5915
	105	54	1	149 000	325 000	15 200	33 000	3 000	5 000	RNA 6915
90	110	30	1	87 500	166 000	8 950	17 000	2 800	4 500	RNA 4916
	110	40	1	116 000	239 000	11 900	24 400	2 800	4 500	RNA 5916
	110	54	1	157 000	350 000	16 000	36 000	2 800	4 500	RNA 6916
100	120	35	1.1	104 000	214 000	10 600	21 800	2 600	4 000	RNA 4917
	120	46	1.1	138 000	310 000	14 100	31 500	2 600	4 000	RNA 5917
	120	63	1.1	174 000	415 000	17 800	42 500	2 600	4 000	RNA 6917
105	125	35	1.1	108 000	228 000	11 000	23 300	2 400	4 000	RNA 4918
	125	46	1.1	143 000	330 000	14 600	33 500	2 400	4 000	RNA 5918
	125	63	1.1	181 000	445 000	18 400	45 000	2 400	4 000	RNA 6918
110	130	35	1.1	111 000	242 000	11 400	24 700	2 200	3 800	RNA 4919
	130	46	1.1	148 000	350 000	15 100	35 500	2 200	3 800	RNA 5919
	130	63	1.1	187 000	470 000	19 100	48 000	2 200	3 800	RNA 6919
115 120	140 140 140	40 54 30	1.1 1.1 1	144 000 193 000 99 500	295 000 430 000 214 000	14 700 19 700 10 100	30 000 43 500 21 900	2 200 2 200 2 000	3 600 3 600 3 400	RNA 4920 RNA 5920 RNA 4822





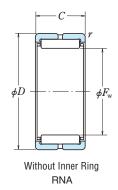
Numbers		Dimensions nm)	Abutment	and Fillet Din (mm)	nensions	Mass (kg)		
With Inner Ring	d	В	$d_{ m a}$ min.	$\begin{array}{c} D_{\rm a} \\ {\rm max.} \end{array}$	${m r}_{ m a}$ max.	appr Without Inner Ring	OX. With Inner Ring	
NA 4911	55	25	60	75	1	0.26	0.40	
NA 5911	55	34	60	75	1	0.37	0.56	
NA 6911	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	

Remarks If a full complement roller bearing is required, please contact NSK.

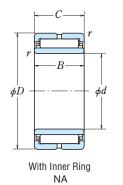
B 270 B 271

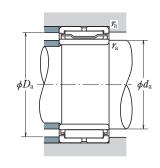


RNA • NA Inscribed Circle Diameter 125 – 390 mm



Во	undary D		ons		Basic Load R	-	kgf}	Limiting (mir		Bearing
$F_{ m W}$	D	С	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	C_{r}	C_{0r}	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





Numbers Boundary Dimension (mm)			Abutment	and Fillet Dir (mm)	nensions	Mass (kg)		
With Inner Ring	d	В	$d_{\scriptscriptstyle m a}$ min.	D_{a} max.	$m{\gamma}_{\mathrm{a}}$ max.	app 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	

Remarks If a full complement roller bearing is required, please contact NSK.

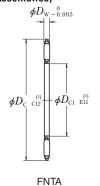


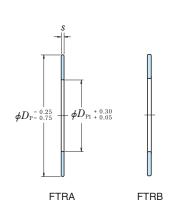
FNTA (Thrust Cage & Needle Roller Assemblies)

Thrust raceway washers FTRA (s=1.0) FTRB (s=1.5) FTRC (s=2.0)

FTRC (s=2.0) FTRD (s=2.5) FTRE (s=3.0)

Bore Diameter 10 – 100 mm

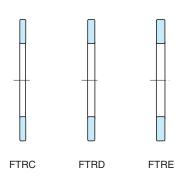


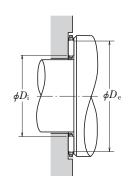


Boundary Dimensions (mm)		ions	(Basic Load	Ü	af}	Limiting Speeds		
D_{c1} , D_{p1}	D_{c} , D_{p}	D_{W}	C_{a}	C_{0a}	$C_{\rm a}$	C_{0a}	(min ⁻¹) Oil	Bearing Numbers	$s=1.0^{\pm0.05}$
10	24	2	7 750	23 000	790	2 350	17 000	FNTA-1024	*FTRA-1024
12	26	2	8 350	26 300	855	2 680	16 000	FNTA-1226	FTRA-1226
15	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 3 3	30 500	152 000	3 100	15 500	5 600	FNTA-5070	FTRA-5070
55	78		37 000	201 000	3 750	20 500	5 300	FNTA-5578	FTRA-5578
60	85		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	105	4	63 000	365 000	6 450	37 500	3 800	FNTA-80105	FTRA-80105
85	110	4	64 500	380 000	6 550	39 000	3 600	FNTA-85110	FTRA-85110
90	120	4	80 000	515 000	8 150	52 500	3 400	FNTA-90120	FTRA-90120
100	135	4	98 500	695 000	10 000	71 000	3 000	FNTA-100135	FTRA-100135



^(*) The tolerance of this bearing bore diameter is +0.025 to +0.175mm and outside diameter tolerance is -0.040 to -0.370mm





Bearing Numbers	of Matching Bearing R		Roller Conta		Ma: (g		
$s=1.5^{-0.08}$	$s=2.0^{+0.08}$	$s=2.5^{+0.08}$	$s=3.0^{+0.08}$	Outside Diameter $D_{ m e}$ min.	Bore Diameter $D_{ m i}$ max.	appr FNTA	ox. FTRA
FTRB-1024 FTRB-1226 FTRB-1528	FTRC-1024 FTRC-1226 FTRC-1528	<u> </u>	— — FTRE-1528	22.0 24.0 26.0	11.5 13.5 16.5	2.3 3.4 3.5	2.9 3.3 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 274 B 275

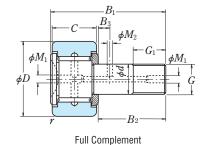
FCR (Full Complement)

FCRS Full Complement, Sealed With Thrust Washer

FCJ (With Cage)

FCJS Sealed, with Cage and Thrust Washer

Outside Diameter 16 - 90 mm



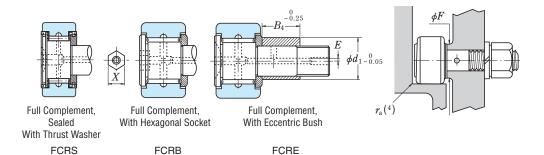
FCR

Bound	ary Dim (mm)	ensions	_		Di	mensions (mm)					Bearing) Numbers
D	С	d	Screw <i>G</i>	G_1	B_1	B_2	B_3	M_2	M_1	γ min.	FCR FCJ	FCRS FCJS
16	11 11	6 6	M 6×1 M 6×1	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	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	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	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	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	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 (N)	{kgf}	Limiting (N)	{kgf}	Limiting Tra	ck Loads {kgf}	Mass (kg)	Dimensions of Hexagonal Socket (2)(width across flats)		Bush Dimer (mm)	. ,	Shoulder Dimensions (mm)	Tightening (N·cm) {	
$C_{\rm r}$		$P_{ m ma}$	х			approx.	(mm)	B_4	d_1	E	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	10	11	0.5	13	550	56
3 450	355	4 200	425	4 150	425	0.030	4	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)

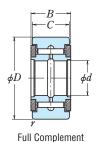
FYCRS Full Complement, Sealed with Thrust Washer

FYCJ (With Cage)

FYCJS Sealed, with Cage and

Thrust Washer

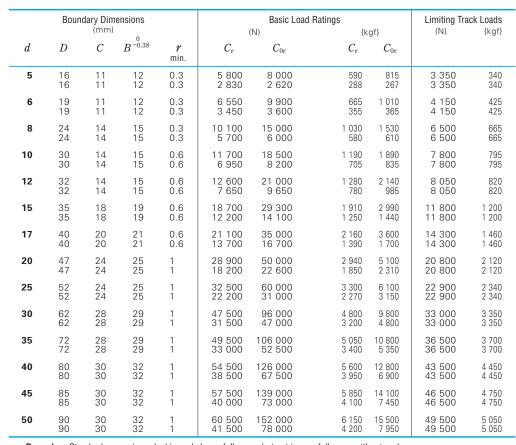
Bore Diameter 5 – 50 mm



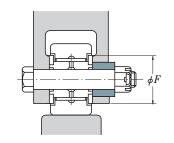
Full Complement, Sealed with Thrust Washer

FYCR

FYCRS



Remarks Standard grease is packed in sealed cam followers, but not in cam followers withou	t seals.
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Bearing	Bearing Numbers			
FYCR FYCJ	FYCRS FYCJS	(kg) 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

UCFL2 Shaft Diameter 12 – 90mm B298

1/2 - 3 1/2 inch

B 280 B 281

1. CONSTRUCTION

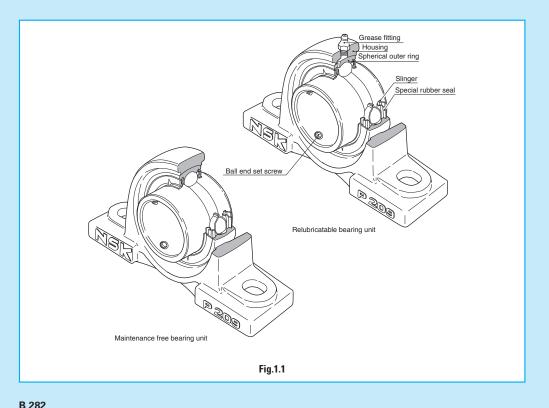
The NSK bearing unit is a combination of a radial ball bearing, seal, and a housing of high-grade cast iron or pressed steel, which comes in various shapes.

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:

- (1) 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

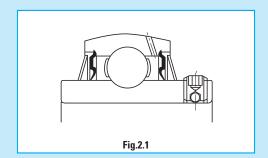
The sealing device of the ball bearing for the NSK bearing unit is a combination of a heat-resistant and oil-proof synthetic rubber seal and a slinger of an exclusive design.

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 -0-



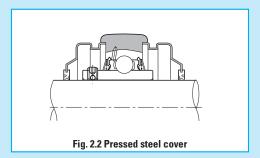
2.3.2 BEARING UNITS WITH COVERS

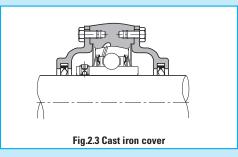
The NSK bearing unit with a cover consists of a standard bearing unit and an outside covering for extra protection against dust. Special consideration has been given to its design with respect to dust-proofing.

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 ι		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

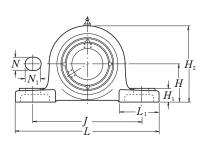
	applied		

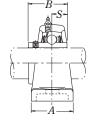
for th	ion of the ne unit to v given are a	vhich	Designation of set screws	Tightening torques lbf·inch (max.)
UC201 to UC205	_	_	No.10 -32UNF	34
UC206	_	UC305 to UC306	¹ /4 -28UNF	43
UC207	UCX05	_	¹ /4 -28UNF	52
UC208 to UC210	_	_	⁵ /16 -24UNF	69
UC211	UCX06 to UCX08	UC307	⁵ /16 -24UNF	86
UC212	UCX09	_	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

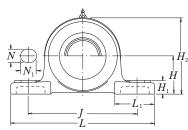
Designation of the bearings of applicable units	Designation of set screws	Tightening torques N·m (max.)
AS201 to 205	M5×0.8 × 7	3.4
AS206	M6×0.75× 8	4.4
AS207	M6×0.75× 8	4.9
AS208	M8×1 ×10	6.8

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

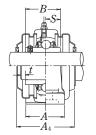
Pillow blocks units cast housing Set screw type

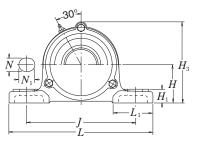


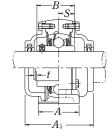




Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1







Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

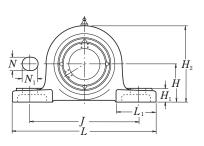
Shaft dia.	Unit number(1)	Nominal dimensions											Bolt size	Bearing number
mm						n	nm inc	h					mm	
inch		Н	L	J	A	N	N_1	H_1	H_2	L_1	B	S	inch	
12 1/2	UCP201D1 UCP201-008D1	30.2 1 ³ / ₁₆	127 5	95 3 ³ / ₄	38 1 ¹ / ₂	13 1/2	16 5/8	14 ⁹ /16	62 2 ⁷ /16	42 1 ²¹ /32	31 1.2205	12.7 0.500	M10 3/8	UC201D1 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	3 3/4	11/2	1/2	5/8	9/16	2 7/16	1 21/32	1.2205	0.500	3/8	UC202-009D1 UC202-010D1
17 11/16	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 2 ⁷ /16	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
13/ ₁₆ 7/ ₈	UCP205-013D1 UCP205-014D1 UCP205-015D1 UCP205-100D1	1 ⁷ /16	5 ¹ / ₂	41/8	1 ¹ / ₂	1/2	5/8				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
1 ¹ / ₁₆ 1 ¹ / ₈ 1 ³ / ₁₆ 1 ¹ / ₄	UCP206-101D1 UCP206-102D1 UCP206-103D1 UCP206-104D1	1 ¹ 1/16	6 ¹ / ₂	4 ³ / ₄	1 ⁷ /8	21/32	25/32	21/32	3 9/32	2 ¹ /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
1 ¹ / ₄ 1 ⁵ / ₁₆ 1 ³ / ₈ 1 ⁷ / ₁₆	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	2 ¹ /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	7 1/4	5 13/32	2 1/8	21/32	25/32	23/32	3 27/32	2 1/16	1.9370	0.748	1/2	UC208-108D1 UC208-109D1

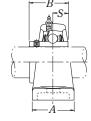
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

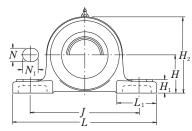
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nominal d	imensions	3	N	lass of un	it
	cover type			mm				kg lb	
			t max.	A_4	H_3	A_5	UCP	Z(ZM)	C(CM)
P203D1 P203D1	Z(ZM)-UCP201D1 Z(ZM)-UCP201-008D1	C(CM)-UCP201D1 C(CM)-UCP201-008D1	2 ⁵ /64	45 1 ²⁵ /32	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	1 25/32	2 5/8	2 7/16	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 2.2
P204D1 P204D1	Z(ZM)-UCP204D1 Z(ZM)-UCP204-012D1	C(CM)-UCP204D1 C(CM)-UCP204-012D1	2 5/64	45 1 ²⁵ /32	70 2 ³ /4	62 2 ⁷ /16	0.7 1.5	0.7 1.5	0.9 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							
P205D1	Z(ZM)-UCP205-014D1	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	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	70.	_ /02	702	_ /.0	0.1	0	0.7
P206D1	_	_							
P207D1	Z(ZM)-UCP207D1	C(CM)-UCP207D1	3	60	99	80	1.6	1.7	2.0
P207D1 P207D1	Z(ZM)-UCP207-104D1 Z(ZM)-UCP207-105D1	C(CM)-UCP207-104D1 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	-76	2-70	3-9/32	3-732	0.0	3.7	4.4
P207D1	_	_							
P208D1	Z(ZM)-UCP208D1	C(CM)-UCP208D1	3	69	105	90	1.9	2.1	2.7
P208D1 P208D1	Z(ZM)-UCP208-108D1 Z(ZM)-UCP208-109D1	C(CM)-UCP208-108D1 C(CM)-UCP208-109D1	1/8	2 23/32	4 1/8	3 17/32	4.2	4.6	6.0
1 20001	Z(ZNI)-UGFZUO-109D1	G(G(VI)-OGF200-109D1							

B 286 B 287

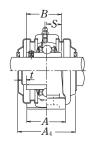
Pillow blocks units cast housing Set screw type

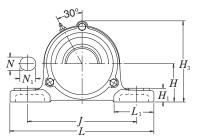


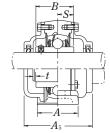




Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1







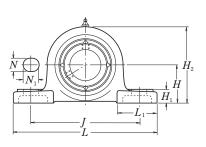
Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

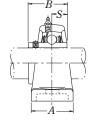
Shaft dia.	Unit number(1)	Nominal dimensions												Bearing number
						п	nm inc	h						
mm inch		Н	L	J	A	N	N_1	H_1	H_2	L_1	B	S	mm inch	
45 15/8	UCP209D1 UCP209-110D1	54	190	146	54	17	20	20	106	60	49.2	19	M14	UC209D1 UC209-110D1
111/16	UCP209-110D1 UCP209-111D1 UCP209-112D1	2 1/8	7 15/32	5 3/4	2 1/8	21/32	25/32	25/32	4 3/16	2 3/8	1.9370	0.748	1/2	UC209-110D1 UC209-111D1 UC209-112D1
50	UCP210D1 UCP210-113D1	57.2	206	159	60	20	23	21	114	65	51.6	19	M16	UC210D1 UC210-113D1
17/8	UCP210-113D1 UCP210-114D1 UCP210-115D1 UCP210-200D1	2 ¹ /4	81/8	6 ¹ / ₄	2 ³ /8	25/32	29/32	13/16	4 ¹ / ₂	2 9/16	2.0315	0.748	5/8	UC210-113D1 UC210-114D1 UC210-115D1 UC210-200D1
	UCP211D1	63.5	219	171	60	20	23	23	126	65	55.6	22.2	M16	UC211D1
21/ ₁₆ 21/ ₈	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
2 ⁵ /16 2 ³ /8	UCP212-204D1 UCP212-205D1 UCP212-206D1 UCP212-207D1	2 ³ /4	91/2	7 ¹ /4	2 ³ /4	25/32	29/32	31/32	5 ⁷ /16	2 ³ /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
	UCP213-208D1 UCP213-209D1	3	10 ⁷ /16	8	2 3/4	31/32	1 ³ /32	1 ¹ /16	5 ¹⁵ /16	3 1/32	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
211/16	UCP214-210D1 UCP214-211D1 UCP214-212D1	3 1/8	10 ¹⁵ /32	8 9/32	2 27/32	31/32	13/32	1 1/16	6 3/16	3 1/32	2.9370	1.189	3/4	UC214-210D1 UC214-211D1 UC214-212D1

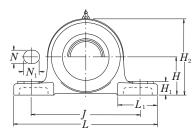
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nominal d	imensions	S	N	lass of uni	it
	,,,,,		_		inch	4		kg lb	
			t max.	A_4	H_3	A_5	UCP	Z(ZM)	C(CM)
P209D1	Z(ZM)-UCP209D1	C(CM)-UCP209D1	3	69	113	95	2.2	2.4	3.1
P209D1 P209D1	Z(ZM)-UCP209-110D1 Z(ZM)-UCP209-111D1	C(CM)-UCP209-110D1 C(CM)-UCP209-111D1	1/8	2 23/32	4 7/16	3 3/4	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	4 11/16	3 15/16	6.0	6.2	7.9
P210D1	Z(ZM)-UCP210-115D1	C(CM)-UCP210-115D1							
P210D1	_	C(CM)-UCP210-200D1							
P211D1 P211D1	Z(ZM)-UCP211D1 Z(ZM)-UCP211-200D1	C(CM)-UCP211D1 C(CM)-UCP211-200D1	4	77	130	100	3.5	3.5	4.4
P211D1	Z(ZM)-UCP211-201D1	C(CM)-UCP211-201D1	5/32	3 1/32	5 ¹ /8	3 ¹⁵ / ₁₆	7.7	7.7	9.7
P211D1 P211D1	Z(ZM)-UCP211-202D1 Z(ZM)-UCP211-203D1	C(CM)-UCP211-202D1 C(CM)-UCP211-203D1							
P212D1	Z(ZM)-UCP212D1	C(CM)-UCP212D1	4	89	143	115	4.7	5.0	6.0
P212D1	Z(ZM)-UCP212-204D1	C(CM)-UCP212-204D1	·	00	1.0			0.0	0.0
P212D1 P212D1	Z(ZM)-UCP212-205D1 Z(ZM)-UCP212-206D1	C(CM)-UCP212-205D1 C(CM)-UCP212-206D1	5/32	3 1/2	5 5/8	4 17/32	10	11	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	3 19/32	6 3/32	4 ²³ / ₃₂	12	13	16
P214D1	2(2141)-001 213-2030 1		4		162	135	6.5		8.3
P214D1 P214D1	_	C(CM)-UCP214D1 C(CM)-UCP214-210D1	4	_	102	135	0.5	_	0.3
P214D1 P214D1	_	C(CM)-UCP214-211D1	5/32	_	6 3/8	5 5/16	14	_	18
PZ 14D1		C(CM)-UCP214-212D1							

Pillow blocks units cast housing Set screw type



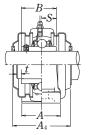


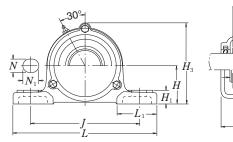


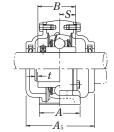
Pressed steel dust cover type
Open end Z-UCP...D1
Closed end ZM-UCP...D1

Shaft dia.	Unit number(1)				Bolt size	Bearing number								
mm inch		Н	L	S	mm									
75 2 ¹³ / ₁₆ 2 ⁷ / ₈	UCP215D1 UCP215-213D1 UCP215-214D1 UCP215-215D1 UCP215-300D1	82.6	275 10 ¹³ / ₁₆	J 217 817/32	74 229/32	N 25 31/32	N ₁ 28 13/32	H ₁ 28 13/32	H ₂ 163 613/32	80 35/32	77.8 3.0630	33.3	M20	UC215D1 UC215-213D1 UC215-214D1 UC215-215D1 UC215-300D1
80 3 ¹ / ₁₆ 3 ¹ / ₈ 3 ³ / ₁₆	UCP216D1 UCP216-301D1 UCP216-302D1 UCP216-303D1	3 1/2	292 11 ¹ /2	232 9 ¹ / ₈	78 3 ¹ / ₁₆	25 31/32	28 1 ³ / ₃₂	30 1 ³ / ₁₆	175 6 ⁷ /8	85 3 ¹¹ / ₃₂	82.6 3.2520	33.3 1.311	M20 3/4	UC216D1 UC216-301D1 UC216-302D1 UC216-303D1
85 3 ¹ / ₄ 3 ⁵ / ₁₆ 3 ⁷ / ₁₆	UCP217D1 UCP217-304D1 UCP217-305D1 UCP217-307D1	95.2 3 ³ / ₄	310 1 2 ⁷ /32	247 9 ²³ / ₃₂	83 3 ⁹ /32	25 31/32	28 1 ³ / ₃₂	32 1 ¹ / ₄	187 7 ³ /8	85 3 ¹¹ /32	85.7 3.3740	34.1 1.343	M20 3/4	UC217D1 UC217-304D1 UC217-305D1 UC217-307D1
90 3 ¹ / ₂	UCP218D1 UCP218-308D1	101.6 4	327 1 2 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".





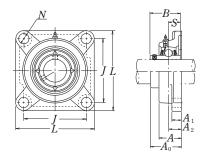


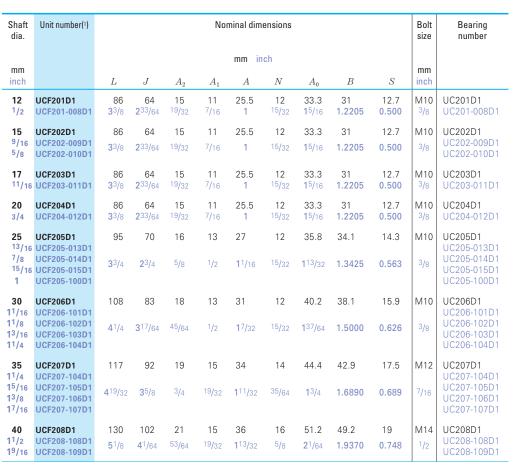
Cast dust cover type
Open end C-UCP...D1
Closed end CM-UCP...D1

Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	1	Nominal o	dimensions	3	Mass of unit				
	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		

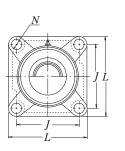
B 290 B 291

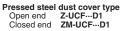
Square flanged units cast housing Set screw type

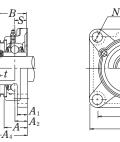




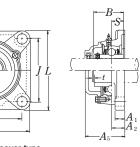
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".







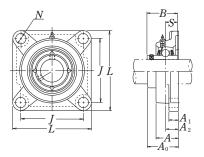
Cast dust cover type
Open end C-UCF...D1
Closed end CM-UCF...D1

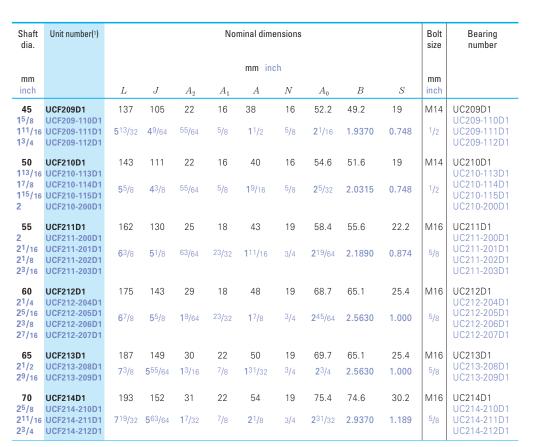


Housing number	Unit number (¹) pressed steel dust cover type	Unit number (1) cast dust cover type	Nomi	nal dimen	sions	Mass of unit			
	oover type		t	mm inch			kg lb		
			max.	A_4	A_5	UCP	Z(ZM)	C(CM)	
F204D1 F204D1	Z(ZM)-UCF201D1 Z(ZM)-UCF201-008D1	C(CM)-UCF201D1 C(CM)-UCF201-008D1	2 5/64	38 1 ¹ / ₂	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.8 1.8	
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 1 ¹ / ₂	46 1 ¹³ / ₁₆	0.6 1.3	0.6 1.3	0.8 1.8	
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	
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	
F205D1 F205D1	Z(ZM)-UCF205D1 Z(ZM)-UCF205-013D1	C(CM)-UCF205D1 C(CM)-UCF205-013D1	2	40	51	0.8	0.8	0.9	
F205D1 F205D1 F205D1	Z(ZM)-UCF205-014D1 Z(ZM)-UCF205-015D1 Z(ZM)-UCF205-100D1	C(CM)-UCF205-013D1 C(CM)-UCF205-014D1 C(CM)-UCF205-015D1 C(CM)-UCF205-100D1	5/64	1 ¹⁹ /32	2	1.8	1.8	2.0	
F206D1 F206D1	Z(ZM)-UCF206D1 Z(ZM)-UCF206-101D1	C(CM)-UCF206D1 C(CM)-UCF206-101D1	2	45	56	1.1	1.1	1.3	
F206D1 F206D1 F206D1	Z(ZM)-UCF206-103D1 Z(ZM)-UCF206-103D1	C(CM)-UCF206-102D1 C(CM)-UCF206-103D1 C(CM)-UCF206-104D1	5/64	1 ³ /4	2 ⁷ /32	2.4	2.4	2.9	
F207D1 F207D1	Z(ZM)-UCF207D1 Z(ZM)-UCF207-104D1	C(CM)-UCF207D1 C(CM)-UCF207-104D1	3	49	59	1.5	1.5	1.8	
F207D1 F207D1 F207D1 F207D1	Z(ZM)-UCF207-104D1 Z(ZM)-UCF207-105D1 Z(ZM)-UCF207-106D1	C(CM)-UCF207-104D1 C(CM)-UCF207-105D1 C(CM)-UCF207-106D1 C(CM)-UCF207-107D1	1/8	1 ¹⁵ /16	2 ⁵ /16	3.3	3.3	4.0	
F208D1	Z(ZM)-UCF208D1	C(CM)-UCF208D1	3	56	66	1.7	1.8	2.2	
F208D1 F208D1	Z(ZM)-UCF208-108D1 Z(ZM)-UCF208-109D1	C(CM)-UCF208-108D1 C(CM)-UCF208-109D1	1/8	2 ³ /16	2 19/32	3.7	4.0	4.9	

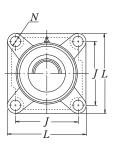
Macc of unit

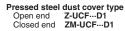
Square flanged units cast housing Set screw type

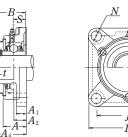




Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

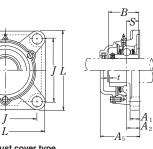






Cast dust cover type
Open end C-UCF...D1
Closed end CM-UCF...D1

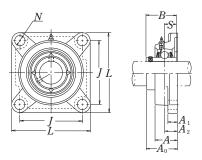
Naminal dimensian



Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	Nomi	nal dimen	sions	N	lass of un	it
	cover type			mm inch			kg lb	
			t max.	A_4	A_5	UCF	Z(ZM)	C(CM)
F209D1 F209D1	Z(ZM)-UCF209D1 Z(ZM)-UCF209-110D1	C(CM)-UCF209D1 C(CM)-UCF209-110D1	3	57	70	2.1	2.2	2.6
F209D1 F209D1	Z(ZM)-UCF209-111D1 Z(ZM)-UCF209-112D1	C(CM)-UCF209-111D1 C(CM)-UCF209-112D1	1/8	2 ¹ / ₄	2 ³ /4	4.6	4.9	5.7
F210D1 F210D1	Z(ZM)-UCF210D1 Z(ZM)-UCF210-113D1	C(CM)-UCF210D1 C(CM)-UCF210-113D1	3	60	72	2.5	2.5	3.0
F210D1 F210D1 F210D1	Z(ZM)-UCF210-114D1 Z(ZM)-UCF210-115D1 —	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 F211D1	Z(ZM)-UCF211D1 Z(ZM)-UCF211-200D1	C(CM)-UCF211D1 C(CM)-UCF211-200D1	4	64	75	3.3	3.4	4.0
F211D1 F211D1 F211D1 F211D1	Z(ZM)-UCF211-201D1 Z(ZM)-UCF211-202D1 Z(ZM)-UCF211-203D1	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 F212D1	Z(ZM)-UCF212D1 Z(ZM)-UCF212-204D1	C(CM)-UCF212D1 C(CM)-UCF212-204D1	4	74	86	3.9	4.1	4.8
F212D1 F212D1 F212D1 F212D1	Z(ZM)-UCF212-205D1 Z(ZM)-UCF212-206D1 ————————————————————————————————————	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	3 17/32	12	12	14
F214D1 F214D1	-	C(CM)-UCF214D1 C(CM)-UCF214-210D1	4	_	98	6.3	_	7.4
F214D1 F214D1	_	C(CM)-UCF214-211D1 C(CM)-UCF214-212D1	5/32	_	3 27/32	14	_	16

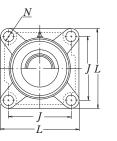
B 294 B 295

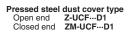
Square flanged units cast housing Set screw type

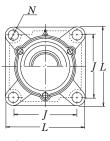


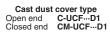
Shaft dia.	Unit number(1)				Bolt size	Bearing number						
mm inch		L	J	S	mm inch							
75	UCF215D1	200	159	34	22	56	19	78.5	77.8	33.3	M16	UC215D1 UC215-213D1
27/8	UCF215-213D1 UCF215-214D1 UCF215-215D1 UCF215-300D1	7 ⁷ /8	6 ¹⁷ /64	1 11/32	7/8	2 ⁷ /32	3/4	3 3/32	3.0630	1.311	5/8	UC215-213D1 UC215-214D1 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	1 ²⁷ /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".







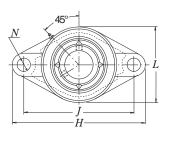


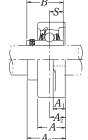
	A_1 A_2
Cast dust cover type en end	

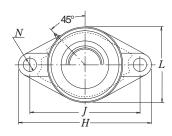
Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type	Nomi	nal dimer	nsions	Mass of unit			
				mm inch	1		kg lb		
			t max.	A_4	A_5	UCF	Z(ZM)	C(CM)	
F215D1 F215D1	_	C(CM)-UCF215D1 C(CM)-UCF215-213D1	4	_	102	6.6	_	7.9	
F215D1 F215D1 F215D1	_	C(CM)-UCF215-214D1 C(CM)-UCF215-215D1 C(CM)-UCF215-300D1	5/32	_	4 1/32	15	_	17	
F216D1 F216D1	_	C(CM)-UCF216D1 C(CM)-UCF216-301D1	4	_	106	7.9	_	9.3	
F216D1 F216D1	_	C(CM)-UCF216-302D1 C(CM)-UCF216-303D1	5/32	_	4 ³ /16	17	_	21	
F217D1 F217D1	_	C(CM)-UCF217D1 C(CM)-UCF217-304D1	5	_	114	9.8	_	12	
F217D1 F217D1	_	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	_	122 4 ¹³ / ₁₆	12 26		13 29	

B 296 B 297

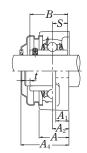
Rhombus flanged units cast housing Set screw type

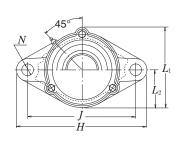


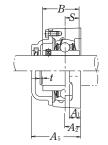




Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1







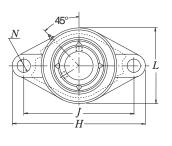
Cast dust cover type
Open end C-UCFL...D1
Closed end CM-UCFL...D1

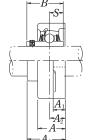
Shaft dia.	Unit number(1)	Nominal dimensions											Bearing number
mm				,			inch	T		D.		mm	
inch		Н	J	A_2	A_1	A	N	L	A_0	В	S	inch	
12 1/2	UCFL201D1 UCFL201-008D1	113 4 ⁷ / ₁₆	90 3 ³⁵ /64	15 19/32	11 ⁷ /16	25.5 1	12 15/32	60 2 ³ /8	33.3 1 ⁵ / ₁₆	31 1.2205	12.7 0.500	M10 3/8	UC201D1 UC201-008D1
15	UCFL202D1	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	3 35/64	19/32	7/16	1	15/32	2 3/8	1 5/16	1.2205	0.500	3/8	UC202-009D1 UC202-010D1
17	UCFL203D1	113	90	15	11	25.5	12	60	33.3	31	12.7	M10	UC203D1
11/16	UCFL203-011D1	4 ⁷ /16	3 35/64	19/32	7/16	1	15/32	2 3/8	1 5/16	1.2205	0.500	3/8	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 1 ⁵ / 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	5 ¹ /8	3 ⁵⁷ /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	UCFL206-103D1 UCFL206-103D1 UCFL206-104D1	5 ¹³ /16	4 ³⁹ /64	45/64	1/2	1 ⁷ /32	5/8	3 5/32	1 ³⁷ /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	5 ¹ /8	3/4	19/32	1 11/32	5/8	3 17/32	1 ³ /4	1.6890	0.689	1/2	UC207-104D1 UC207-105D1 UC207-106D1 UC207-107D1
40	UCFL208D1	175	144	21	15	36	16	100	51.2	49.2	19	M14	UC208D1
1 ¹ /2 1 ⁹ /16	UCFL208-108D1 UCFL208-109D1	6 ⁷ /8	5 ⁴³ /64	53/64	19/32	1 13/32	5/8	3 ¹⁵ /16	2 1/64	1.9370	0.748	1/2	UC208-108D1 UC208-109D1

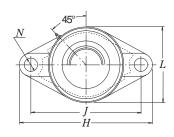
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

Housing number	Unit number (¹) pressed steel dust cover type	Unit number (¹) cast dust cover type		Nomin	nal dimer	nsions		N	lass of un	it
					nm inch				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	Z(ZM)-UCFL202D1	C(CM)-UCFL202D1	2	38	46	67	30	0.5	0.5	0.6
FL204D1 FL204D1	Z(ZM)-UCFL202-009D1 Z(ZM)-UCFL202-010D1	C(CM)-UCFL202-009D1 C(CM)-UCFL202-010D1	5/64	11/2	1 13/16	2 5/8	1 3/16	1.1	1.1	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	0.6 1.3
	, , , , , , , , , , , , , , , , , , , ,			,	40		, ,	0.4		
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 0.9	0.4	0.6 1.3
FL205D1	Z(ZM)-UCFL205D1	C(CM)-UCFL205D1	2	40	51	74	34	0.6	0.6	0.8
FL205D1 FL205D1 FL205D1 FL205D1	Z(ZM)-UCFL205-013D1 Z(ZM)-UCFL205-014D1 Z(ZM)-UCFL205-015D1 Z(ZM)-UCFL205-100D1	C(CM)-UCFL205-013D1 C(CM)-UCFL205-014D1 C(CM)-UCFL205-015D1 C(CM)-UCFL205-100D1	5/64	1 ¹⁹ /32	2	2 ²⁹ /32	1 11/32	1.3	1.3	1.8
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	1 ³ /4	2 ⁷ /32	3 ¹¹ /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	Z(ZM)-UCFL208D1	C(CM)-UCFL208D1	3	56	66	106	50	1.5	1.5	1.9
FL208D1 FL208D1	Z(ZM)-UCFL208-108D1 Z(ZM)-UCFL208-109D1	C(CM)-UCFL208-108D1 C(CM)-UCFL208-109D1	1/8	2 ³ /16	2 ¹⁹ /32	4 ³ /16	1 31/32	3.3	3.3	4.2

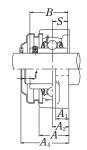
Rhombus flanged units cast housing Set screw type

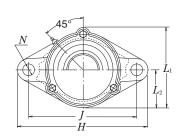


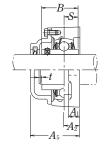




Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1







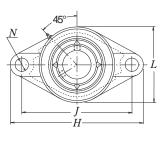
Cast dust cover type
Open end C-UCFL...D1
Closed end CM-UCFL...D1

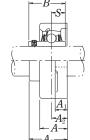
Shaft dia.	Unit number(1)				N	ominal d	limensi	ons				Bolt size	Bearing number
						mm	inch						
mm inch		Н	J	A_2	A_1	A	N	L	A_0	B	S	mm inch	
45	UCFL209D1	188	148	22	16	38	19	108	52.2	49.2	19	M16	UC209D1
1 ⁵ /8 1 ¹¹ / ₁₆ 1 ³ / ₄	UCFL209-110D1 UCFL209-111D1 UCFL209-112D1	7 13/32	5 ⁵³ /64	55/64	5/8	11/2	3/4	4 ¹ /4	2 ¹ /16	1.9370	0.748	5/8	UC209-110D1 UC209-111D1 UC209-112D1
50	UCFL210D1 UCFL210-113D1	197	157	22	16	40	19	115	54.6	51.6	19	M16	UC210D1 UC210-113D1
17/8	UCFL210-113D1 UCFL210-114D1 UCFL210-115D1 UCFL210-200D1	7 3/4	6 ³ /16	55/64	5/8	1 9/16	3/4	4 ¹⁷ /32	2 5/32	2.0315	0.748	5/8	UC210-113D1 UC210-114D1 UC210-115D1 UC210-200D1
55	UCFL211D1	224	184	25	18	43	19	130	58.4	55.6	22.2	M16	UC211D1
2 2 ¹ / ₁₆ 2 ¹ / ₈ 2 ³ / ₁₆	UCFL211-200D1 UCFL211-201D1 UCFL211-202D1 UCFL211-203D1	8 13/16	71/4	63/64	23/32	1 11/16	3/4	5 1/8	2 19/64	2.1890	0.874	5/8	UC211-200D1 UC211-201D1 UC211-202D1 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 2 ³ / ₈ 2 ⁷ / ₁₆	UCFL212-204D1 UCFL212-205D1 UCFL212-206D1 UCFL212-207D1	927/32	7 61/64	1 9/64	23/32	1 7/8	29/32	5 ¹ / ₂	2 ⁴⁵ /64	2.5630	1.000	3/4	UC212-204D1 UC212-205D1 UC212-206D1 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	2 ³ /4	2.5630	1.000	3/4	UC213-208D1 UC213-209D1
70	UCFL214D1	265	216	31	22	54	23	160	75.4	74.6	30.2	M20	UC214D1
2 ⁵ /8 2 ¹¹ / ₁₆ 2 ³ / ₄	UCFL214-210D1 UCFL214-211D1 UCFL214-212D1	10 ⁷ /16	81/2	1 7/32	7/8	2 ¹ /8	29/32	6 ⁵ /16	2 31/32	2.9370	1.189	3/4	UC214-210D1 UC214-211D1 UC214-212D1

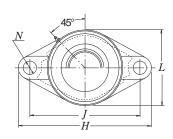
Note (1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".

Housing number	Unit number (1) pressed steel dust cover type	Unit number (1) cast dust cover type		Nomin	al dimer	nsions		N	lass of uni	it
	,,			-	nm inch				kg lb	
			max.	A_4	A_5	L_1	L_2	UCFL	Z(ZM)	C(CM)
FL209D1 FL209D1	Z(ZM)-UCFL209D1 Z(ZM)-UCFL209-110D1	C(CM)-UCFL209D1 C(CM)-UCFL209-110D1	3	57	70	113	54	1.8	1.9	2.3
FL209D1 FL209D1	Z(ZM)-UCFL209-112D1 Z(ZM)-UCFL209-112D1	C(CM)-UCFL209-112D1 C(CM)-UCFL209-112D1	1/8	2 ¹ / ₄	2 ³ /4	4 ⁷ /16	2 ¹ /8	4.0	4.2	5.1
FL210D1 FL210D1	Z(ZM)-UCFL210D1 Z(ZM)-UCFL210-113D1	C(CM)-UCFL210D1 C(CM)-UCFL210-113D1	3	60	72	120	58	2.0	2.1	2.7
FL210D1 FL210D1 FL210D1	Z(ZM)-UCFL210-114D1 Z(ZM)-UCFL210-115D1 —	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 FL211D1	Z(ZM)-UCFL211D1 Z(ZM)-UCFL211-200D1	C(CM)-UCFL211D1 C(CM)-UCFL211-200D1	4	64	75	133	65	2.9	3.0	3.4
FL211D1 FL211D1 FL211D1	Z(ZM)-UCFL211-201D1 Z(ZM)-UCFL211-202D1 Z(ZM)-UCFL211-203D1	C(CM)-UCFL211-201D1 C(CM)-UCFL211-202D1 C(CM)-UCFL211-203D1	5/32	2 1/2	2 15/16	51/4	2 9/16	6.4	6.6	7.5
FL212D1 FL212D1	Z(ZM)-UCFL212D1 Z(ZM)-UCFL212-204D1	C(CM)-UCFL212D1 C(CM)-UCFL212-204D1	4	74	86	144	70	3.8	4.0	4.6
FL212D1 FL212D1 FL212D1	Z(ZM)-UCFL212-205D1 Z(ZM)-UCFL212-206D1 —	C(CM)-UCFL212-205D1 C(CM)-UCFL212-206D1 C(CM)-UCFL212-207D1	5/32	2 ²⁹ /32	3 3/8	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	3 17/32	6 3/16	3 ¹ /16	11	11	15
FL214D1 FL214D1	_	C(CM)-UCFL214D1 C(CM)-UCFL214-210D1	4	_	98	164	80	5.4	_	7.7
FL214D1 FL214D1	_	C(CM)-UCFL214-211D1 C(CM)-UCFL214-212D1	5/32	_	3 ²⁷ /32	6 ¹⁵ /32	3 5/32	12	_	17

Rhombus flanged units cast housing Set screw type



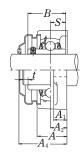


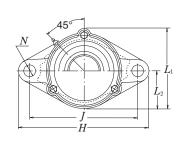


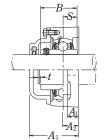
Pressed steel dust cover type
Open end Z-UCFL...D1
Closed end ZM-UCFL...D1

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	B	S	inch	
75	UCFL215D1	275	225	34	22	56	23	165	78.5	77.8	33.3	M20	UC215D1
2 ¹³ / ₁₆ 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	6 ¹ /2	3 ³ /32	3.0630	1.311	3/4	UC215-213D1 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	9 ⁴⁹ /64	1 ²⁷ /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		N	lass of uni	it
	cover type				mm inch				kg lb	
			t max.	A_4	A_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	_	41/32	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	3 17/32	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	_	4 1/2	7 9/16	3 3/4	19	_	22
FL218D1 FL218D1	Ξ	C(CM)-UCFL218D1 C(CM)-UCFL218-308D1	5 13/64	_	122 4 ¹³ / ₁₆	205 8 ¹ /16	102 4 ¹ / ₃₂	11 24	_	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.





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.

SD31TS SD32TS

SN 5

SN 6

SN 30

SN 31

SN 2

SN 3

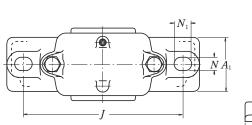
SN 2C

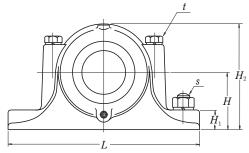
SG 5

These are provided with labyrinth seals, so they are suitable for high speed applications.

B 304 B 305

SN 5, SN 6 Types Shaft Diameter 20 – 55 mm



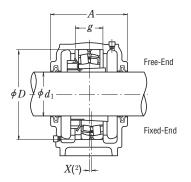


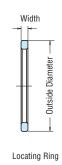
Shaft Diameter (mm)	Plummer Block							Dimens (mr							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	tnominal	S nominal	approx.
20	SN 505	52	40	130	15	20	67	165	46	22	75	25	M 8	M 12	1.1
	SN 605	62	50	150	15	20	80	185	52	22	90	34	M 8	M 12	1.6
25	SN 506	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.



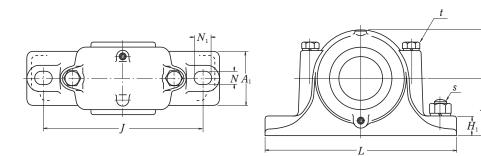


		Ap	plicable Parts				Oil
Self-Align Numbers	ning Ball Bearing Basic Dynamic Load Ratings $C_{ m r}$ (N)		r Bearing sic Dynamic Load Ratings $C_{ m r}$ (N)	Adapter Numbers	$\begin{array}{c} \text{Locating Rings} \\ \text{Nominal } \left(\begin{smallmatrix} \text{Outside} \\ \text{Dia.} \end{smallmatrix} \right. \\ \times \text{Width} \left. \right) \end{array}$	Q'ty	Seals (3)
1205 K 2205 K 1305 K 2305 K	12 400 18 200	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	15 300 21 400	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	21 700 25 300	 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	22 400 29 800	 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	23 300 38 500	 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	23 400 43 500	 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	26 700 51 500	— 22211 EAKE4 21311 EAKE4 22311 EAKE4	 119 000 142 000 234 000	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	34 000 57 500	— 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

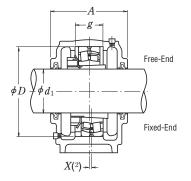


Shaft Diameter (mm)	Plummer Block							Dimen:							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{\rm H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal	approx.
60	SN 513	120	80	230	18	23	110	275	80	30	150	43	M 12	M 16	5.6
	SN 613	140	95	260	22	27	130	315	90	32	175	58	M 16	M 20	8.7
65	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".

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.





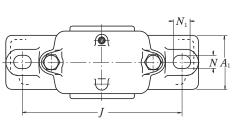
Oalf Aliania a Dall Daggia		pplicable Parts	A -l t	Leasting Divers		Oil Seals (3)
$\begin{array}{c} \text{Self-Aligning Ball Bearing} \\ \text{Numbers} & \begin{array}{c} \text{Basic Dynamic L} \\ \text{Ratings } C_r \text{ (N)} \end{array} \end{array}$		r Bearing sic Dynamic Load Ratings $C_{ m r}$ (N)	Adapter Numbers	Locating Rings Nominal (Outside Awidth)	Q'ty	
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		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		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	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 — — — — 1320 K 140 000 2320 K 187 000	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	GS20 GS20
1222 K 87 000 2222 K 122 000	23122 CKE4 	385 000 	H 3122X H 222X H 322X H 2322X	SR 180×10 SR 200×21 SR 200×13.5 SR 200×10	1 2 2 1	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

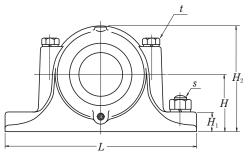
Notes (2) The *X* dimension indicates the offset of the bearing center from the center of the plummer block bearing box. When one locating ring is used, it is 1/2 of the locating ring width, and when two rings are used, it becomes 0.

^{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





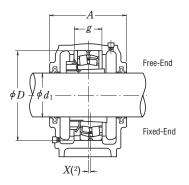
Shaft Diameter	Plummer Block							Dimen: (mr							Mass (kg)
d_1	Bearing Box Numbers (1)	$_{ m H8}^{D}$	H h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	t nominal	S nominal	approx.
110	SN 3024	180	112	320	26	32	150	380	110	40	218	56	M 20	M 24	16
	SN 3124	200	125	350	26	32	165	410	120	45	245	72	M 20	M 24	20
	SN 524	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
125	SN 3128	225	150	380	28	36	180	410	130	45 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
405	ON 0000	005	450	000	00	0.0	475	4.45	400	F.0	000	0.0	1.404	1404	00
135	SN 3030 SN 3130	225 250	150 150	380 420	28 33	36 42	175 200	445 500	130 150	50 50	290 305	66 90	M 24 M 24	M 24 M 30	29 38
	SN 530	270	160	450	33	42	200	530	160	60	325	106	M 24	M 30	46
	314 330	2.70	100	450	33	42	220	550	100	00	323	100	IVI 24	101 30	40
	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.



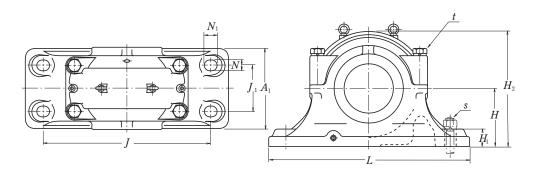


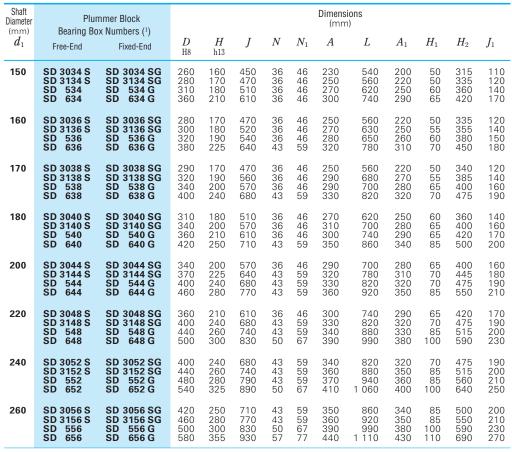
		Α	pplicable Parts				Oil Seals (3)
Self-Aligni Numbers	ng Ball Bearing Basic Dynamic Load	Spherical Roll Numbers	Basic Dynamic Load	Adapter Numbers	Locating Rings Nominal $\begin{pmatrix} \text{Outside} \\ \text{Dia.} \end{pmatrix}$	Q'ty	Outio ()
	Ratings $C_{\rm r}$ (N)		Ratings $C_{\rm r}$ (N)		Vola.		
_	_	23024 CDKE4	315 000	H 3024	SR 180×10	1	GS24
_	_	23124 CKE4	465 000	H 3124	SR 200×10	1	GS24
_	_	22224 EAKE4 23224 CKE4	550 000 630 000	H 3124 H 2324	SR 215×14 SR 215×10	2 1	GS24
_	_	22324 EAKE4	955 000	H 2324	SR 260×10	1	GS24
_	_	23026 CDKE4		H 3026	SR 200×10	1	GS26
_	_	23126 CKE4	505 000	H 3126	SR 210×10	1	GS26
_	_	22226 EAKE4 23226 CKE4	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 CDKE4		H 3028	SR 210×10	1	GS 28
_	_	23128 CKE4	580 000	H 3128	SR 225×10	1	GS28
_	_	22228 CDKE4 23228 CKE4	645 000 835 000	H 3128 H 2328	SR 250×15 SR 250×10	2 1	GS28
_	_	22328 CKE4	1 160 000	H 2328	SR 300×10	1	GS 28
_	_	23030 CDKE4	470 000	H 3030	SR 225×10	1	GS30
_	_	23130 CKE4	725 000	H 3130	SR 250×10	1	GS30
_	_	22230 CDKE4 23230 CKE4	765 000 975 000	H 3130 H 2330	SR 270×16.5 SR 270×10	2	GS30
_	_						
_	_	22330 CAKE4	1 220 000	H 2330	SR 320×10	1	GS30
_	_	23032 CDKE4	540 000	H 3032	SR 240×10	1	GS32
_	_	23132 CKE4	855 000	H 3132	SR 270×10	1	GS32
_	_	22232 CDKE4 23232 CKE4	910 000 1 100 000	H 3132 H 2332	SR 290×17 SR 290×10	2	GS32
_	_	22332 CAKE4	1 360 000	H 2332	SR 340×10	1	GS32

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

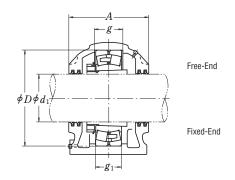






To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+adapter".

Remarks 1. The threads for oil replenishing hole plugs are R 1/4 and those for drain plugs are R 3/8.

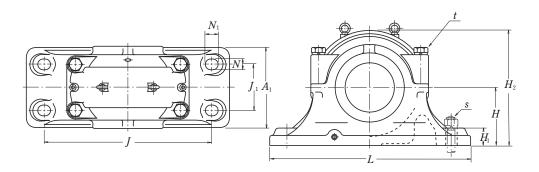


g	g_1	t	s	Mass (kg)	Applicable Parts Spherical Roller Bearing Adapter Numbers Basic Dynamic Load Numbers	Oil Seals (²)
g H13	g ₁ H13	nominal	nominal	approx.	Ratings $C_{\rm r}$ (N)	
77	67	M 24	M 30	70	23034 CDKE4 640 000 H 3034	GS 34
98	88	M 24	M 30	75	23134 CKE4 940 000 H 3134	GS 34
96	86	M 24	M 30	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

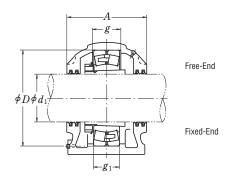


Shaft								Dimens	ione				
Diameter		nmer Block						(mn					
$\stackrel{ ext{(mm)}}{d_1}$	ŭ	x Numbers (1)	D	H	J	N	N_1	A	L	A_1	H_1	H_2	J_1
u ₁	Free-End	Fixed-End	H8	h13	J	11	111	71	L	211	111	112	J 1
280	SD 3060 S	SD 3060 SG	460	280	770	43	59	360	920	350	85	550	210
	SD 3160 S SD 560	SD 3160 SG SD 560 G	500 540	300 325	830 890	50 50	67 67	390 410	990 1 060	380 400	100 100	590 640	230 250
300	SD 3064 S	SD 3064 SG	480	280	790	43	59	380	940	360	85	560	210
	SD 3164 S SD 564	SD 3164 SG SD 564 G	540 580	325 355	890 930	50 57	67 77	430 440	1 060 1 110	400 430	100 110	640 690	250 270
320	SD 3068 S SD 3168 S	SD 3068 SG SD 3168 SG	520 580	310 355	860 930	50 57	67 77	400 470	1 020 1 110	370	100 110	615	230 270
	30 3 108 3	SD 3108 SG	580	355	930	57	//	470	1 110	450	110	690	270
340	SD 3072 S	SD 3072 SG	540	325	890	50	67	410	1 060	390	100	640	250
	SD 3172 S	SD 3172 SG	600	365	960	57	77	470	1 140	460	120	710	310
360	SD 3076 S SD 3176 S	SD 3076 SG SD 3176 SG	560 620	340 375	900 980	50 57	67 77	410 500	1 080 1 160	390 490	100 120	665 735	260 320
380	SD 3080 S	SD 3080 SG	600	365	960	57	77	430	1 140	420	120	710	270
	SD 3180 S	SD 3180 SG	650	390	1 040	57	77	520	1 220	510	125	765	340
400	SD 3084 S	SD 3084 SG	620	375	980	57	77	430	1 160	420	120	735	270
400	SD 3184 S	SD 3184 SG	700	420		57	77	560	1 250	550	135	830	380
410 430	SD 3088 S SD 3092 S	SD 3088 SG SD 3092 SG	650 680	390 405	1 040 1 040	57 57	77 77	460 470	1 220 1 220	450 460	125 130	765 790	280 310
450	SD 3096 S	SD 3096 SG	700	415		57 57	77	485	1 280	470	130	820	320



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.

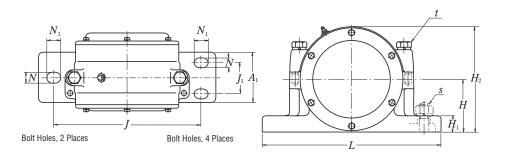


ď	ď	t	s	Mass (kg)	Applicable Parts Spherical Roller Bearing Adapter	Oil Seals (²)
g H13	g ₁ H13	nominal	nominal	approx.	Numbers $egin{array}{ll} ext{Basic Dynamic Load} & ext{Numbers} \ ext{Ratings } C_{ ext{r}} \left(ext{N} ight) \end{array}$	
128	118	M 36	M 36	300	23060 CAKE4 1 920 000 H 3060	GS 60
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

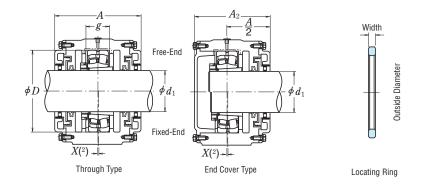


Shaft Diameter		ner Block ing Box							nension (mm)	S					
d_1	Num Through Type	bers (1) End Cover Type	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	J_1	A_2	g H13
50	SG 511	SG 511-0	100	70	210	18	23	125	255	70	23	137	_	112.5	29
55	SG 512	SG 512-0	110	80	230	18	23	145	290	80	25	160	_	135	32
60	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".

Remarks 1. The threads for grease nipples are R 1/8 for SG518 and under, and R 1/4 for SG520 and over.



			ass			Applic	able	Parts			Oil
		app	(g) orox.	Spherical		•	Α	dapter	Locating Rir	ng	Seals (3)
t nominal	S nominal	Through Type	End Cover Type	Numbers		Dynamic Load $C_{ m r}$ (N)	Nu	ımbers	Nominal (Outside Dia.×Width)	Q'ty	
M 12	M 16	8.5	7.5	22211 EAK	Œ4 ´	119 000	Н	311 X	SR 100×4	1	GS 11
M 16	M 16	15	14	22212 EAK	Œ4 ´	142 000	Н	312 X	SR 110×4	1	GS 12
M 16	M 16	9.5	8.5	22213 EAK	Œ4 ´	177 000	Н	313 X	SR 120×5	1	GS 13
M 16	M 16	12.5	11	22215 EAK	Œ4 ´	190 000	Н	315 X	SR 130×5	1	GS 15
M 20	M 20	18.5	17	22216 EAK	Œ4 2	212 000	Н	316 X	SR 140×5	1	GS 16
M 20	M 20	21	20	22217 EAK	Œ4 2	250 000	Н	317 X	SR 150×5	1	GS 17
M 20	M 20	25	23	22218 EAK	Œ4 2	289 000	Н	318 X	SR 160×5	1	GS 18
M 20	M 20	37	34	22220 EAK	Œ4 3	365 000	Н	320 X	SR 180×5	1	GS 20
M 20	M 20	50	45	22222 EAK	Œ4 4	485 000	Н	322 X	SR 200×5	1	GS 22
M 20	M 20	59	53	22224 EAK	Œ4 5	550 000	Н:	3124	SR 215×5	1	GS 24
M 24	M 24	67	62	22226 EAK	Œ4 6	655 000	Н:	3126	SR 230×5	1	GS 26
M 24	M 24	73	68	22228 CDk	ΚΕ4 6	645 000	Н:	3128	SR 250×5	1	GS 28
M 24	M 24	90	80	22230 CDk	KE4 7	765 000	Н:	3130	SR 270×5	1	GS 30
M 24	M 24	105	92	22232 CDk	KE4 9	910 000	Н:	3132	SR 290×5	1	GS 32
M 30	M 30	130	115	22234 CDk	KE4 9	990 000	Н:	3134	SR 310×5	1	GS 34
M 30	M 30	155	135	22236 CDk	(E4 1 (020 000	Н	3136	SR 320×5	1	GS 36
M 36	M 36	175	155	22238 CAK	Œ4 1 ´	140 000	Н	3138	SR 340×5	1	GS 38
M 36	M 36	210	180	22240 CAK	Œ4 1 3	300 000	Н	3140	SR 360×5	1	GS 40
		1									

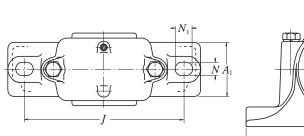
Notes (2) The X dimension indicates the offset of the bearing center from the center of plummer block bearing box, and it is 1/2 of the locating ring width.

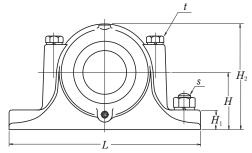
B 316 B 317

^{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



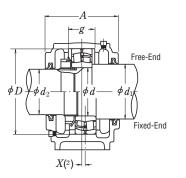


Shaft Diameter (mm)	Plummer Block								Dimens (mm							
d	Bearing Box Numbers (1)	d_1	d_2	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	tnominal	\$ nominal
25	SN 205 C	30	20	52	40	130	15	20	67	165	46	22	75	25	M 8	M 12
	SN 305 C	30	20	62	50	150	15	20	80	185	52	22	90	34	M 8	M 12
30	SN 206 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.





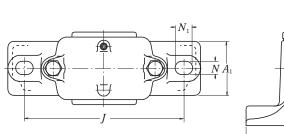
Locating Ring

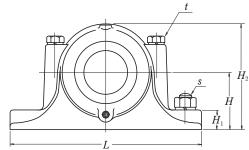
Mass				Applicable	e Parts				Oil Se	eals (3)
(kg)	Self-Alignin	ig Ball Bearing B. D. L. R. (4)		r Bearing B. D. L. R. (4)	Nut	Lock-washer	Locating Ring	Olf-	Side d	Side d_2
approx.	Numbers	$C_{\rm r}$ (N)	Numbers	$C_{\rm r}$ (N)	Numbers	Numbers	Nominal (Outside Dia.×Width)	Q'ty	0.00 01	0.00 02
1.1	1205 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	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	GS 10	GS 7
2.6	1208 2208	19 300 22 400	 22208 EAE4	— 90 500	AN 08 AN 08	X80 WA X80 WA	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	AN 08 AN 08	AW 08X X80 WA	SR 90×10 SR 90×10	2	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



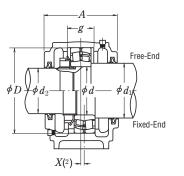


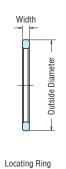
Shaft Diameter (mm)	Plummer Block								Dimensi (mm							
d	Bearing Box Numbers (1)	d_1	d_2	$_{ m H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	tnominal	S nominal
60	SN 212 C	70	55	110	70	210	18	23	105	255	70	30	135	38	M 12	M 16
	SN 312 C	70	55	130	80	230	18	23	125	280	80	30	155	56	M 12	M 16
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.



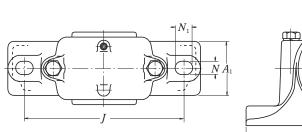


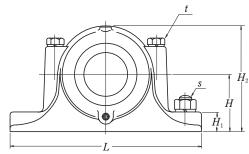
Mass				Applicable	e Parts				Oil Se	als (3)
(kg) approx.	Numbers	ng Ball Bearing B. D. L. R. $^{(4)}$ $C_{ m r}$ (N)	Spherical Rolle Numbers	er Bearing B. D. L. R. $^{(4)}$ $C_{ m r}$ (N)	Nut Numbers	Lock-washer Numbers	Locating Ring Nominal (Outside Dia.×Width)	Q'ty	Side d_1	Side d_2
5.0	1212 2212	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		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			AW 14X AW 14X	SR 150 × 13 SR 150 × 10	2	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			AW 15X AW 15X	SR 160 × 14 SR 160 × 10	2	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			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			AW 17X AW 17X	SR 180 × 14.5 SR 180 × 10	2	GS 21	GS 18
13	1218 2218 —	57 500 70 500 —	 22218 EAE4 23218 CE4	 289 000 340 000		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





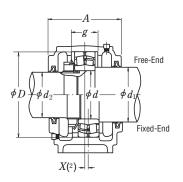
Shaft Diameter	Plummer Block								Dimensi (mm							
$d^{(mm)}$	Bearing Box Numbers (1)	d_1	d_2	$_{\rm H8}^{D}$	<i>H</i> h13	J	N	N_1	A	L	A_1	H_1	H_2	g H13	tnominal	S nominal
95	SN 219 C	110	90	170	112	290	22	27	140	345	100	35	210	53	M 16	M 20
	SN 319 C	110	90	200	125	350	26	32	170	410	120	45	245	77	M 20	M 24
100	SN 220 C	115	95	180	112	320	26	32	160	380	110	40	218	70.3	M 20	M 24
	SN 320 C	115	95	215	140	350	26	32	175	410	120	45	270	83	M 20	M 24
110	SN 222 C	125	105	200	125	350	26	32	175	410	120	45	240	80	M 20	M 24
	SN 322 C	125	105	240	150	390	28	36	190	450	130	50	300	90	M 24	M 24
120	SN 224 C	135	115	215	140	350	26	32	185	410	120	45	270	86	M 20	M 24
	SN 324 C	135	115	260	160	450	33	42	200	530	160	60	320	96	M 24	M 30
130	SN 226 C	145	125	230	150	380	28	36	190	445	130	50	290	90	M 24	M 24
	SN 326 C	150	125	280	170	470	33	42	210	550	160	60	340	103	M 24	M 30
140	SN 228 C	155	135	250	150	420	33	42	205	500	150	50	305	98	M 24	M 30
	SN 328 C	160	135	300	180	520	35	45	235	610	170	65	365	112	M 30	M 30
150	SN 230 C	165	145	270	160	450	33	42	220	530	160	60	325	106	M 24	M 30
	SN 330 C	170	145	320	190	560	35	45	245	650	180	65	385	118	M 30	M 30
160	SN 232 C	175	150	290	170	470	33	42	235	550	160	60	345	114	M 24	M 30
	SN 332 C	180	150	340	200	580	42	50	255	680	190	70	405	124	M 30	M 36

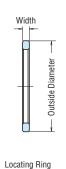


To place an order for a complete unit, please specify, "Plummer block bearing box+bearing+nut+Lock-washer+locating ring".

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.



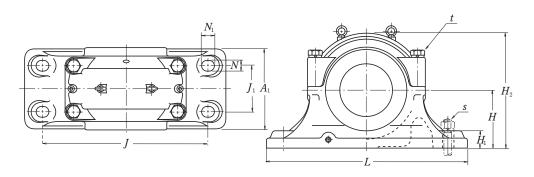


Mass				Applicable	e Parts				Oil Se	als (3)
(kg)	Self-Aligni	ng Ball Bearing	Spherical Ro	ler Bearing	Nut	Lock-washer	Locating Ring			
approx.	Numbers	B. D. L. R. (4) $C_{ m r}$ (N)	Numbers	B. D. L. R. (4) $C_{ m r}$ (N)	Numbers	Numbers	Nominal (Outside Dia.×Width)	Q'ty	Side d_1	Side d_2
15	1219 2219	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	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			AW 22X AW 22X	SR 240 × 20 SR 240 × 10	2	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.

(3) Applicable to the ZF Type with the same number. (4) B. D. L. R.: Basic Dynamic Load Ratings

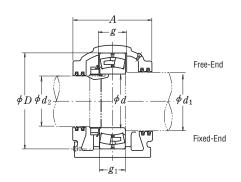
SD 2 C, SD 3 C Types Shaft Diameter 170 – 320 mm



Shaft Diameter		ner Block ing Box						C	imensi (mm						
$\stackrel{\text{(mm)}}{d}$	Num Free-End	bers (1) Fixed-End	d_1	d_2	$_{\rm H8}^{D}$	<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
		SD 336 CG	200	170	380	225	640	43	59	320	780	310	70	450	180
190		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
	SD 344 C	SD 344 CG	240	210	460	280	770	43	59	360	920	350	85	550	210
040	00.040.0	00.040.00	000	000	440	000	740	40	F-0	0.40	000	000	0.5	E4E	000
240		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
280	SD 256 C	SD 256 CG	300	260	500	300	830	50	67	390	990	380	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	Applicable Parts				Oil Se	als (²)
		,		(kg)	Spherical R	oller Bearing	Nut	Lock-washer		O
g H13	g 1 H13	tnominal	S nominal	approx.	Numbers	Basic Dynamic Load Ratings $C_{ m r}$ (N)	Numbers	or Stopper Numbers	Side d_1	Side d_2
96	86	M 24	M 30	100	22234 CDE	4 990 000	AN 34	AW 34	GS 42	GS 36
130	120	M 30	M 30	160	22334 CAE	4 1 580 000	AN 34	AW 34	GS 42	GS 36
96	86	M 24	M 30	110	22236 CDE	4 1 020 000	AN 36	AW 36	GS 44	GS 38
136	126	M 30	M 36	195	22336 CAE	4 1 740 000	AN 36	AW 36	GS 44	GS 38
102	92	M 30	M 30	130	22238 CAE	4 1 140 000	AN 38	AW 38	GS 46	GS 40
142	132	M 30	M 36	210	22338 CAE	4 1 890 000	AN 38	AW 38	GS 46	GS 40
108	98	M 30	M 30	155	22240 CAE	4 1 300 000	AN 40	AW 40	GS 48	GS 42
148	138	M 36	M 36	240	22340 CAE	4 2 000 000	AN 40	AW 40	GS 48	GS 42
118	108	M 30	M 36	205	22244 CAE	4 1 570 000	AN 44	AL 44	GS 52	GS 46
155	145	M 36	M 36	315	22344 CAE	4 2 350 000	AN 44	AL 44	GS 52	GS 46
130	120	M 36	M 36	240	22248 CAE	4 1 870 000	AN 48	AL 44	GS 56	GS 50
165	155	M 36	M 42	405	22348 CAE	4 2 600 000	AN 48	AL 44	GS 56	GS 50
140	130	M 36	M 36	315	22252 CAE	4 2 180 000	AN 52	AL 52	GS 60	GS 54
175	165	M 36	M 42	480	22352 CAE	4 3 100 000	AN 52	AL 52	GS 60	GS 54
140	130	M 36	M 42	390	22256 CAE	4 2 280 000	AN 56	AL 52	GS 64	GS 56
185	175	M 42	M 48	610	22356 CAE	4 3 500 000	AN 56	AL 52	GS 64	GS 56
150	140	M 36	M 42	465	22260 CAE	4 2 610 000	AN 60	AL 60	GS 68	GS 60
160	150	M 42	M 48	595	22264 CAE	4 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

Nominal		Clear	ances	
Bore Dia. d (mm)	С	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
100 120	35	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

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

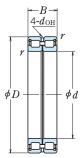
0	perating Conditions	Fitting between Inner Ring and Shaft	Fitting between Outer Ring and Housing Bore	Recommended Internal Clearance
	Thin walled housings and heavy loads	g6 or h6	P7	C3
Outer Ring Rotation	Normal to heavy loads	g6 or h6	N7	C3
	Light or fluctuating loads	g6 or h6	M7	CN

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.

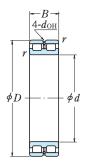
B 326 B 327

RS-48 · RS-49 Types RSF-48 · RSF-49 Types

Bore Diameter 50 - 220 mm



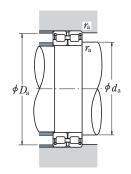




Free-End Bearing RSF

	Boundary [S	(Basic Loa	nd Ratings	gf}	Limiting Speeds (min ⁻¹)	
d	D	В	r min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{ m r}$	C_{0r}	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.



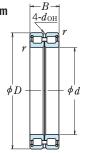
Bearing N	umbers(1)		nsions im)		butment and Dimensions (n	nm)	Mass (kg)
Fixed-End Bearing	Free-End Bearing	$d_{ m OH}^{(2)}$	Axial Disp.(3)	$d_{ m a}$ min.	$D_{ m a}$ max.	$\pmb{\gamma}_{\mathrm{a}}$ max.	approx.
RS-4910E4	RSF-4910E4	2.5	1.5	54	68	0.6	0.30
RS-4912E4	RSF-4912E4	2.5	1.5	65	80	1	0.46
RS-4913E4	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	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	2.85
RS-4930E4	RSF-4930E4	5	3.5	159	201		6.65
RS-4832E4	RSF-4832E4	3	2	166.5	193.5	1 2	3.05
RS-4932E4	RSF-4932E4	5	3.5	169	211		7.0
RS-4834E4	RSF-4834E4	4	3	176.5	208.5	1 2	4.1
RS-4934E4	RSF-4934E4	4	3.5	179	221		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

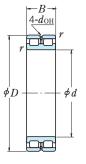
Notes (1) The suffix E4 indicates that the outer ring is provided with oil holes and oil groove.

- (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

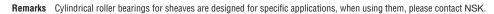


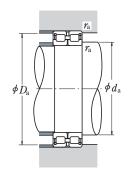


Fixed-End Bearing RS

Free-End Bearing RSF

		Dimension	S	(Basic Lo	ad Ratings {k	:gf}	Limiting Speeds (min ⁻¹)	
d	D	В	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	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	710	180	5	3 400 000	9 200 000	350 000	935 000	160	320
560	750	190	5	3 800 000	10 100 000	385 000	1 030 000	150	300



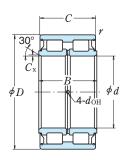


Bearing N	lumbers(1)		nsions im)		Abutment and Dimensions (r	mm)	Mass (kg)
Fixed-End Bearing	Free-End Bearing	$d_{ m OH}^{(2)}$	Axial Disp.(3)	$d_{ m a}$ min.	$\begin{array}{c} D_{\rm a} \\ {\rm max.} \end{array}$	$m{\gamma}_{\mathrm{a}}$ max.	approx.
RS-4848E4	RSF-4848E4	5	3.5	249	291	2	10.3
RS-4948E4	RSF-4948E4	7	5	251	309	2	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	3	90.5
RS-4880E4	RSF-4880E4	8	6	411	489	2	47.5
RS-4980E4	RSF-4980E4	11	8	416	524	3	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	3	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

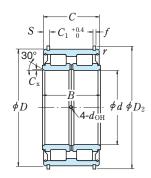
Notes (1) The suffix E4 indicates that the outer ring is provided with oil holes and oil groove.

- (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



Without Locating Ring



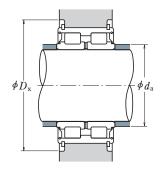
With Locating Ring

	Е	Boundary I	Dimensior	1S		(Basic Load I	•	gf}	Limiting Speeds
d	D	В	С	$C_{ m x}^{(1)}$ min.	γ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$	(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



Remarks 1. Good quality grease is prepacked in bearings.

2. Grease can be supplied through oil holes in the inner rings.



Bearing N	Numbers			ing Ring ions (mm)		Oil Holes (mm)		ent and isions (mm)	Mass (kg)
Without Locating Ring	With Locating Ring	C_1	S	D_2	f	$d_{ m OH}$	$d_{ m a}$ min.	$D_{\mathbf{x}} \\ \text{min.}$	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.

^{4.} 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 BEARINGS	Table 8.3 (Pages A64 to A67)
INCH DESIGN FOUR-ROW TAPERED ROLLER BEARINGS	Table 8.4 (Pages A68 to A69)
FOUR-ROW CYLINDRICAL ROLLER BEARINGS	Table 8.2 (Pages A60 to A63)

RECOMMENDED FITS

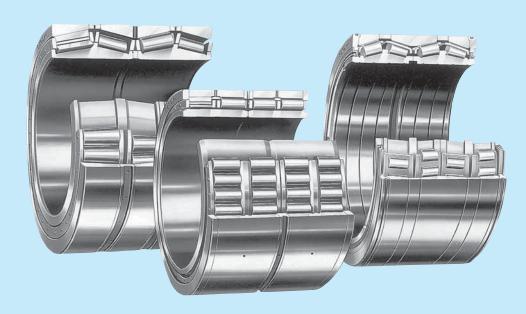
FOUR-ROW TAPERED ROLLER BEARINGS (CYLINDRICAL BORES)

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

•	Nominal Bore Diameter d (mm)		Bore Dia.	ane Mean Deviation d_{mp}	Tole	rance	Clear	ance	Wear Limits
	over	incl.	high	low	high	low	min.	max.	Ref.
	80 120 180	120 180 250	0 0 0	-20 -25 -30	- 120 - 150 - 175	- 150 - 175 - 200	100 125 145	150 175 200	300 350 400
	250 315 400	315 400 500	0 0 0	-35 -40 -45	-210 -240 -245	-250 -300 -300	175 200 200	250 300 300	500 600 600
	500 630	630 800	0	- 50 - 75	- 250 - 325	-300 -400	200 250	300 400	600 800



B 334 B 335





Table 2 Fits of Metric Design Four-Row Tapered Roller Bearings with Chock

Units: µm

Diar	l Outside neter mm)	Outside D	lane Mean ia. Deviation $D_{ m mp}$		nce for K Bore neter	Clea	rance	Wear Limits of Chock
over	incl.	high	low	high	low	min.	max.	Ref.
120 150 180 250 315	150 180 250 315 400	0 0 0 0	- 18 - 25 - 30 - 35 - 40	+ 57 +100 +120 +115 +110	+25 +50 +50 +50 +50	25 50 50 50 50	75 125 150 150 150	150 250 300 300 300
400 500 630 800	500 630 800 1 000	0 0 0 0	- 45 - 50 - 75 - 100	+105 +100 +150 +150	+50 +50 +75 +75	50 50 75 75	150 150 225 250	300 300 450 500

Table 3 Fits of Inch Design Four-Row Tapered Roller Bearings with Roll Necks

Units: µm

N	Bore Diameter Deviation ∆ds		Tolerance for Roll Neck Diameter		Clearance		Wear Limits of			
(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

Nominal Outside Diameter D					Outside Dia. Deviation △Ds		Tolerance for Chock Bore Diameter		rance	Wear Limits of
ove	over incl.		hiah	low	hiah	low	min.	max.	Chock	
(mm)	1/25.4	(mm)	1/25.4	iligii	10 00	Illgii	IUW	111111.	IIIax.	Ref.
_	_	304.800	12.0000	+ 25	0	+ 75	+ 50	25	75	150
304.800	12.0000	609.600	24.0000	+ 51	0	+150	+100		150	300
609.600	24.0000	914.400	36.0000	+ 76	0	+225	+150	74	225	450
914.400	36.0000	1 219.200	48.0000	+102	0	+300	+200		300	600
1 219.200	48.0000	1 524.000	60.0000	+127	0	+375	+250	123	375	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 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	•	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)

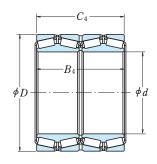
Units: µm

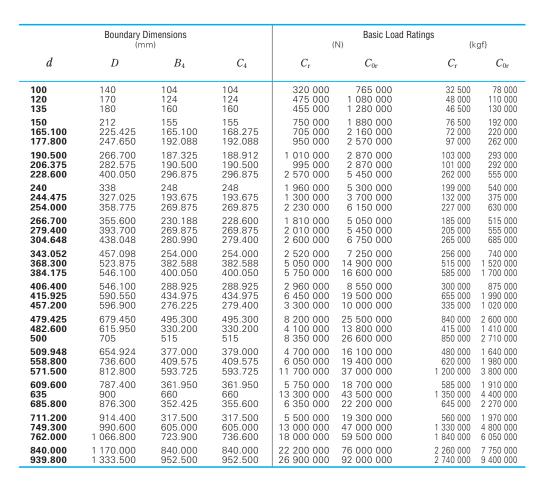
Nominal Bo		Radial Internal Clearance			
over	incl.	min.	max.		
80	120	25	45		
120	180	30	50		
180	250	40	60		
250	315	50	70		
315	400	60	80		
400	500	70	90		
500	630	80	100		
630	800	100	120		
800	1 000	120	140		

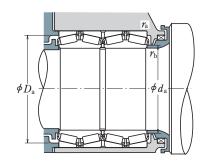
B 336 B 337

Bore Diameter 100 - 939.800 mm









D : N .	Abuti	ment and Fill (mn		ons	Mass (kg)	2.4
Bearing Numbers	d_{a}	D_{a}	${m \gamma}_{\rm a}$ max.	$ m \emph{Y}_b$ max.	approx.	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	536	619	6.4	1.5	312	
*558 KV 7352	588	697	6.4	3.3	457	LM 377449DW -410-410D
*571 KV 8151	622	755	6.4	3.3	1 020	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

Note (*) Bearings marked * are inch design.

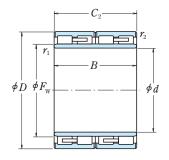
Remarks 1. For four-row tapered roller bearings not listed above, please contact NSK.

2. Four-row tapered roller bearings are designed for specific applications, when using them, please contact NSK.

B 338 B 339



Bore Diameter 100 - 330 mm



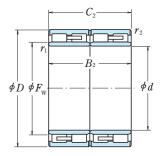


Figure 1

Figure 2

		Воц	ı ndary D (mr	imensions n)			1)	Basic Load Rati	i ngs {kg	ıf}
d	D	B, B_2	C_2	$F_{ m w}$	${m r}_1$ min.	$\emph{\textbf{r}}_2$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	$C_{0\mathrm{r}}$
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	300	300	328	2	2	2 330 000	6 900 000	238 000	700 000
	420	240	240	332	3	3	2 280 000	5 750 000	233 000	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

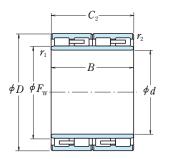
Bearing Numbers	Mass (kg) approx.	Figures	Reference Bearing Numbers
100 RV 1401	4	2	
145 RV 2201	23	1	313924A
150 RV 2201	20	1	—
150 RV 2302	23	1	313891A
160 RV 2301	16	1	=
160 RV 2302	22	1	
170 RV 2501	27	1	=
170 RV 2503	31	1	
180 RV 2501	23	1	—
180 RV 2601	29	1	313812
190 RV 2601	26	1	—
190 RV 2701	36	1	314199B
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.

B 340 B 341

^{2.} Four-row cylindrical roller bearings are designed for specific applications, when using them, please contact NSK.

Bore Diameter 370 - 920 mm



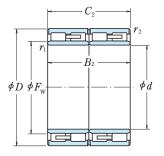
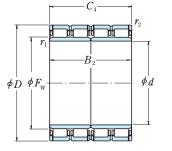


Figure 1

Figure 2



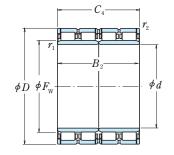


Figure 3

Figure 4

							5			
		Bo	undary D mr)	imensions n)			(1	Basic Load N)		gf}
d	D	B, B_2	C_2	$F_{ m w}$	${m r}_1$ min.	${m r}_2$ min.	$C_{\rm r}$	$C_{0\mathrm{r}}$	$C_{\rm r}$	C_{0r}
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 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	roller	bearings	not listed	above.	please c	ontact NSK.
Homan		101100110110	ymmamour	101101	bournigo	not notou	abovo,	piodoc o	ontaot i toi t.

^{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

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
 - > 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
- A reinforced cage has been adopted for these bearings.

Specified catalogs

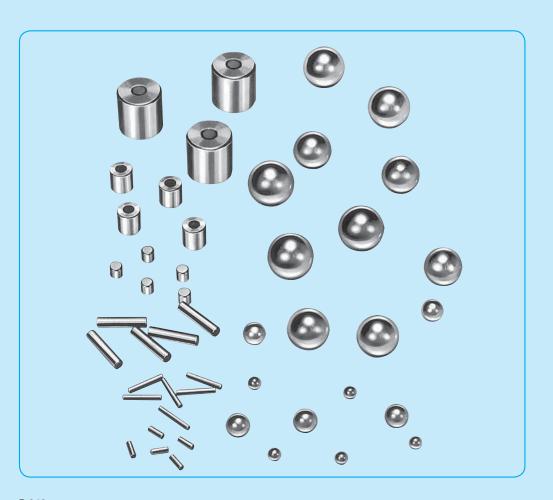
- Bearings for Railway Rolling Stock CAT, No. E1156
- Axle Bearings for Railway Rolling Stock (Cylindrical Roller Bearings) CAT. No. E1239
- Axle Bearings for Railway Rolling Stock (Spherical Roller Bearings) CAT. No. E1240
- Bearings for Traction Motors CAT. No. E1241

B 344 B 345

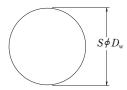


STEEL BALLS AND ROLLERS

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 BOLLER REARINGS	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 $D_{ m w}$ (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
17/64	6.74688	12.52	15/16	23.81250	55.04	3	76.20000	18.04
7 mm	7.00000	13.98	24 mm	24.00000	56.35	3 1/4	82.55000	22.93
9/32	7.14375	14.86	31/32	24.60625	60.73	3 1/2	88.90000	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} 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

	Tolerances(1)				Gauges			
Class	Variation in Dia. max.	Sphericity max.	$\begin{array}{c} \text{Roughness} \\ R_a \\ \text{max.} \end{array}$	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			

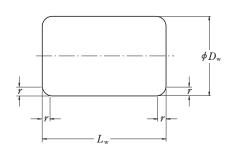
Note (1) Values in () are converted values for reference.

Remarks A column blue letter of Nominal Size is inch dimensions.



Tolerances for Cylindrical Roller Chamfers

Units: mm



min. max. 0.1 0.3 0.2 0.5 0.3 0.8 0.5 1.2 0.6 1.5 0.7 1.7 1 2.2(1)		Units : mm
0.2 0.5 0.3 0.8 0.5 1.2 0.6 1.5 0.7 1.7	min.	max.
1.5	0.2 0.3 0.5 0.6 0.7	0.5 0.8

Note (1) If $D_{\rm W}$ exceeds 40 mm, r (max.) is 2.7 mm.

- 1	ln	ite	mr
C	,,,	ιιs	11111

0.31 0.465

0.44 0.68

0.60

0.85

0.81 1.1

1.04 1.57

1.33 2.04

1.66 2.38

0.3 0.3

0.3 0.3

0.3 0.3

0.3 0.3

0.3

0.3 0.3

0.3 0.3

Inits	mn

				OTILS . IIIII
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	3	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 ×12

9 × 9 9 ×14

10 ×10 10 ×14

11 ×11 11 ×15

12 ×12 12 ×18

13 ×13 13 ×20

14 ×14 14 ×20

8

9

10

10

11 11

12 12

13 13

14 14

8 12

9 14

10

14

11 15

12 18

13 20

14 20

15 × 15 15 15 22 0.5 3.0 16 × 16 16 16 0.5 2.48 16 × 24 16 24 0.5 3.75 17 × 17 17 17 0.5 2.97 17 × 24 17 24 0.5 4.2 18 × 18 18 18 0.5 3.55 19 × 19 19 19 0.6 4.16 19 × 28 19 28 0.6 6.1 20 × 20 20 20 0.6 4.85 20 × 30 20 30 0.6 5.6 21 × 21 21 21 0.6 6.4 21 × 30 21 30 0.6 8.0 22 × 22 22 22 0.6 6.4 23 × 23 23 23 23 0.6 7.3 23 × 34 23 24 0.6 11.2 24 × 24 24 24 26 0.7 9.5 25 × 25 25 25 0.7 9.5	Nominal Size	$D_{ m W}$	$L_{ m W}$	r min.	Mass (kg) per 100 pc: approx.
	15 × 22 16 × 16 16 × 24 17 × 17 17 × 24 18 × 18 18 × 26 19 × 19 19 × 28 20 × 30 21 × 21 21 × 30 22 × 22 22 × 34 23 × 34 24 × 24 24 × 36 25 × 25 25 × 36 26 × 40 28 × 28 28 × 44 30 × 30 30 × 48 32 × 52 34 × 34 30 × 30 30 × 48 32 × 52 34 × 34 36 × 58 37 × 52 38 × 36 39 × 48 30 × 30 30 × 48 31 × 55 32 × 52 34 × 34 34 × 55 36 × 36 36 × 58 38 × 38 38 × 62 40 × 40	16 16 17 17 18 19 20 21 21 22 23 24 25 26 28 30 30 32 34 36 36 38 40	16 24 17 24 18 26 19 28 20 30 21 30 22 34 23 34 24 36 25 36 26 40 48 32 34 34 48 35 36 48 36 48 36 48 36 48 36 48 36 48 36 48 36 48 36 48 36 48 36 36 48 36 36 48 36 48 36 36 36 36 36 36 36 36 36 36 36 36 36	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	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 12.6 9.5 13.7 10.7 10.7 10.7 10.3 21 10.3 21 21 21 21 21 21 21 21 21 21 21 21 21

Units: mm

Nominal Size	$D_{ m W}$	$L_{ m W}$	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

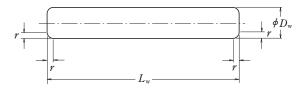
Units : µm

Class) _w m)	Out-of- Roundness (1)	Single Plane Mean Roller Diameter Variation(2)	Lot Diameter Variation(1)	Len	gth Deviation $^{(3)}$ $\Delta L_{ m Ws}$	Roller Gauge Lot Length Variation	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.
- $\binom{3}{4}$ To find the IT9 standard tolerance according to the $L_{\rm W}$ 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.

1.08 1.38

				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	0.44 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

31.5 40

Nominal Size	$D_{ m W}$	$L_{ m W}$	r (1) min.	Mass (kg) per 100 pcs approx.
8 ×25	8888888	25	0.3	0.978
8 ×31.5		31.5	0.3	1.23
8 ×40		40	0.3	1.56
8 ×50		50	0.3	1.96
8 ×63		63	0.3	2.46
9 ×28	9999	28	0.3	1.39
9 ×35.5		35.5	0.3	1.76
9 ×45		45	0.3	2.23
9 ×56		56	0.3	2.77
10×31.5	10	31.5	0.3	1.93
10×40	10	40	0.3	2.44
10×50	10	50	0.3	3.06
10×63	10	63	0.3	3.85
12×40	12	40	0.3	3.52
12×50	12	50	0.3	4.4
12×63	12	63	0.3	5.54
15×45	15	45	0.5	6.16
15×56	15	56	0.5	7.68
15×71	15	71	0.5	9.74
15×90	15	90	0.5	12.4

Units: mm

Note (1) Only for flat-end rollers.

7.5 7.5

7.5×31.5 7.5×40

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) ΔR max.	Single Plane Mean Roller Diameter Variation ${}^{(3)}$ VD_{Wmp} max.	Roller Gauge Lot Diameter Variation $\binom{1}{V}$ VD_{WL} max.	Length Deviation(2) $ extstyle eta L_{ ext{Ws}}$
3	1.5	3	3	h12
5	2	5	5	h12

- $\begin{array}{ll} \text{(1)} & \text{Applicable to roller center (length direction).} \\ \text{(2)} & \text{Classified by } L_{\text{W}}. \text{ Refer to Tolerauce for Length Doviation.} \\ \text{(3)} & \text{Applicable to cylindrical outside surface.} \end{array}$

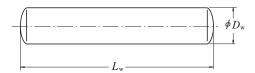
Tolerance for Length Deviation

Units: mm

Length		h12		h13	
over	incl.	high low		high	low
3	6	_		0	- 0.18
6	10	_		0	-0.22
10	18	_		0	-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

				OTHES . IIIIII					Offics . IIIII
Nominal Size	$D_{ m W}$	$L_{ m W}$	r (1) min.	Mass (kg) per 1000 pcs approx.	Nominal Size	$D_{ m W}$	$L_{ m W}$	r $(^1)$ min.	Mass (kg) per 1000 pcs approx.
1 × 5.8 1 × 7.8 1 × 7.8 1 × 7.8 1 × 9.8 1.5× 6.8 1.5× 7.8 1.5× 13.8 2 × 7.8 1.5× 13.8 2 × 13.8 2 × 13.8 2 × 15.8 2 × 15.8 3 × 15.8 3 × 15.8 3 × 15.8 3 × 21.8 3 × 21.8	1111111111 QQQ QQQQQ QXQQQQQQQQQQQQQQQQ	5.67.9.5.67.9.1.3.67.9.1.3.57.	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.035 0.042 0.042 0.060 0.080 0.105 0.1360 0.190 0.165 0.240 0.295 0.385 0.485 0.3750 0.525 0.680 0.7555 0.680 0.7555 0.835 0.485 0.7555 0.835 0.8370 0.870 0.870 0.870 0.870 0.870 0.885 0.885 1.05 1.20 1.35	3.5×19.8 3.5×21.8 3.5×25.8 3.5×25.8 3.5×27.8 3.5×31.8 3.5×31.8 4 ×15.8 4 ×15.8 4 ×21.8 4 ×21.8 4 ×27.8 4 ×27.8 4 ×27.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 4 ×31.8 5 ×31.8 4 ×31.8 5 ×31.8	55 55 55 55 55 55 55 55 55 55 55 55 55	19.8 23.5 25.7 29.1 29.1 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.3 20.7 20.7 20.7 20.7 20.7 20.7 20.7 20.7	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	1.505 1.895 1.2240 1.555 1.910 2.240 1.555 1.222 2.333 3.392 2.247 9.005 1.555 1.00 1.005

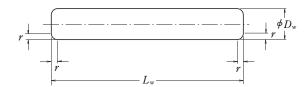
Note (1) Only for flat-end rollers.

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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

			O mico i mini
D	w	r	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

				Omito : pini
Class	Single Plane Mean Roller Diameter Variation $^{(1)}$ VD_{WP} max.	Out-of- Roundness (1) ΔR max.	Roller Gauge Lot Diameter Variation $^{(1)}$ $VD_{ m WL}$ max.	Length Deviation(2) $ extstyle eta L_{ m W_S}$
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·····	B35
WITHDRAWAL SLEEVES For rolling bearings	Shaft Diameter 35 – 480mm	B36
NUTS FOR ROLLING BEARINGS		B37
STOPPERS FOR ROLLING BEARI	NGS	B37
LOCK-WASHERS FOR BOLLING	RFARINGS	B37

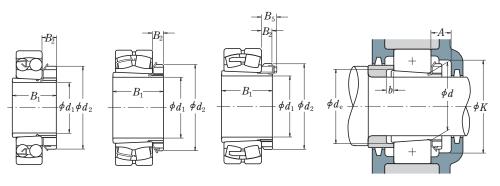


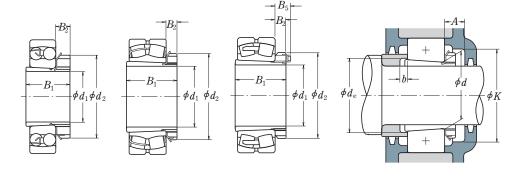
B 356 B 357

- NSK

Shaft Diameter 45 – 60 mm

Shaft Diameter 17 – 40 mm





Shaft	Nominal Bearing			Dimen:			Adapter	Abu	tment D (mr		ons	Mass (kg)
d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop { m min.}$	$d_{ m e}$ min.	$b \atop { m min.}$	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 A2304X	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	_	A 305X A2305X	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	_	A 306X A2306X	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 A2309X A2309X	17 17 17	72 72 72	49 50 50	5 5 5	0.26 0.30 0.30

Shaft	Nominal Bearing	Nacciael Newsbarr		Dimen:			Adapter	Abu	tment D (mr		ons	Mass (kg)
mameter d_1	Bore Dia. (mm)	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop ext{min.}$	$d_{ m e}$ min.	$b \atop { m min.}$	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 A2310X A2310X	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

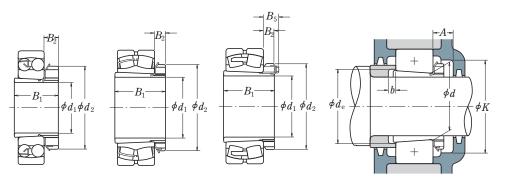
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

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Shaft Diameter 85 - 115 mm

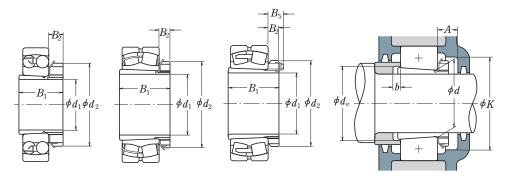
NSK

Shaft Diameter 65 - 80 mm



Shaft	Nominal Bearing			Dimen:			Adapter	Abu	tment D		ons	Mass (kg)
Diameter	Bore Dia.	Nominal Numbers	D			D	Sleeve		K		b	(Kg)
d_1	$d^{(mm)}$	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	A min.	n min.	$d_{ m e}$ min.	min.	approx.
65	75	1215K + H 215X	43	98	15	_	A 215X	23	110	80	5	0.70
	75 75	2215K + H 315X 22215E AKE4 + H 315X	55 55	98 98	15 15	_	A 315X A 315X	23 23	110 110	80 80	12 12	0.85 0.85
	75	1315K + H 315X	55	98	15	_	A 315X	23	110	80	5	0.85
	75	21315E AKE4 + H 315X	55	98 98	15 15	_	A 315X	23	110 110 110	80	5	0.85 1.05
	75 75	2315K + H2315X 22315E AKE4 + H2315X	73 73	98	15	_	A 2315X A 2315X	23	110	82 82	5 5	1.05
70	80	1216K + H 216X	46	105	17	_	A 216X	25	120	85	5	0.85
	80 80	2216K + H 316X 22216E AKE4 + H 316X	59 59	105 105	17 17	_	A 316X A 316X	25 25	120 120	86 86	12 12	1.05 1.05
	80	1316K + H 316X	59	105	17	_	A 316X	25	120	86	5	1.05
	80	21316E AKE4 + H 316X	59	105	17	_	A 316X	25	120	86	5	1.05
	80 80	2316K + H2316X 22316E AKE4 + H2316X	78 78	105 105	17 17	_	A 2316X A 2316X	25 25	120 120	87 87	5 5	1.3
75	85	1217K + H 217X	50	110	18	_	A 217X	27	128	90	6	1.0
	85 85	2217K + H 317X 22217E AKE4 + H 317X	63 63	110 110	18 18	_	A 317X A 317X	27 27	128 128	91 91	12 12	1.2 1.2
	85	1317K + H 317X	63	110	18		A 317X	27	128	91	6	1.2
	85	21317E AKE4 + H 317X	63	110	18	_	A 317X	27	128	91	6	1.2
	85 85	2317K + H2317X 22317E AKE4 + H2317X	82 82	110 110	18 18	_	A 2317X A 2317X	27 27	128 128	94 94	6 6	1.45 1.45
80	90	1218K + H 218X	52	120	18	_	A 218X	28	139	95	6	1.15
	90 90	2218K + H 318X 22218E AKE4 + H 318X	65 65	120 120	18 18	_	A 318X A 318X	28 28	139 139	96 96	10 10	1.4 1.4
	90 90	1318K + H 318X 21318E AKE4 + H 318X	65 65	120 120	18 18	_	A 318X A 318X	28 28	139 139	96 96	6 6	1.4 1.4
	90	2318K + H2318X	86	120	18	_	A2318X	28	139	99	6	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	1.7 1.7
	90	22318E ANE4 + 12318X	80	120	10	_	AZJIOX	28	139	99	О	1./



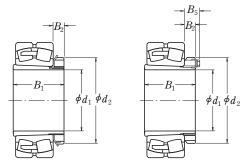


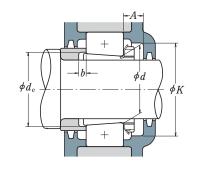
Shaft Diameter	Nominal Bearing Bore Dia.	Nominal Numbers		Dimen: (mr			Adapter Sleeve	Abu	tment D (mr		ons	Mass (kg)
d_1	(mm)	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop { m min.}$	$d_{ m e}$ min.	$b \atop ext{min.}$	approx.
85	95 95 95	1219K + 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 A2320X	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	_	A3122X 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 A2322X	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

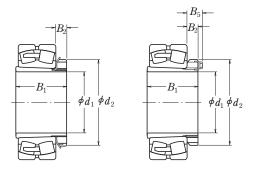
Remarks The suffix X represents adapter sleeves having narrow slits, for which washers with straight tabs should be used.

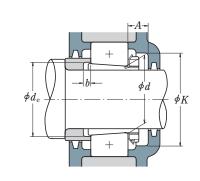
Shaft Diameter 180 – 260 mm

Shaft Diameter 125 – 170 mm









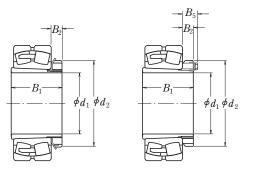
Shaft	Nominal Bearing			Dimen (mr			Adapter	Abu	tment D (mr		ons	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm)	Nominal Numbers Applicable Bearings	B_1	d_2	B_2	B_5	Sleeve Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop ext{min.}$	$d_{ m e}$ min.	$b \atop { m min.}$	approx.
125	140 140 140	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	_	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

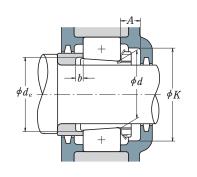
Shaft Diameter	Nominal Bearing Bore Dia.	Nominal Numbers		Dimen: (mr			Adapter Sleeve	Abu	tment D (mr		ons	Mass (kg)
d_1	(mm)	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop { m min.}$	$d_{ m e}$ min.	$b \atop { m min.}$	approx.
180	200 200 200	23940C 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

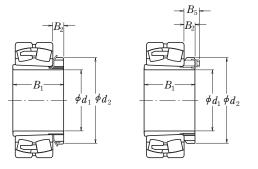
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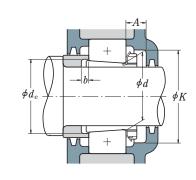
Shaft Diameter 280 - 410 mm





Shaft	Nominal Bearing Bore Dia.	Nominal Numbers		Dimen:			Adapter Sleeve	Abu	tment D (mr		ons	Mass (kg)
d_1	(mm) d	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	$\begin{array}{c} A \\ \text{min.} \end{array}$	$K \atop ext{min.}$	$d_{ m e}$ min.	$b \atop ext{min.}$	approx.
280	300	23960C AKE4 + H3960	140	360	42	54	A3960	69	380	313	12	20.7
	300	23060C AKE4 + H3060	168	360	42	54	A3060	69	430	313	12	23
	300	23160C AKE4 + H3160	208	380	40	53	A3160	69	430	317	12	30
	300	22260C AKE4 + H3160	208	380	40	53	A3160	69	430	317	32	30
	300	23260C AKE4 + H3260	240	380	40	53	A3260	69	430	321	12	34
300	320	23964C AKE4 + H3964	140	380	42	55	A3964	72	400	334	13	21.8
	320	23064C AKE4 + H3064	171	380	42	55	A3064	72	450	334	13	24.5
	320	23164C AKE4 + H3164	226	400	42	56	A3164	72	450	339	13	35
	320	22264C AKE4 + H3164	226	400	42	56	A3164	72	450	339	39	35
	320	23264C AKE4 + H3264	258	400	42	56	A3264	72	450	343	13	39.5
320	340	23968C AKE4 + H3968	144	400	45	58	A3968	75	430	354	14	24.6
	340	23068C AKE4 + H3068	187	400	45	58	A3068	75	490	355	14	28.5
	340	23168C AKE4 + H3168	254	440	55	72	A3168	75	490	360	14	49.5
	340	23268C AKE4 + H3268	288	440	55	72	A3268	75	490	364	14	54.5
340	360	23972C AKE4 + H3972	144	420	45	58	A3972	75	450	374	14	25.7
	360	23072C AKE4 + H3072	188	420	45	58	A3072	75	510	375	14	30.5
	360	23172C AKE4 + H3172	259	460	58	75	A3172	75	510	380	14	54
	360	23272C AKE4 + H3272	299	460	58	75	A3272	75	510	385	14	60.5
360	380	23976C AKE4 + H3976	164	450	48	62	A3976	82	480	396	15	31.9
	380	23076C AKE4 + H3076	193	450	48	62	A3076	82	540	396	15	36
	380	23176C AKE4 + H3176	264	490	60	77	A3176	82	540	401	15	61.5
	380	23276C AKE4 + H3276	310	490	60	77	A3276	82	540	405	15	69.5
380	400	23980C AKE4 + H3980	168	470	52	66	A3980	86	500	417	15	35.2
	400	23080C AKE4 + H3080	210	470	52	66	A3080	86	580	417	15	41.5
	400	23180C AKE4 + H3180	272	520	62	82	A3180	86	580	421	15	70.5
	400	23280C AKE4 + H3280	328	520	62	82	A3280	86	580	427	15	81
400	420	23984C AKE4 + H3984	168	490	52	66	A3984	86	520	437	16	36.6
	420	23084C AKE4 + H3084	212	490	52	66	A3084	86	600	437	16	43.5
	420	23184C AKE4 + H3184	304	540	70	90	A3184	86	600	443	16	84
	420	23284C AKE4 + H3284	352	540	70	90	A3284	86	600	448	16	94
410	440	23988C AKE4 + H3988	189	520	60	77	A3988	99	550	458	17	58.6
	440	23088C AKE4 + H3088	228	520	60	77	A3088	99	620	458	17	65
	440	23188C AKE4 + H3188	307	560	70	90	A3188	99	620	464	17	104
	440	23288C AKE4 + H3288	361	560	70	90	A3288	99	620	469	17	118

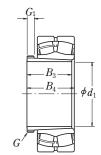


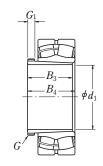


Shaft Diameter	Nominal Bearing Bore Dia	Nominal Numbers		Dimen (mr			Adapter Sleeve	Abu	tment D (mi		ons	Mass (kg)
d_1	(mm)	Applicable Bearings	B_1	d_2	B_2	B_5	Numbers	$\stackrel{A}{\operatorname{min}}$.	$K \atop ext{min.}$	$d_{ m e}$ min.	$b \atop ext{min.}$	approx.
430	460	23992C AKE4 + H3992	189	540	60	77	A3992	99	570	478	17	62
	460	23092C AKE4 + H3092	234	540	60	77	A3092	99	650	478	17	69.5
	460	23192C AKE4 + H3192	326	580	75	95	A3192	99	650	485	17	116
	460	23292C AKE4 + H3292	382	580	75	95	A3292	99	650	491	17	132
450	480	23996C AKE4 + H3996	200	560	60	77	A3996	99	600	499	18	67.5
	480	23096C AKE4 + H3096	237	560	60	77	A3096	99	690	499	18	73.5
	480	23196C AKE4 + H3196	335	620	75	95	A3196	99	690	505	18	133
	480	23296C AKE4 + H3296	397	620	75	95	A3296	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

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Shaft Diameter 35 – 85 mm Shaft Diameter 90 – 135 mm





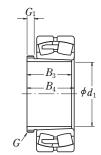
Shaft	Nominal Bearing	Managard Managhana	Screw Thread	D	imensions (mm)		Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	approx.
35 40	40 40 45 45	21308EAKE4 + AH 308 22308EAKE4 + AH 2308 21309EAKE4 + AH 309 22309EAKE4 + AH 2309	M 45 × 1.5 M 45 × 1.5 M 50 × 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	22218EAKE4 + AHX 318	M 100 × 2	53	9	57	0.52
	90	21318EAKE4 + AHX 318	M 100 × 2	53	9	57	0.52
	90	23218CKE4 + AHX 3218	M 100 × 2	63	10	67	0.58
	90	22318EAKE4 + AHX 2318	M 100 × 2	79	14	83	0.845

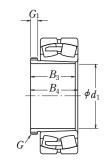
Shaft	Nominal Bearing		Screw Thread	D	imensions (mm)		Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	approx.
90	95	22219EAKE4 + AHX 319	M 105 × 2	57	10	61	0.595
	95	21319CKE4 + AHX 319	M 105 × 2	57	10	61	0.595
	95	22319EAKE4 + AHX 2319	M 105 × 2	85	16	89	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 × 2	60	13	64	0.75
	120	24024C K30E4 + AH 24024	M 125 × 2	73	13	82	0.70
	120	23124C KE4 + AHX 3124	M 130 × 2	75	12	79	0.95
	120	22224EAKE4 + AHX 3124	M 130 × 2	75	12	79	0.95
	120	24124CK30E4 + AH 24124	M 130 × 2	93	13	102	1.02
	120	23224CKE4 + AHX 3224	M 135 × 2	90	13	94	1.3
	120	22324EAKE4 + 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

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Shaft Diameter 145 – 180 mm



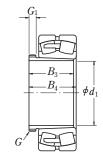


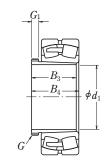
Shaft	Nominal Bearing	Nominal Numbers	Screw Thread	D	imensions (mm)	3	Mass (kg)
Diameter (mm) d_1	Bore Dia. (mm) d	Applicable Bearings	G	B_3	G_1	B_4	approx.
145	150	23030CDKE4 + AHX 3030	M 160 × 3	72	15	77	1.15
	150	24030CK30E4 + AH 24030	M 155 × 3	90	15	101	1.11
	150	23130CKE4 + AHX 3130	M 165 × 3	96	15	101	1.79
	150	22230CDKE4 + AHX 3130	M 165 × 3	96	15	101	1.79
	150	24130CK30E4 + AH 24130	M 160 × 3	115	15	126	1.63
	150	23230CKE4 + AHX 3230	M 165 × 3	114	17	119	2.22
	150	22330CAKE4 + 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	22232CDKE4 + AH 3132	M 180 × 3	103	16	108	3.2
	160	24132CK30E4 + AH 24132	M 170 × 3	124	15	135	3.03
	160	23232CKE4 + AH 3232	M 180 × 3	124	20	130	4.1
	160	22332CAKE4 + 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 × 3	92	17	98	2.8
	180	24036C K30E4 + AH 24036	M 190 × 3	116	16	127	3.19
	180	23136C KE4 + AH 3136	M 200 × 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	approx.
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	23048CAKE4 + AH 3048	Tr 260 × 4	116	21	123	8.75
	240	24048CK30E4 + AH 24048	Tr 250 × 4	138	20	153	9.0
	240	23148CKE4 + 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	24152CAK30E4 + AH 24152	Tr 280 × 4	202	22	218	15.5
	260	22252CAKE4 + AH 2252	Tr 290 × 4	155	23	161	14
	260	23252CAKE4 + AH 2352	Tr 290 × 4	205	30	213	19.5
	260	22352CAKE4 + AH 2352	Tr 290 × 4	205	30	213	19.5
260	280	23056CAKE4 + AH 3056	Tr 300 × 4	131	24	139	12
	280	24056CAK30E4 + AH 24056	Tr 290 × 4	162	22	179	12.6
	280	23156CAKE4 + 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

M>K

Shaft Diameter 280 – 380 mm

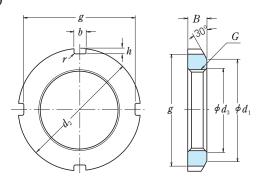




Shaft	Nominal Bearing		Screw Thread	D	imensions (mm)	3	Mass (kg)
Diameter d_1	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	approx.
280	300	23060CAKE4 + AH 3060	Tr 320 × 5	145	26	153	14.5
	300	24060CAK30E4 + AH 24060	Tr 310 × 5	184	24	202	15.5
	300	23160CAKE4 + AH 3160	Tr 330 × 5	192	30	200	21
	300	24160CAK30E4 + AH 24160	Tr 320 × 5	224	24	242	20.3
	300	22260CAKE4 + AH 2260	Tr 330 × 5	170	26	178	18
	300	23260CAKE4 + AH 3260	Tr 330 × 5	228	34	236	20
300	320	23064CAKE4 + AH 3064	Tr 345 × 5	149	27	157	16
	320	24064CAK30E4 + AH 24064	Tr 330 × 5	184	24	202	16.4
	320	23164CAKE4 + 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	23076CAKE4 + AH 3076	Tr 410 × 5	170	31	180	23.5
	380	24076CAK30E4 + AH 24076	Tr 400 × 5	208	28	228	24.1
	380	23176CAKE4 + 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	D	imensions (mm)	3	Mass (kg)
Diameter (mm)	Bore Dia. (mm) d	Nominal Numbers Applicable Bearings	G	B_3	G_1	B_4	approx.
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	23092CAKE4 + AHX 3092	Tr 490 × 5	202	37	213	46
	460	24092CAK30E4 + AH 24092	Tr 480 × 5	250	32	273	35.9
	460	23192CAKE4 + 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	24196CAK30E4 + AH 24196	Tr 500 × 5	340	32	363	53
	480	23296CAKE4 + 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	241/500CAK30E4 + AH 241/500	Tr 530 × 6	360	35	383	61.2
	500	232/500CAKE4 + AHX 32/500	Tr 550 × 6	393	54	405	94.5





Nut with Washer

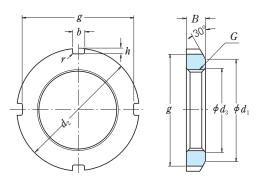
												Uni	its : mm
				Nut	Series	AN						Reference	
minal mbers	Screw Threads	d_2	d_1	g	Basic Di	mensior <i>h</i>	is d_3	В	r max	Mass (kg)	Adapter (¹) Sleeve Bore Dia Numbers	Washer Numbers	Shaft Dia.

Nominal Numbers	Screw Threads G	d_2	d_1	g g	asic Di	mensio	ns d_3	В	r max.	Mass (kg) approx.	Adapter (¹) Sleeve Bore Dia. Numbers	Washer Numbers	Shaft Dia.
AN 02	M 15×1	25	21	21	4	2	15.5	5	0.4	0.010	—	AW 02 X	15
AN 03	M 17×1	28	24	24	4	2	17.5	5	0.4	0.013	—	AW 03 X	17
AN 04	M 20×1	32	26	28	4	2	20.5	6	0.4	0.019	04	AW 04 X	20
AN 05	M 25×1.5	38	32	34	5	2	25.8	7	0.4	0.025	05	AW 05 X	25
AN 06	M 30×1.5	45	38	41	5	2	30.8	7	0.4	0.043	06	AW 06 X	30
AN 07	M 35×1.5	52	44	48	5	2	35.8	8	0.4	0.053	07	AW 07 X	35
AN 08	M 40×1.5	58	50	53	6	2.5	40.8	9	0.5	0.085	08	AW 08 X	40
AN 09	M 45×1.5	65	56	60	6	2.5	45.8	10	0.5	0.119	09	AW 09 X	45
AN 10	M 50×1.5	70	61	65	6	2.5	50.8	11	0.5	0.148	10	AW 10 X	50
AN 11	M 55×2	75	67	69	7	3	56	11	0.5	0.158	11	AW 11 X	55
AN 12	M 60×2	80	73	74	7	3	61	11	0.5	0.174	12	AW 12 X	60
AN 13	M 65×2	85	79	79	7	3	66	12	0.5	0.203	13	AW 13 X	65
AN 14	M 70×2	92	85	85	8	3.5	71	12	0.5	0.242	14	AW 14 X	70
AN 15	M 75×2	98	90	91	8	3.5	76	13	0.5	0.287	15	AW 15 X	75
AN 16	M 80×2	105	95	98	8	3.5	81	15	0.6	0.395	16	AW 16 X	80
AN 17	M 85×2	110	102	103	8	3.5	86	16	0.6	0.45	17	AW 17 X	85
AN 18	M 90×2	120	108	112	10	4	91	16	0.6	0.555	18	AW 18 X	90
AN 19	M 95×2	125	113	117	10	4	96	17	0.6	0.66	19	AW 19 X	95
AN 20	M 100×2	130	120	122	10	4	101	18	0.6	0.70	20	AW 20 X	100
AN 21	M 105×2	140	126	130	12	5	106	18	0.7	0.845	21	AW 21 X	105
AN 22	M 110×2	145	133	135	12	5	111	19	0.7	0.965	22	AW 22 X	110
AN 23 AN 24 AN 25	M 115×2 M 120×2 M 125×2	150 155 160	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		AW 23 AW 24 AW 25	

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 ${\it G}$	d_2	d_1	g B	asic Di b	mensio	ons 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		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 .	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.

 $\textbf{Remarks} \quad \text{The basic design and dimensions of screw threads are in accordance with JIS B 0205}.$

B 372 B 373

(For Adapters and Shafts)

ANL 60 Tr 300×4

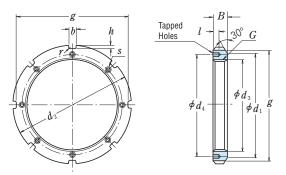
ANL 64 Tr 320×5

ANL 68 Tr 340×5

ANL 72 Tr 360×5

ANL 76 Tr 380×5

ANL 80 Tr 400×5



Nut with Stopper

Nut Series AN

Nominal Screw **Basic Dimensions** Mass Adapter (1) Stopper Shaft Numbers Threads Tapped Holes Sleeve Bore (kg) bhBNumbers Dia. d_2 approx. Dia. Numbers I Screw Threads (S) max. 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 **AN 44** Tr 220×4 **AL 44** 220 **AL 44** 240 **48** Tr 240×4 48 5.95 36 0.8 18 M 10×1.5 281 **AN 52** Tr 260×4 330 300 306 24 12 262 8.05 52 **AL 52** 260 350 320 326 24 12 282 38 0.8 18 M 10×1.5 **AL 52** 280 **56** Tr 280×4 **60** Tr 300×4 380 340 356 24 12 302 40 0.8 18 M 10×1.5 326 11.8 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** 340 460 420 430 28 15 362.5 58 1 490 450 454 32 18 382.5 60 1 **72** Tr 360×5 21 M 12×1.75 392 25.1 72 **AL 68** 360 21 M 12×1.75 414 31 **76** Tr 380×5 76 **AL 76** 380 **AN 80** Tr 400×5 520 470 484 32 18 402.5 62 27 M 16×2 80 **AL 80** 400 439 37 **84** Tr 420×5 | 540 | 490 | 504 | 32 | 18 | 422.5 | 70 | 1 | 88 | Tr 440×5 | 560 | 510 | 520 | 36 | 20 | 442.5 | 70 | 1 27 M 16×2 459 43.5 **AL 80** 420 84 27 M 16×2 477 45 88 **AL 88** 440 **AN 92** Tr 460×5 580 540 540 36 20 462.5 75 **AN 96** Tr 480×5 620 560 580 36 20 482.5 75 27 M 16×2 27 M 16×2 497 50.5 **AL 88** 460 527 62 **AL 96** 480 96 27 M 16×2 **AN 100** Tr 500×5 630 580 584 40 23 502.5 80 1 539 63.5 /500 **AL 100** 500 Nut Series ANL **ANL 44** Tr 220×4 260 242 242 20 9 222 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** 260 330 310 310 24 10 282 38 0.8 15 M 8×1.25 293 **ALL 56** 280 **ANL 56** Tr 280×4 6.8

ANL 100 Tr 500×5 580 550 550 36 15 502.5 68 1 21 M 12×1.75 522 33.5 /500 ALL 96 500

Note (1) Series AN is applicable to adapter sleeve Series A31, A32 and A23. Series ANL is applicable to adapter sleeve Series A30.

Remarks 1. The basic design and dimensions of screw threads are in accordance with JIS B 0216.
 The basic design and dimensions of threads in tapped holes are in accordance with JIS B 0205.

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

400 376 376 24 12 342.5 45 1

470 442 442 28 14 402.5 52 1

420 394 394 28 13 362.5 45 450 422 422 28 14 382.5 48

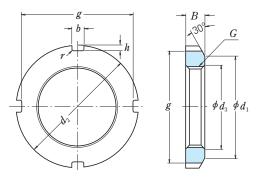
ANL 84 Tr 420×5 490 462 462 32 14 422.5 52 1

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

(For Withdrawal Sleeves)



Units · mm

NSK

Uni											Units : mm				
ı					Nut	Serie	s HN						Refer	ence	
	Nominal Numbers	Screw Threads	_		Bas		nens			r	Mass	W	ithdrawal Sle	eeve Numbers	1
		G	d_2	d_1	g	b	h	d_3	В	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	250 260 280	20	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	330	306 346 366	24	12	262 292 312.5		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	390 420 440	28 28	15 15	332.5 352.5 372.5		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	484 504 520	32	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	540 580 604	36 40	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	78 92.5	AHX 3196 AHX 31/500	_	AHX 3296 AHX 32/500	_
					Nut S	Series	s HNI	L				AH 30	AH 2		
	HNL 41 HNL 43 HNL 47	Tr 205×4 Tr 215×4 Tr 235×4	250 260 280	242	234 242 262	20	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 260×4 Tr 280×4 Tr 300×4	310 330 360	310	290 310 336	24	10	262 282 302		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	13 13	322.5 347.5 367.5		1 1 1	10.3 11.5 14.2	AH 3060 AH 3064 AH 3068	_		
	HNL 77 HNL 82 HNL 86		450 480 500	452 472	422 452 472	32 32	14 14	432.5	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	452.5 472.5 492.5	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

Units: mm

ALL 60 300

ALL 64 320

ALL 64 340

ALL 72 360

ALL 76 380

ALL 76 400

ALL 84 420

ALL 88 440

ALL 88 460

ALL 96 480

9.95

68

76

80

84

88

92

15 M 8×1.25 355

15 M 8×1.25 374

18 M 10×1.5

18 M 10×1.5 398 14.9

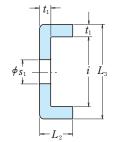
18 M 10×1.5 438 17.4

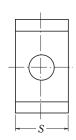
21 M 12×1.75 462 26.2 21 M 12×1.75 482 28

21 M 12×1.75 502 29.5

Reference

(Combination of Withdrawal Sleeves and Nuts)





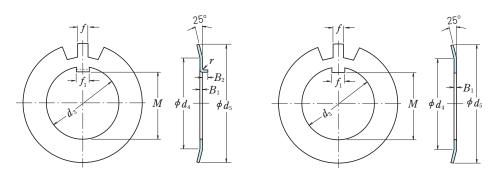
								Units : mm
				Stopper S	eries AL			Reference
Nominal Numbers				Dimensions			Mass (kg) per 100 pcs	Nut Numbers
	t_1	S	L_2	s_1	i	L_3	approx.	
AL 44	4	20	12	9	22.5	30.5	2.6	AN 44, AN 48
AL 52	4	24	12	12	25.5	33.5	3.4	AN 52, AN 56
AL 60	4	24	12	12	30.5	38.5	3.8	AN 60
AL 64	5	24	15	12	31	41	5.35	AN 64
AL 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		
Wallibers	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	_ _ _	 AHX 3218	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	AHX 2319 AHX 2320
AN 24 AN 25 AN 26	 AHX 3024	AHX 3122 — AHX 3124	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



Units: mm

B 379



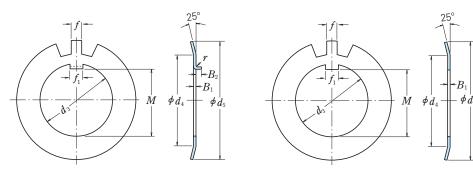
Bent-Tab Straight-Tab

Units: mm

Nomina	al Numbers	Lock-washer Series AW									F	Reference			
Bent-Tab	Straight-Tab	d_3	M	f_1	Basic B_1	Dimen	sions d_4	d_5	Ben **	it-Tab B_2	No. of Teeth	Mass (kg) per 100 pcs approx.	Adapter (¹) Sleeve Bore Dia. Numbers	Nut Numbers	Shaft Dia.
AW 02 AW 03 AW 04	AW 02 X AW 03 X AW 04 X	15 17 20	13.5 15.5 18.5	4 4 4	1 1 1	4 4 4	21 24 26	28 32 36	1 1 1	2.5 2.5 2.5	13 13 13	0.253 0.315 0.35	<u>-</u> 04	AN 02 AN 03 AN 04	15 17 20
AW 05	AW 05 X	25	23	5	1.2	5	32	42	1	2.5	13	0.64	05	AN 05	25
AW 06	AW 06 X	30	27.5	5	1.2	5	38	49	1	2.5	13	0.78	06	AN 06	30
AW 07	AW 07 X	35	32.5	6	1.2	5	44	57	1	2.5	15	1.04	07	AN 07	35
AW 08	AW 08 X	40	37.5	6	1.2	6	50	62	1	2.5	15	1.23	08	AN 08	40
AW 09	AW 09 X	45	42.5	6	1.2	6	56	69	1	2.5	17	1.52	09	AN 09	45
AW 10	AW 10 X	50	47.5	6	1.2	6	61	74	1	2.5	17	1.6	10	AN 10	50
AW 11	AW 11 X	55	52.5	8	1.2	7	67	81	1	4	17	1.96	11	AN 11	55
AW 12	AW 12 X	60	57.5	8	1.5	7	73	86	1.2	4	17	2.53	12	AN 12	60
AW 13	AW 13 X	65	62.5	8	1.5	7	79	92	1.2	4	19	2.9	13	AN 13	65
AW 14	AW 14 X	70	66.5	8	1.5	8	85	98	1.2	4	19	3.35	14	AN 14	70
AW 15	AW 15 X	75	71.5	8	1.5	8	90	104	1.2	4	19	3.55	15	AN 15	75
AW 16	AW 16 X	80	76.5	10	1.8	8	95	112	1.2	4	19	4.65	16	AN 16	80
AW 17	AW 17 X	85	81.5	10	1.8	8	102	119	1.2	4	19	5.25	17	AN 17	85
AW 18	AW 18 X	90	86.5	10	1.8	10	108	126	1.2	4	19	6.25	18	AN 18	90
AW 19	AW 19 X	95	91.5	10	1.8	10	113	133	1.2	4	19	6.7	19	AN 19	95
AW 20	AW 20 X	100	96.5	12	1.8	10	120	142	1.2	6	19	7.65	20	AN 20	100
AW 21	AW 21 X	105	100.5	12	1.8	12	126	145	1.2	6	19	8.25	21	AN 21	105
AW 22	AW 22 X	110	105.5	12	1.8	12	133	154	1.2	6	19	9.4	22	AN 22	110
AW 23	AW 23 X	115	110.5	12	2	12	137	159	1.5	6	19	10.8		AN 23	115
AW 24	AW 24 X	120	115	14	2	12	138	164	1.5	6	19	10.5	24	AN 24	120
AW 25	AW 25 X	125	120	14	2	12	148	170	1.5	6	19	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

Nominal Numbers Lock-washer Series AW											F	Reference			
Bent-Tab	Straight-Tab	d_3	M	f_1	Basic I B_1	Dimen	sions d_4	d_5	Ben r	t-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 29 X	145	140	16	2	14	172	202	1.5	8	19	16.8	30	AN 29	145
AW 30	AW 30 X	150	145	16	2	14	171	205	1.5	8	19	15.9		AN 30	150
AW 31	AW 31 X	155	147.5	16	2.5	16	182	212	1.5	8	19	20.9		AN 31	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. 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

Photos 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 (CAT.No. E4102)

PRECISION MACHINE COMPONENTS

BALL SCREWS



NSK Standard Ball Screws Compact FA Series (CAT. No. E3239, E3162)



High-Speed, Low-Noise Ball Screws BSS Series (CAT. No. E3162)



Ball Screws for High-Speed Machine Tools HMD Series (CAT. No. E3162)



Ball Screws for Twin-Drive Systems TW Series (CAT. No. E3162)



Ball Screws for Small Lathes BSL Series (CAT. No. E3162)



Ball Screws for High-Load Drive HTF-SRC Series, HTF-SRD Series, HTF Series, A1 Series (CAT. No. E3238, E3162)



Highly Dust-Resistant Ball Screws, NSK Linear Guides V1 Series (CAT. No. E3162)

MONOCARRIERS



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)



Monocarriers (CAT. No. E3419, E3162)



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)



New Type of Rolling Element Linear Motion Bearing Translide™ (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)

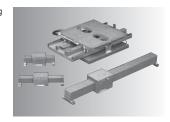


Spindles for Electrical and Electric Equipment





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



C 6 C 7



Appendix Table 1 Conversion Table from SI (International Units) System

Comparison of SI, CGS, and Engineering Units

Units Unit System	Length	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/cm ²	dyn/cm ²	erg	erg/s
Engineering Unit System	m	$kgf\cdot s^2/m$	s	°C	m/s ²	kgf	kgf/m ²	kgf/m²	$kgf\cdot m$	kgf⋅m/s

Conversion Factors from SI Units

Parameter	SI Units		Units other than S	I	Conversion Factors	
raiailielei	Names of Units	Symbols	Name of Units	Symbols	from SI Units	
Angle	Radian	rad	Degree Minute Second	o , ″	180/π 10 800/π 648 000/π	
Length	Meter	m	Micron Angstrom	$\overset{\mu}{A}$	10 ⁶ 10 ¹⁰	
Area	Square meter	m^2	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/s ²	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 65×10 ³) 10 ⁵	
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
10 ²	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
i arameter	Names of Units	Symbols	Names of Units	Units	from SI Units
Pressure	Pascal (Newton per square meter)				
Energy	Joule (Newton · meter)	J (N·m)	Erg Calorie (International) Kilogram-force meter Kilowatt hour French horse power hour	$\begin{array}{c} erg \\ cal_{IT} \\ kgf \cdot m \\ kW \cdot h \\ PS \cdot h \end{array}$	10 ⁷ 1/4.186 8 1/9.806 65 1/(3.6×10 ⁹) ≈ 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	m²/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	Т	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 $\theta \circ C$ 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 1b, read the figure in the right 1b 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		1b	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
78.453 88.260	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
117.68 127.49 137.29	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
166.71 176.52 186.33	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
215.75 225.55 235.36	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	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	191.80 194.01 196.21 198.42 200.62
264.78 274.59 284.39	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
313.81	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 11 C 10



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.

$$C = \frac{5}{9}(F - 32)$$

 $F = 32 + \frac{9}{9}C$

9	
$F=32+\frac{9}{5}C$	

°C		°F	°C		°F	°C		°F	°C		°F
-73.3	-100	-148.0	0.0	32	89.6	21.7	71	159.8	43.3	110	230
-62.2	- 80	-112.0	0.6	33	91.4	22.2	72	161.6	46.1	115	239
-51.1	- 60	- 76.0	1.1	34	93.2	22.8	73	163.4	48.9	120	248
-40.0	- 40	- 40.0	1.7	35	95.0	23.3	74	165.2	51.7	125	257
-34.4	- 30	- 22.0	2.2	36	96.8	23.9	75	167.0	54.4	130	266
-28.9	- 20	- 4.0	2.8	37	98.6	24.4	76	168.8	57.2	135	275
-23.3	- 10	14.0	3.3	38	100.4	25.0	77	170.6	60.0	140	284
-17.8	0	32.0	3.9	39	102.2	25.6	78	172.4	65.6	150	302
-17.2	1	33.8	4.4	40	104.0	26.1	79	174.2	71.1	160	320
-16.7	2	35.6	5.0	41	105.8	26.7	80	176.0	76.7	170	338
-16.1	3	37.4	5.6	42	107.6	27.2	81	177.8	82.2	180	356
-15.6	4	39.2	6.1	43	109.4	27.8	82	179.6	87.8	190	374
-15.0	5	41.0	6.7	44	111.2	28.3	83	181.4	93.3	200	392
-14.4	6	42.8	7.2	45	113.0	28.9	84	183.2	98.9	210	410
-13.9	7	44.6	7.8	46	114.8	29.4	85	185.0	104.4	220	428
-13.3	8	46.4	8.3	47	116.6	30.0	86	186.8	110.0	230	446
-12.8	9	48.2	8.9	48	118.4	30.6	87	188.6	115.6	240	464
-12.2	10	50.0	9.4	49	120.2	31.1	88	190.4	121.1	250	482
-11.7	11	51.8	10.0	50	122.0	31.7	89	192.2	148.9	300	572
-11.1	12	53.6	10.6	51	123.8	32.2	90	194.0	176.7	350	662
-10.6	13	55.4	11.1	52	125.6	32.8	91	195.8	204	400	752
-10.0	14	57.2	11.7	53	127.4	33.3	92	197.6	232	450	842
- 9.4	15	59.0	12.2	54	129.2	33.9	93	199.4	260	500	932
- 8.9	16	60.8	12.8	55	131.0	34.4	94	201.2	288	550	1022
- 8.3	17	62.6	13.3	56	132.8	35.0	95	203.0	316	600	1112
- 7.8	18	64.4	13.9	57	134.6	35.6	96	204.8	343	650	1202
- 7.2	19	66.2	14.4	58	136.4	36.1	97	206.6	371	700	1292
- 6.7	20	68.0	15.0	59	138.2	36.7	98	208.4	399	750	1382
- 6.1	21	69.8	15.6	60	140.0	37.2	99	210.2	427	800	1472
- 5.6	22	71.6	16.1	61	141.8	37.8	100	212.0	454	850	1562
- 5.0	23	73.4	16.7	62	143.6	38.3	101	213.8	482	900	1652
- 4.4	24	75.2	17.2	63	145.4	38.9	102	215.6	510	950	1742
- 3.9	25	77.0	17.8	64	147.2	39.4	103	217.4	538	1000	1832
- 3.3	26	78.8	18.3	65	149.0	40.0	104	219.2	593	1100	2012
- 2.8	27	80.6	18.9	66	150.8	40.6	105	221.0	649	1200	2192
- 2.2	28	82.4	19.4	67	152.6	41.1	106	222.8	704	1300	2372
- 1.7	29	84.2	20.0	68	154.4	41.7	107	224.6	760	1400	2552
- 1.1	30	86.0	20.6	69	156.2	42.2	108	226.4	816	1500	2732
- 0.6	31	87.8	21.1	70	158.0	42.8	109	228.2	871	1600	2912

Kinematic Viscosity mm ² /s		bolt ersal (sec)	No.1 Redv R (s	vood	Engler E (degree)	Kinematic Viscosity mm ² /s	Sayl Unive SUS	ersal	No.1 Redw R (s	rood	Engler E (degree)
11111 / 8	100°F	210°F	50°C	100°C		IIIII / 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
pp	*******	

1"=25.4 mm

ir	nch	0	1	2	3	4	5	6	7	8	9	10
Fraction	n Decimal						mm					
0 1/64 1/32 3/64	0.000000 0.015625 0.031250 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 5/64 3/32 7/64	0.062500 0.078125 0.093750 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 9/64 5/32 11/64	0.125000 0.140625 0.156250 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 13/64 7/32 15/64	0.187500 0.203125 0.218750 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 17/64 9/32 19/64	0.250000 0.265625 0.281250 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 21/64 11/32 23/64	0.312500 0.328125 0.343750 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 25/64 13/32 27/64	0.375000 0.390625 0.406250 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 29/64 15/32 31/64	0.437500 0.453125 0.468750 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 33/64 17/32 35/64	0.500000 0.515625 0.531250 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 37/64 19/32 39/64	0.562500 0.578125 0.593750 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 41/64 21/32 43/64	0.625000 0.640625 0.656250 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 45/64 23/32 47/64	0.687500 0.703125 0.718750 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 49/64 25/32 51/64	0.750000 0.765625 0.781250 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 53/64 27/32 55/64	0.812500 0.828125 0.843750 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 57/64 29/32 59/64	0.875000 0.890625 0.906250 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 61/64 31/32 63/64	0.937500 0.953125 0.968750 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	ch	11	12	13	14	15	16	17	18	19	20	
Fraction	n Decimal		mm									
0 1/16 1/8 3/16	0.0000 0.0625 0.1250 0.1875	279.400 280.988 282.575 284.162	304.800 306.388 307.975 309.562	330.200 331.788 333.375 334.962	355.600 357.188 358.775 360.362	381.000 382.588 384.175 385.762	406.400 407.988 409.575 411.162	431.800 433.388 434.975 436.562	457.200 458.788 460.375 461.962	482.600 484.188 485.775 487.362	508.000 509.588 511.175 512.762	
1/4 5/16 3/8 7/16	0.2500 0.3125 0.3750 0.4375	285.750 287.338 288.925 290.512	311.150 312.738 314.325 315.912	336.550 338.138 339.725 341.312	361.950 363.538 365.125 366.712	387.350 388.938 390.525 392.112	412.750 414.338 415.925 417.512	438.150 439.738 441.325 442.912	463.550 465.138 466.725 468.312	488.950 490.538 492.125 493.712	514.350 515.938 517.525 519.112	
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 13/16 7/8 15/16	0.7500 0.8125 0.8750 0.9375	298.450 300.038 301.625 303.212	323.850 325.438 327.025 328.612	349.250 350.838 352.425 354.012	374.650 376.238 377.825 379.412	400.050 401.638 403.225 404.812	425.450 427.038 428.625 430.212	450.850 452.438 454.025 455.612	476.250 477.838 479.425 481.012	501.650 503.238 504.825 506.412	527.050 528.638 530.225 531.812	

1"=25.4 mm

in	ıch	21	22	23	24	25	25 26 27 28 29		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	ch	31	32	33	34	35	36	37	38	39	40
Fraction	Decimal					m	m				
0 1/16 1/8 3/16	0.0000 0.0625 0.1250 0.1875	787.400 788.988 790.575 792.162	812.800 814.388 815.975 817.562	838.200 839.788 841.375 842.962	863.600 865.188 866.775 868.362	889.000 890.588 892.175 893.762	914.400 915.988 917.575 919.162	939.800 941.388 942.975 944.562	965.200 966.788 968.375 969.962	990.600 992.188 993.775 995.362	1016.000 1017.588 1019.175 1020.762
1/4 5/16 3/8 7/16	0.2500 0.3125 0.3750 0.4375	793.750 795.338 796.925 798.512	819.150 820.738 822.325 823.912	844.550 846.138 847.725 849.312	869.950 871.538 873.125 874.712	895.350 896.938 898.525 900.112	920.750 922.338 923.925 925.512	946.150 947.738 949.325 950.912	971.550 973.138 974.725 976.312	996.950 998.538 1000.125 1001.712	1022.350 1023.938 1025.525 1027.112
1/2 9/16 5/8 11/16	0.5000 0.5625 0.6250 0.6875	800.100 801.688 803.275 804.862	825.500 827.088 828.675 830.262	850.900 852.488 854.075 855.662	876.300 877.888 879.475 881.062	901.700 903.288 904.875 906.462	927.100 928.688 930.275 931.862	952.500 954.088 955.675 957.262	977.900 979.488 981.075 982.662	1003.300 1004.888 1006.475 1008.062	1028.700 1030.288 1031.875 1033.462
3/4 13/16 7/8 15/16	0.7500 0.8125 0.8750 0.9375	806.450 808.038 809.625 811.212	831.850 833.438 835.025 836.612	857.250 858.838 860.425 862.012	882.650 884.238 885.825 887.412	908.050 909.638 911.225 912.812	933.450 935.038 936.625 938.212	958.850 960.438 962.025 963.621	984.250 985.838 987.425 989.012	1009.650 1011.238 1012.825 1014.412	1035.050 1036.638 1038.225 1039.812
									ı		C 15



Appendix Table 7 Hardness Conversion Table (Reference)

Rockwell C Scale Hardness (1 471N) {150kgf}	Vickers Hardness	Brinell H Standard Ball	lardness Tungsten Carbide Ball	Rockwell A Scale Load ^{588.4N} [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		_	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

Classifica	neter tion (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}	- 30	- 20	- 10	_ 4	- 4	0	0	0	0	0	0	-	
3	6	- 8 0	- 38 - 40	- 20 - 28 - 25	- 18 - 13	- 9 - 5	- 12 - 5	- 5 0	- 8 0	- 12 0	- 18 0	- 30 0	- 48 0	± 2.5	± 4
6	10	- 8 0	- 49 - 50	- 34 - 32	- 22 - 16	- 11 - 6	- 14 - 6	- 6 0	- 9 0	- 15 0	- 22 0	- 36 0	- 58 0	± 3	± 4.5
10	18	- 8	- 61	- 43	- 27	- 14	- 17	- 8	-11	- 18	- 27	- 43	– 70	± 4	± 5.5
18	30	- 10	- 65 - 78	- 40 - 53	- 20 - 33	- 7 - 16	- 7 - 20	_ 0 _ 9	0 -13	_ 0 _ 21	- 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	0 - 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	_ 0 _ 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	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 - 46	- ⁰	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	- 52	- 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	- 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	0 - 63	- 97	0 155	0 -250	± 13.5	± 20
500	630	0 - 50	-260 -304	-145 -189	- 76 -120	_	- 22 - 66	_	0 -44	- 70	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 	0 -320	_	± 25
800	1 000	0 -100	-320 -376	170 226	- 86 -142	_	- 26 - 82	_	0 -56	- 90	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 Shaft Diameters

Units : µm

i5	j6	i7	k5	k6	k7	m5	m6	n6	р6	r6	r7	Diameter Cl (m	
		-							•			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 - 6	+ 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	+ 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 + 93	+ 105 + 65 + 108	140	160
										+ 68	+ 68	160	180
+ 7	+ 16	+ 25	+ 24	+ 33	+ 50	+ 37	+ 46	+ 60	+ 79	+ 106 + 77 + 109	+ 123 + 77 + 126	180	200
-13	-13	-21	+ 4	+ 4	+ 4	+ 17	+ 17	+ 31	+ 50	+ 80	+ 80 + 130	200	225
										+ 84 + 126	+ 84 + 146	225	250
+ 7 -16	± 16	± 26	+ 27 + 4	+ 36 + 4	+ 56 + 4	+ 43 + 20	+ 52 + 20	+ 66 + 34	+ 88 + 56	+ 94 + 130	+ 94 + 150	250	280 315
										+ 98	+ 98 + 165	315	355
+ 7 -18	± 18	+ 29 - 28	+ 29 + 4	+ 40 + 4	+ 61 + 4	+ 46 + 21	+ 57 + 21	+ 73 + 37	+ 98 + 62	+ 108	+ 108	355	400
_									400	+ 114	+ 114	400	450
+ 7 -20	± 20	+ 31 - 32	+ 32 + 5	+ 45 + 5	+ 68 + 5	+ 50 + 23	+ 63 + 23	+ 80 + 40	+ 108 + 68	+ 126 + 172 + 132	+ 126 + 195 + 132	450	500
				+ 44	+ 70		+ 70	+ 88	+ 122	+ 194 + 150	+ 220 + 150	500	560
_	_	_	_	0	0	_	+ 70 + 26	+ 88 + 44	+ 78	+ 199 + 155	+ 225 + 155	560	630
				+ 50	+ 80		+ 80	+ 100	+ 138	+ 225 + 175	+ 255 + 175	630	710
-	_	_	_	0	0	_	+ 30	+ 50	+ 88	+ 235 + 185	+ 265 + 185	710	800
				+ 56	+ 90		+ 90	+ 112	+ 156	+ 266 + 210	+ 300 + 210	800	900
_	_			0	0	_	+ 34	+ 56	+ 100	+ 276 + 220	+ 310 + 220	900	1 000
				+ 66	+ 105		+ 106	+ 132	+ 186	+ 316 + 250	+ 355 + 250	1 000	1 120
				0	0		+ 40	+ 66	+ 120	+ 326 + 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 0	+ 150 0	_	+ 150 + 58	+ 184 + 92	+ 262	+ 462 + 370 + 492	+ 520 + 370	1 600	1 800
				U	U		+ 56	+ 92	+ 170	+ 492	+ 550 + 400	1 800	2 000



Appendix Table 10

Dian Classifica over	neter tion (mm) incl.	Single Plane Mean O.D. Deviation (Normal) D _{mp}	E6	F6	F7	G6	G7	Н6	Н7	Н8	J6	J7	JS6	JS7
10	18	0 - 8	+ 43 + 32	+ 27 + 16	+ 34 + 16	+ 17 + 6	+ 24 + 6	+ 11	+ 18 0	+ 27 0	+ 6 - 5	+ 10 — 8	± 5.5	± 9
18	30	- 9	+ 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	+ 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 0	+ 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	+ 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 0	+ 90	+ 140 0	_	_	± 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	+ 150 0	+ 230		_	± 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

Units : µm

											Diameter Cl	
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 - 9	+ 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	0 - 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	0 - 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	0 - 90	_	- 34 - 90	- 34 -124	_	- 56 -112	- 56 -146	-100 -156	-100 -190	800	1 000
	0 - 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

C 20 C 21



Appendix Table 11 Values of

Basic	Size											Standard
(m	ım)	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 $f_{ m n}$

Appendix Table 13 Fatigue Life Factor f_n and Fatigue Life $L \cdot L_h$

Ball Bearings $f_{
m n}$ = (0.03 n) $^{-1/3}$ Roller Bearings $f_{\rm n}$ = (0.03 n) $^{-3/10}$ Ball Bearings $L=(C/P)^3$ $L_{\rm h}=500\,f_{\rm h}^3$ $_{\rm h}$ =500 $f_{\rm h}^{10/3}$

Speed		factor $f_{\rm n}$	Speed	Speed F		Speed	Speed F	actor $f_{\rm n}$
<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	1.10	1.09	460	0.417	0.455	6 000	0.177	0.211
26	1.09	1.08	480	0.411	0.449	6 200	0.175	0.209
27	1.07	1.07	500	0.405	0.444	6 400	0.173	0.207
28	1.06	1.05	550	0.393	0.431	6 600	0.172	0.205
29	1.05	1.04	600	0.382	0.420	6 800	0.170	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

						Roller B	earings $L = (C$	$/P)^{10/3}L_{\rm h}$	$=500 f_{\mathrm{h}}^{10/3}$
	Ball Bear	ing Life	Roller Bea	aring Life		Ball Bear	ing Life	Roller Be	aring Life
C/P or $f_{ m h}$	<i>L</i> (10 ⁶ rev)	<i>L</i> _h (h)	<i>L</i> (10 ⁶ rev)	<i>L</i> _h (h)	C/P or $f_{ m h}$	<i>L</i> (10 ⁶ rev)	<i>L</i> _h (h)	<i>L</i> (10 ⁶ rev)	<i>L</i> _h (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	d:C0	al Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages
332 336 342	D 80.000 d 41.275 d 41.275	B140,B144,B146 B146 B146	497 498 522	d 85.725 d 84.138 D 101.600	B162 B162 B148,B150	657 658 659	$egin{matrix} d \\ d \\ d \end{bmatrix}$	73.025 74.612 76.200	B158 B158 B158	1328 1329 1380	D 52.388 D 53.975 d 22.225	B136 B136 B136
342 S 344 344 A	d 42.875 d 40.000 d 40.000	B146 B144 B144	528 529 529 X	d 47.625 d 50.800 d 50.800	B148 B150 B150	661 663 664	$egin{array}{c} d \\ d \\ d \end{array}$	79.375 82.550 84.138	B160 B160 B162	1620 1680 1729	D 66.675 d 33.338 D 56.896	B142 B142 B136,B138
346 354 A 359 S	d 31.750 D 85.000 d 46.038	B140 B148 B148	532 X 539 552 A	D 107.950 d 53.975 D 123.825	B152 B152 B152,B154,B156	665 665 A 672	d d D	85.725 85.725 168.275	B162 B162 B162,B164,B166	1755 1779 1922	d 22.225 d 23.812 D 57.150	B136 B138 B138
362 A 366 368	D 88.900 d 50.000 d 50.800	B148,B150 B150 B150	553 X 555 S 557 S	D 122.238 d 57.150 d 53.975	B154,B156 B152 B152	677 681 683	$egin{array}{c} d \\ d \\ d \end{array}$	85.725 92.075 95.250	B162 B164 B164	1988 1997 X A2047	d 28.575 d 26.988 d 12.000	B138 B138 B136
368 A 369 A 372	d 50.800 d 47.625 D 100.000	B150 B148 B150	558 559 560	d 60.325 d 63.500 d 66.675	B154 B154 B156	685 687 742	$d \\ d \\ D$	98.425 101.600 150.089	B164 B166 B156,B160,B162	A2126 2523 2558	D 31.991 D 69.850 d 30.162	B136 B140,B142 B140
374 376 377	D 93.264 d 45.000 d 52.388	B148 B148 B150	560 S 563 563 X	d 68.262 D 127.000 D 127.000	B156 B154,B156,B158 B156	743 745 A 749	D d d	150.000 69.850 85.026	B160 B156 B162	2559 2580 2582	d 30.162 d 31.750 d 31.750	B140 B140 B140
382 382 A 382 S	D 98.425 D 96.838 D 96.838	B152 B152 B152	565 566 567	d 63.500 d 69.850 d 73.025	B154 B156 B158	749 A 749 S 750	$egin{array}{c} d \\ d \\ d \end{array}$	82.550 85.026 79.375	B160 B162 B160	2585 2631 2690	d 33.338 D 66.421 d 29.367	B142 B140 B140
385 387 387 A	d 55.000 d 57.150 d 57.150	B152 B152 B152	567 A 567 S 568	d 71.438 d 71.438 d 73.817	B158 B158 B158	752 753 757	D D d	161.925 168.275 82.550	B160,B162 B160,B162 B160	2720 2729 2735 X	D 76.200 D 76.200 D 73.025	B144 B144 B144
388 A 390 A 394 A	d 57.531 d 63.500 D 110.000	B152 B154 B154,B156	569 570 572	d 64.963 d 68.262 D 139.992	B154 B156 B158,B160	758 759 760	d d d	85.725 88.900 90.488	B162 B162 B162	2788 2789 2820	d 38.100 d 39.688 D 73.025	B144 B144 B142
395 395 A 395 S	d 63.500 d 66.675 d 66.675	B154 B156 B156	572 X 575 580	D 139.700 d 76.200 d 82.550	B160 B158 B160	766 772 776	$egin{matrix} d \\ D \\ d \end{matrix}$	88.900 180.975 95.250	B162 B164,B166 B164	2877 2924 2984	d 34.925 D 85.000 d 46.038	B142 B148 B148
397 399 A 414	d 60.000 d 68.262 D 88.501	B154 B156 B144	581 582 590 A	d 80.962 d 82.550 d 76.200	B160 B160 B158	779 780 782	d d d	98.425 101.600 104.775	B164 B166 B166	3120 3188 3197	D 72.626 d 31.750 d 33.338	B140,B142 B140 B142
418 432 432 A	d 38.100 D 95.250 D 95.250	B144 B146 B148	592 592 A 593	D 152.400 D 152.400 d 88.900	B164 B158,B162,B164 B162	787 792 795	$egin{matrix} d \\ D \\ d \end{bmatrix}$	104.775 206.375 120.650	B166 B168 B168	3320 3386 3420	D 80.167 d 39.688 D 79.375	B144 B144 B142,B144
436 438 453 A	d 46.038 d 44.450 D 107.950	B148 B146 B148	594 596 597	d 95.250 d 85.725 d 93.662	B164 B162 B164	797 799 799 A	$egin{array}{c} d \\ d \\ d \end{array}$	130.000 128.588 130.175	B168 B168 B168	3478 3479 3490	d 34.925 d 36.512 d 38.100	B142 B144 B144
453 X 460 462	D 104.775 d 44.450 d 57.150	B152 B148 B152	598 598 A 614 X	d 92.075 d 92.075 D 115.000	B164 B164 B152	832 837 842	$egin{array}{c} D \\ d \\ d \end{array}$	168.275 76.200 82.550	B160,B162 B160 B160	3525 3576 3578	D 87.312 d 41.275 d 44.450	B146 B146 B146
469 472 472 A	d 57.150 D 120.000 D 120.000	B152 B156,B158 B156	622 X 632 633	d 55.000 D 136.525 D 130.175	B152 B154,B158 B154,B156,B158	843 850 854	d d D	76.200 88.900 190.500	B160 B162 B162,B164,B166	3720 3730 3775	D 93.264 D 93.264 d 50.800	B146 B150 B150
478 480 484	d 65.000 d 68.262 d 70.000	B156 B156 B158	637 639 643	$egin{array}{ccc} d & 60.325 \\ d & 63.500 \\ d & 69.850 \\ \end{array}$	B154 B154 B156	855 857 861	$egin{matrix} d \\ d \\ d \end{bmatrix}$	88.900 92.075 101.600	B162 B164 B166	3780 3782 3820	d 50.800 d 44.450 D 85.725	B150 B146 B146
492 A 493 495	D 133.350 D 136.525 d 82.550	B160,B162 B158,B160,B162 B160	644 645 652	d 71.438 d 71.438 D 152.400	B158 B158 B158,B160	864 866 932	$d \\ d \\ D$	95.250 98.425 212.725	B164 B164 B166	3877 3920 3926	d 41.275 D 112.712 D 112.712	B146 B154,B156 B152,B154
495 A 495 AX 496	d 76.200 d 76.200 d 80.962	B158 B158 B160	653 653 X 655	$egin{array}{ccc} D & 146.050 \\ D & 150.000 \\ d & 69.850 \\ \end{array}$	B156,B158,B160,B162 B158 B156	938 1220 1280	d D d	114.300 57.150 22.225	B166 B136 B136	3981 3982 3984	d 58.738 d 63.500 d 66.675	B152 B154 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 (mm) d:CONE (Bore Dia.) D:CUP (Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (r d:CONE (Bore Di D:CUP (Outside D
3994	d 66.675	B156	02820	D 73.025	B138,B142	13685	d 38.100	B144	19150	d 38.10
A4050	d 12.700	B136	02872	d 28.575	B138	13687	d 38.100	B144	19268	D 68.26
A4059	d 15.000	B136	02878	d 34.925	B142	13830	D 63.500	B144	21075	d 19.05
A4138 4335 4388	D 34.988 D 90.488 d 41.275	B136 B146 B146	03062 03162 05062	$egin{array}{ccc} d & 15.875 \\ D & 41.275 \\ d & 15.875 \\ \end{array}$	B136 B136 B136	13889 14123 A 14125 A	d 38.100 d 31.750 d 31.750	B144 B140 B140	21212 L21511 L21549	D 53.97 D 34.98 d 15.87
4535 4595 A5069	D 104.775 d 53.975 d 17.455	B152 B152 B136	05068 05075 05079	d 17.462 d 19.050 d 19.990	B136 B136 B136	14130 14131 14137 A	$egin{array}{ccc} d & 33.338 \\ d & 33.338 \\ d & 34.925 \\ \end{array}$	B142 B142 B142	22168 22325 23100	d 42.86 D 82.55 d 25.40
A5144 5335 5356	D 36.525 D 103.188 d 44.450	B136 B148 B148	05175 05185 07079	$\begin{array}{ccc} D & 44.450 \\ D & 47.000 \\ d & 20.000 \end{array}$	B136 B136 B136	14138 A 14139 14274	d 34.925 d 34.976 D 69.012	B142 B142 B140,B142	23256 23621 23691	D 65.08 D 73.02 d 35.00
5535	D 122.238	B152,B154	07087	d 22.225	B136	14276	D 69.012	B140,B142	24720	D 76.20
5566	d 55.562	B152	07097	d 25.000	B138	14283	D 72.085	B142	24721	D 76.20
5582	d 60.325	B154	07098	d 24.981	B138	15100	d 25.400	B138	24780	d 41.27
5584 5735 5760	$egin{array}{ccc} d & 63.500 \\ D & 135.733 \\ d & 76.200 \\ \end{array}$	B154 B158,B160 B158	07100 07100SA 07196	d 25.400 d 25.400 D 50.005	B138 B138 B136,B138	15101 15106 15112	$egin{array}{ccc} d & 25.400 \\ d & 26.988 \\ d & 28.575 \\ \end{array}$	B138 B138 B138	25520 25521 25523	D 82.93 D 83.05 D 82.93
5795 A6062 A6067	d 77.788 d 15.875 d 16.993	B160 B136 B136	07204 07205 08118	$\begin{array}{ccc} D & 51.994 \\ D & 52.001 \\ d & 30.162 \end{array}$	B136,B138 B138 B140	15113 15116 15117	d 28.575 d 30.112 d 30.000	B138 B140 B140	25577 25578 25580	d 42.87 d 42.86 d 44.45
A6075 A6157 6220	d 19.050 D 39.992 D 127.000	B136 B136 B150,B152	08125 08231 09062	$egin{array}{ccc} d & 31.750 \\ D & 58.738 \\ d & 15.875 \end{array}$	B140 B140 B136	15118 15119 15120	d 30.213 d 30.213 d 30.213	B140 B140 B140	25584 25590 25820	d 44.98 d 45.61 D 73.02
6279 6280 6320	d 50.800 d 53.975 D 135.755	B150 B152 B154,B156	09067 09074 09078	$egin{array}{ccc} d & 19.050 \\ d & 19.050 \\ d & 19.050 \\ \end{array}$	B136 B136 B136	15123 15125 15126	d 31.750 d 31.750 d 31.750	B140 B140 B140	25821 25877 25878	D 73.02 d 34.92 d 34.92
6376	d 60.325	B154	09081	d 20.625	B136	15245	D 62.000	B138,B140	25880	d 36.48
6379	d 65.088	B156	09194	D 49.225	B136	15250	D 63.500	B140	26118	d 30.00
6420	D 149.225	B152,B156,B158	09195	D 49.225	B136	15250 X	D 63.500	B138	26131	d 33.33
6454	d 69.850	B156	09196	D 49.225	B136	15520	D 57.150	B138	26283	D 72.00
6455	d 57.150	B152	11162	d 41.275	B146	15523	D 60.325	B138	26820	D 80.16
6460	d 73.025	B158	11300	D 76.200	B146	15578	d 25.400	B138	26822	D 79.37
6461	d 76.200	B158	11520	D 42.862	B136	15580	d 26.988	B138	26823	D 76.20
6535	D 161.925	B158,B160,B162	11590	d 15.875	B136	16150	d 38.100	B144	26882	d 41.27
6536	D 161.925	B158	LM11710	D 39.878	B136	16284	D 72.238	B144	26884	d 42.87
6559	d 82.550	B160	LM11749	d 17.462	B136	16929	D 74.988	B146	27620	D 125.41
6575	d 76.200	B158	LM11910	D 45.237	B136	16986	d 43.000	B146	27687	d 82.55
6576	d 76.200	B158	LM11949	d 19.050	B136	17098	d 24.981	B138	27689	d 83.34
6580	d 88.900	B162	12168	d 42.862	B146	17118	d 30.000	B140	27690	d 83.34
9121	D 152.400	B154,B156	12303	D 76.992	B146	17244	D 62.000	B138,B140	27820	D 80.03
9180	d 61.912	B154	12520	D 49.225	B136	17520	D 42.862	B136	27880	d 38.10
9185 9220 9285	d 68.262 D 161.925 d 76.200	B156 B158 B158	12580 M12610 M12648	$egin{array}{ccc} d & 20.638 \\ D & 50.005 \\ d & 22.225 \\ \end{array}$	B136 B136 B136	17580 17831 17887	d 15.875 D 79.985 d 45.230	B136 B148 B148	28138 28315 28521	d 34.97 D 80.00 D 92.07
9320	D 177.800	B160	M12649	d 21.430	B136	18200	d 50.800	B150	28580	d 50.80
9321	D 171.450	B160,B162	LM12710	D 45.237	B136	18337	D 85.725	B150	28584	d 52.38
9378	d 76.200	B160	LM12711	D 45.975	B136	18520	D 73.025	B144	28622	D 97.63
9380	d 76.200	B160	LM12749	d 22.000	B136	18590	d 41.275	B144	28680	d 55.56
9385	d 84.138	B162	13175	d 44.450	B146	18620	D 79.375	B148	28920	D 101.60
02420	D 68.262	B138,B140	13181	d 46.038	B148	18690	d 46.038	B148	28921	D 100.00
02473	d 25.400	B138	13318	D 80.962	B146,B148	18720	D 85.000	B150	28985	d 60.32
02474	d 28.575	B138	13620	D 69.012	B144	18790	d 50.800	B150	29520	D 107.95
02475	d 31.750	B140	13621	D 69.012	B144	19138	d 34.976	B142	29586	d 63.50

Bearing No. CONE, CUP	d:00	I Dimension (mm) NE (Bore Dia.) P (Outside Dia.)	Pages	Bearing No. CONE, CUP	d:CC	al Dimension (mm) DNE (Bore Dia.) IP (Outside Dia.)	Pages
13685 13687 13830	d d D	38.100 38.100 63.500	B144 B144 B144	19150 19268 21075	$d \\ D \\ d$	38.100 68.262 19.050	B144 B142,B144 B136
13889 14123 A 14125 A	$egin{array}{c} d \\ d \\ d \end{array}$	38.100 31.750 31.750	B144 B140 B140	21212 L21511 L21549	$D \\ D \\ d$	53.975 34.988 15.875	B136 B136 B136
14130 14131 14137 A	$egin{array}{c} d \\ d \\ d \end{array}$	33.338 33.338 34.925	B142 B142 B142	22168 22325 23100	d_D_d	42.862 82.550 25.400	B146 B146 B138
14138 A 14139 14274	$egin{matrix} d \\ d \\ D \end{matrix}$	34.925 34.976 69.012	B142 B142 B140,B142	23256 23621 23691	$D \\ D \\ d$	65.088 73.025 35.000	B138 B142 B142
14276 14283 15100	$D \\ D \\ d$	69.012 72.085 25.400	B140,B142 B142 B138	24720 24721 24780	$D \\ D \\ d$	76.200 76.200 41.275	B146 B146 B146
15101 15106 15112	$egin{array}{c} d \\ d \\ d \end{array}$	25.400 26.988 28.575	B138 B138 B138	25520 25521 25523	$D \\ D \\ D$	82.931 83.058 82.931	B146,B148 B146 B146,B148
15113 15116 15117	$egin{array}{c} d \\ d \\ d \end{array}$	28.575 30.112 30.000	B138 B140 B140	25577 25578 25580	$egin{array}{c} d \\ d \\ d \end{array}$	42.875 42.862 44.450	B146 B146 B146
15118 15119 15120	$egin{array}{c} d \\ d \\ d \end{array}$	30.213 30.213 30.213	B140 B140 B140	25584 25590 25820	$\stackrel{d}{\stackrel{d}{_D}}$	44.983 45.618 73.025	B148 B148 B142
15123 15125 15126	$egin{matrix} d \\ d \\ d \end{bmatrix}$	31.750 31.750 31.750	B140 B140 B140	25821 25877 25878	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	73.025 34.925 34.925	B142,B144 B142 B142
15245 15250 15250 X	$D \\ D \\ D$	62.000 63.500 63.500	B138,B140 B140 B138	25880 26118 26131	$egin{array}{c} d \\ d \\ d \end{array}$	36.487 30.000 33.338	B144 B140 B142
15520 15523 15578	$D \\ D \\ d$	57.150 60.325 25.400	B138 B138 B138	26283 26820 26822	$D \\ D \\ D$	72.000 80.167 79.375	B140,B142 B146 B146
15580 16150 16284	$egin{matrix} d \\ d \\ D \end{matrix}$	26.988 38.100 72.238	B138 B144 B144	26823 26882 26884	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	76.200 41.275 42.875	B146 B146 B146
16929 16986 17098	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	74.988 43.000 24.981	B146 B146 B138	27620 27687 27689	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	125.412 82.550 83.345	B160 B160 B160
17118 17244 17520	$_{D}^{d}$	30.000 62.000 42.862	B140 B138,B140 B136	27690 27820 27880	d D d	83.345 80.035 38.100	B160 B144 B144
17580 17831 17887	$egin{matrix} d \\ D \\ d \end{matrix}$	15.875 79.985 45.230	B136 B148 B148	28138 28315 28521	$_{D}^{d}$	34.976 80.000 92.075	B142 B142 B150
18200 18337 18520	d D D	50.800 85.725 73.025	B150 B150 B144	28580 28584 28622	$_{D}^{d}$	50.800 52.388 97.630	B150 B150 B152
18590 18620 18690	$egin{matrix} d \\ D \\ d \end{bmatrix}$	41.275 79.375 46.038	B144 B148 B148	28680 28920 28921	$_{D}^{d}$	55.562 101.600 100.000	B152 B154 B154
18720 18790 19138	D d d	85.000 50.800 34.976	B150 B150 B142	28985 29520 29586	d D d	60.325 107.950 63.500	B154 B154 B154

C 28 C 29



Bearing No. CONE, CUP	d:CONE	nension (mm) (Bore Dia.) Outside Dia.)	Pages	Bearing No. CONE, CUP	Nominal Dimension (mm) d :CONE (Bore Dia.) D :CUP (Outside Dia.)	Pages		ing No. E, 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
29620 29630 29675	D 12	12.712 20.650 69.850	B156,B158 B156 B156	42690 43118 43131	d 77.788 d 30.162 d 33.338	B160 B140 B142	5	9585 2387 2393	d 50.800 d 98.425 d 100.012	B150 B164 B164	67920 67983 67985	D 282.575 d 203.200 d 206.375	B170 B170 B170
29685 LM29710 LM29711	d D D	73.025 65.088 65.088	B158 B144 B144	43300 43312 44143	D 76.200 D 79.375 d 36.512	B140 B142 B144	5	2400 2618 2637	d 101.600 D 157.162 D 161.925	B166 B164,B166 B164,B166	L68110 L68111 L68149	D 59.131 D 59.975 d 35.000	B142 B142 B142
LM29748 LM29749 31520	d 3	38.100 38.100 76.200	B144 B144 B142	44150 44157 44162	d 38.100 d 40.000 d 41.275	B144 B144 B146	5	3150 3162 3176	d 38.100 d 41.275 d 44.450	B144 B146 B148	68450 68462 68709	d 114.300 d 117.475 D 180.000	B166 B166 B166
31594 33262 33275	d 6	34.925 66.675 69.850	B142 B156 B156	44348 L44610 L44640	D 88.501 D 50.292 d 23.812	B144,B146 B138 B138	5	3177 3178 3375	d 44.450 d 44.450 D 95.250	B148 B148 B144,B148	68712 JL69310 JL69349	D 180.975 D 63.000 d 38.000	B166 B144 B144
33281 33287 JHM33410	d	71.438 73.025 55.000	B158 B158 B138	L44643 L44649 45220	d 25.400 d 26.988 D 104.775	B138 B138 B152	5	3387 5175 5187	D 98.425 d 44.450 d 47.625	B146,B148 B148 B148	71412 71425 71437	 d 104.775 d 107.950 d 111.125 	B166
JHM33449 33462 33821	D 11	24.000 17.475 95.250	B138 B156,B158 B150	45221 45289 L45410	D 104.775 d 57.150 D 50.292	B152 B152 B140	5	5200 5200 C 5206	d 50.800 d 50.800 d 52.388	B150 B150 B150	71450 71453 71750	d 114.300 d 115.087 D 190.500	B166 B166 B166
33889 34300 34306	d	50.800 76.200 77.788	B150 B158 B160	L45449 46143 46162	d 29.000 d 36.512 d 41.275	B140 B144 B146	5	5437 5443 6418	D 111.125 D 112.712 d 106.362	B148,B150 B148 B166	72187 72200 72200 C	d 47.625 d 50.800 d 50.800	B148 B150 B150
34478 36620 36690	D 19	21.442 93.675 46.050	B158,B160 B168 B168	46176 46368 46720	d 44.450 D 93.662 D 225.425	B146 B144,B146 B168	5	6425 6650 9200	d 107.950 D 165.100 d 50.800	B166 B166 B150	72212 72212C 72218	d 53.975 d 53.975 d 55.562	B152 B152 B152
36920 36990 37425	d 17	27.012 77.800 07.950	B170 B170 B166	46780 47420 47487	d 158.750 D 120.000 d 69.850	B168 B156,B158 B156	6	9429 4433 4450	D 108.966 d 109.992 d 114.300	B150 B166 B166	72218C 72225C 72487	d 55.562 d 57.150 D 123.825	B152 B152 B148,B150,B152
37625 M38510 M38511	D = 6	58.750 66.675 65.987	B166 B142 B142	47490 47620 47680	d 71.438 D 133.350 d 76.200	B158 B158,B160 B158	6	4700 5200 5212	D 177.800 d 50.800 d 53.975	B166 B150 B152	LM72810 LM72849 74500	D 47.000 d 22.606 d 127.000	B138 B138 B168
M38547 M38549 39236	d 3	35.000 34.925 60.000	B142 B142 B154	47685 47686 47687	d 82.550 d 82.550 d 82.550	B160 B160 B160	6	5237 5320 5385	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
39250 39412 39520	D 10	63.500 04.775 12.712	B154 B154 B154,B156	47820 47890 47896	D 146.050 d 92.075 d 95.250	B164 B164 B164	6	5500 6187 6462	D 127.000 d 47.625 D 117.475	B150,B152,B154 B148 B148	74850 74856 77375	D 215.900 D 217.488 d 95.250	B168 B168 B164
39521 39585 39590	d 6	12.712 63.500 66.675	B156 B154 B156	48120 48190 48220	D 161.925 d 107.950 D 182.562	B166 B166 B168	6	6520 6584 6585	D 122.238 d 53.975 d 60.000	B152,B154 B152 B154	77675 78225 78250	D 171.450 d 57.150 d 63.500	
41100 41125 41126	d 2	25.400 28.575 28.575	B138 B138 B138	48282 48286 48290	d 120.650 d 123.825 d 127.000	B168 B168 B168	LM6	6587 7010 7043	d 57.150 D 59.131 d 28.575	B152 B138,B140 B138	LM78310 LM78310 A LM78349	D 62.000 D 62.000 d 35.000	B142 B142 B142
41286 42350 42362	d 8	72.626 88.900 92.075	B138 B162 B164	48320 48385 48393	D 190.500 d 133.350 d 136.525	B168 B168 B168	6	7048 7320 7322	d 31.750 D 203.200 D 196.850	B140 B168 B168	78537 78551 78571	D 136.525 D 140.030 D 144.983	
42368 42375 42376	d	93.662 95.250 95.250	B164 B164 B164	LM48510 LM48511 LM48548	$egin{array}{ccc} D & 65.088 \\ D & 65.088 \\ d & 34.925 \\ \end{array}$	B142 B142 B142	6	7388 7389 7390	d 127.000 d 130.175 d 133.350	B168 B168 B168	HM81610 HM81649 M84210	D 47.000 d 16.000 D 59.530	B136 B136 B138
42381 42584 42587	D 14	96.838 48.430 49.225	B164 B164 B162,B164	48620 48685 49175	D 200.025 d 142.875 d 44.450	B168 B168 B146	6	7720 7780 7787	D 247.650 d 165.100 d 174.625	B168,B170 B168 B170	M84249 M84510 M84548	d 25.400 D 57.150 d 25.400	
42620 42687 42688	d	27.000 76.200 76.200	B158,B160 B158 B158	49176 49368 49520	d 44.450 D 93.662 D 101.600	B146 B150	6	7790 7820 7885	d 177.800 D 266.700 d 190.500	B170 B170 B170	M86610 M86643 M86647	D 64.292 d 25.400 d 28.575	B138,B140 B138 B138



Bearing No. CONE, CUP	d:C0	nal Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages	Bearing No. CONE, CUP	d:C0	al Dimension (mm) DNE (Bore Dia.) JP (Outside Dia.)	Pages
M86648 A M86649 M88010	$d \\ d \\ D$	30.955 30.162 68.262	B140 B140 B140,B142	HH221432 HH221434 HH221440	$egin{matrix} d \\ d \\ d \end{matrix}$	87.312 88.900 95.250	B162 B162 B164
M88043 M88046 M88048	$egin{matrix} d \\ d \\ d \end{bmatrix}$	30.162 31.750 33.338	B140 B140 B142	HH221442 HH221447 HH221449	$egin{array}{c} d \\ d \\ d \end{array}$	98.425 99.982 101.600	B164 B164 B166
HM88510	$egin{array}{c} D \\ d \\ d \end{array}$	73.025	B140,B142	HH224310	D	212.725	B166
HM88542		31.750	B140	HH224335	d	101.600	B166
HM88547		33.338	B142	HH224340	d	107.950	B166
HM88610 HM88630 HM88638	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	72.233 25.400 32.000	B138,B140,B142,B144 B138 B140	HH224346 M224710 M224748	$^{d}_{\substack{D\\d}}$	114.300 174.625 120.000	B166 B168 B168
HM88648	$d \\ d \\ D$	35.717	B144	LL225710	D	165.895	B168
HM88649		34.925	B142	LL225749	d	127.000	B168
HM89410		76.200	B142,B144	HM231110	D	236.538	B168
HM89411 HM89443 HM89444	$egin{array}{c} D \\ d \\ d \end{array}$	76.200 33.338 33.338	B142 B142 B142	HM231140 M236810 M236849	$egin{matrix} d \\ D \\ d \end{matrix}$	146.050 260.350 177.800	B168 B170 B170
HM89446	$egin{array}{c} d \\ d \\ d \end{array}$	34.925	B142	LM300811	D	68.000	B144
HM89446 A		34.925	B142	LM300849	d	41.000	B144
HM89449		36.512	B144	L305610	D	80.962	B150
99100	D	254.000	B168	L305649	$\stackrel{d}{\stackrel{D}{D}}_{d}$	50.800	B150
99550	d	139.700	B168	JH307710		110.000	B152
99575	d	146.050	B168	JH307749		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	$\stackrel{d}{\stackrel{D}{D}}_{d}$	133.350	B168
JLM104910	D	82.000	B150	LM328410		187.325	B168
LM104911	D	82.550	B150	LM328448		139.700	B168
LM104911 A LM104912 LM104947 A	$D \\ D \\ d$	82.550 82.931 50.000	B150 B150 B150	H414210 H414245 H414249	$egin{matrix} D \\ d \\ d \end{smallmatrix}$	136.525 68.262 71.438	B156,B158 B156 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	$egin{matrix} d \\ D \\ d \end{bmatrix}$	39.688	B144	LM501314	D	73.431	B144
JM205110		90.000	B150	LM501349	d	41.275	B144
JM205149		50.000	B150	LM503310	D	75.000	B148
JM207010	D	95.000	B152	LM503349	$\stackrel{d}{\stackrel{D}{D}}_{d}$	46.000	B148
JM207049	d	55.000	B152	HH506310		114.300	B150
JH211710	D	120.000	B156	HH506348		49.212	B150
JH211749	$D \\ D \\ D$	65.000	B156	JLM506810	D	90.000	B152
HM212010		122.238	B154,B156	JLM506849	d	55.000	B152
HM212011		122.238	B154,B156	JLM508710	D	95.000	B154
HM212044 HM212046 HM212047	$egin{matrix} d \\ d \\ d \end{bmatrix}$	60.325 63.500 63.500	B154 B154 B154	JLM508748 JM511910 JM511946	$\stackrel{d}{\stackrel{D}{D}}_{d}$	60.000 110.000 65.000	B154 B156 B156
HM212049	$egin{matrix} d \\ D \\ d \end{bmatrix}$	66.675	B156	JM515610	D	130.000	B160
JH217210		150.000	B162	JM515649	d	80.000	B160
JH217249		85.000	B162	HM516410	D	133.350	B160
HM218210	D	147.000	B162	HM516448	$\stackrel{d}{\stackrel{D}{D}}_{d}$	82.550	B160
HM218248	d	90.000	B162	JHM516810		140.000	B162
HH221410	D	190.500	B162,B164,B166	JHM516849		85.000	B162

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	$egin{matrix} d \\ d \\ d \end{bmatrix}$	107.950	B166
LM522548		109.987	B166
LM522549		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	$egin{array}{c} d \\ D \\ d \end{array}$	69.850	B156
HM617010		142.138	B162
HM617049		85.725	B162
L623110	D	152.400	B166
L623149	d	114.300	B166
JLM710910	D	105.000	B156
JLM710949	$egin{matrix} d \\ D \\ d \end{bmatrix}$	65.000	B156
JLM714110		115.000	B158
JLM714149		75.000	B158
JM714210	D	120.000	B158
JM714249	d	75.000	B158
H715311	D	136.525	B154,B156,B158
H715334	$egin{array}{c} d \\ d \\ d \end{array}$	61.912	B154
H715340		65.088	B156
H715341		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	$egin{array}{c} d \\ D \\ d \end{array}$	90.000	B162
JM719113		150.000	B164
JM719149		95.000	B164
JM720210	$D \\ D \\ d$	155.000	B164
JHM720210		160.000	B164
JM720249		100.000	B164
JHM720249	$egin{matrix} d \\ D \\ d \end{bmatrix}$	100.000	B164
JL724314		170.000	B168
JL724348		120.000	B168
JL725316	D	175.000	B168
JL725346	d	125.000	B168
JM734410	D	240.000	B170
JM734449	$egin{matrix} d \\ D \\ d \end{bmatrix}$	170.000	B170
JM738210		260.000	B170
JM738249		190.000	B170

Bearing No. CONE, CUP	d:C0	nal Dimension (mm) ONE (Bore Dia.) JP (Outside Dia.)	Pages
HM801310	D	82.550	B144
HM801346	d	38.100	B144
M802011	D	82.550	B146
M802048	$egin{matrix} d \\ D \\ d \end{bmatrix}$	41.275	B146
HM803110		88.900	B146
HM803145		41.275	B146
HM803146	$d \\ d \\ D$	41.275	B146
HM803149		44.450	B146
M804010		88.900	B148
M804049	$\stackrel{d}{\stackrel{D}{D}}_{d}$	47.625	B148
HM804810		95.250	B146,B148,B150
HM804840		41.275	B146
HM804843	$egin{array}{c} d \\ d \\ d \end{array}$	44.450	B148
HM804846		47.625	B148
HM804848		48.412	B150
HM804849	$_{D}^{d}$	48.412	B150
HM807010		104.775	B148,B150
HM807011		104.775	B150
JHM807012	D	105.000	B150
HM807040	d	44.450	B148
HM807044	d	49.212	B150
JHM807045	$d \\ d \\ D$	50.000	B150
HM807046		50.800	B150
JLM813010		110.000	B158
JLM813049	d_D	70.000	B158
JLM820012		150.000	B164
JLM820048		100.000	B164
JM822010	D	165.000	B166
JM822049	d	110.000	B166
JHM840410	D	300.000	B170
JHM840449	d_D	200.000	B170
HM903210		95.250	B148
HM903247		44.450	B148
HM903249	$egin{matrix} d \\ D \\ d \end{bmatrix}$	44.450	B148
HM911210		130.175	B152
HM911242		53.975	B152
H913810	$egin{array}{c} D \\ d \\ d \end{array}$	146.050	B154,B156
H913842		61.912	B154
H913849		69.850	B156



Worldwi	de Sales Offices and Manufacturi	ng Plants	P: Phone F: Fax C: Country Code Printed in Japan
NSK LTD.	-HEADQUARTERS, TOKYO, JAPAN Nissei Bldg., 1-6-3 Ohsaki, Shinagawa-ku, Tokyo 141-8560, Japan	CHONGQING	Room 2306, Unit B, No.137, Keyuan 2nd Road, Jiulongpo District, Chonqing, China (400039)
	INERY BUSINESS DIVISION-HEADQUARTERS P: 03-3779-7227 F: 03-3779-7644 C: 81	CHENGDU	P:023-8806-5310 F:023-6806-5292 C:86 Room1117, Lippo Tower, No.62 North Kehua Road, Chengdu, Sichuan, China (610041) P: 028-8528-3680 F: 028-8528-3690 C: 86
	RKET DEPARTMENT P: 03-3779-7253 F: 03-3779-7644 C: 81 NERY DEPARTMENT	NSK CHINA SA HEAD OFFICE	ALES CO., LTD. No.8 NSK Rd., Huagiao Economic Development Zone, Kunshan, Jiangsu, China (215332)
	P: 03-3779-7163 F: 03-3779-7644 C: 81 USINESS DEPARTMENT	NSK-WARNER OFFICE/PLANT	P: 0512-5796-3000 F: 0512-5796-3300 C: 86 (SHANGHAI) CO., LTD. No. 2518 bit upop hong Poad (Meet) Fanayian Dietrict Shanghai China (201401)
	P: 0466-21-3027 F: 0466-21-3206 C: 81 NESS DIVISION-HEADQUARTERS		No. 2518 Huancheng Road (West) Fengxian District, Shanghai,China (201401) P: 021-3365-5757 F: 021-3365-5262 C: 86 N BALL (HANGZHOU) CO., LTD.
• Africa South Africa:	P: 03-3779-7189 F: 03-3779-7917 C: 81	PLANT	No. 189 Hongda Road, Xiaoshan Area of Economic & Technological Development Zone, Hangzhou, Zhejiang, China (311231)
NSK SOUTH AF	FRICA (PTY) LTD. 25 Galaxy Avenue, Linbro Business Park, Sandton, Gauteng, P.O. Box 1157, Kelvin, 2054, South Africa P: 011-458-3600 F: 011-458-3608 C: 27	NSK-YAGI PRE PLANT	P: 0571-2280-1288 F: 0571-2280-1268 C: 86 ECISION FORGING (ZHANGJIAGANG) CO., LTD. No. 34 Zhenxing Road, Zhangjiagang Economic Development Zone, Zhangjiagang City, Jiangsu, China (215600)
•Asia and	l Oceania	NSK-WANDA E OFFICE/PLANT	P:0512-5867-6496 F:0512-5818-0970 C:86 ELECTRIC POWER ASSISTED STEERING SYSTEMS CO.,LTD. 1833 Yatai Road, Wenyan Town, Xiaoshan, Hangzhou, Zhejiang, China (311258)
NSK AUSTRALI. MELBOURNE	A PTY, LTD. 11 Dalmore Drive, Scoresby, Victoria 3179, Australia P: 03-9765-4400 F: 03-9764-8304 C: 61	SHENYANG NS	P:0571-8231-4818 F:0571-8248-6656 C:86 SK PRECISION CO., LTD.
SYDNEY	P: 03-9763-4400 F: 03-9764-8304 C: 61 24-28 River Road West, Parramatta, New South Wales 2150, Australia P: 02-9843-8100 F: 02-9893-8406 C: 61	OFFICE/PLANT	No. 7, 15 Street, Shenyang Economic & Technological Development Area, Shenyang, Liaoning, China (110141) P: 024-2550-5017 F: 024-2532-6081 C: 86
BRISBANE	F: 02-9893-8400 F: 02-9893-8400 C: 61 1/69 Selhurst Street, Coopers Plains, Queensland 4108, Australia P: 07-3347-2600 F: 07-3345-5376 C: 61	SHENYANG NS	SK CO., LTD.
PERTH	P: 07-3347-2000 F: 07-3349-3370 C: 61 Unit 1, 71 Tacoma Circuit, Canning Vale, Western Australia 6155, Australia P: 08-9256-5000 F: 08-9256-1044 C: 61	OFFICE/PLANT	No. 5, 15 Street, Shenyang Economic & Technological Development Area, Shenyang, Liaoning, China (110141) P. 024-252-6080 F: 024-2532-6081 C: 86
China: NSK HONG KO	NG LTD.	India:	
HONG KONG	Suite 705, 7th Floor, South Tower, World Finance Centre, Harbour City, T.S.T, Kowloon, Hong Kong, China	CHENNAI	EERING SYSTEMS LTD. 14, Rajagopalan Salai, Vallancherry, Guduvancherry, Tamil Nadu-603 202, India
SHENZHEN	P: 02739-9933 F: 02739-9323 C: 852 Room 624-626, 6/F, Kerry Center, Renminnan Road, Shenzhen, Guangdong, China	BAWAL	P:044-474-06017 F:044-274-66001 C:91 Plot No.28A, Sector 6, HSIIDC Growth Centre Bawal, District Rewari, Haryana -123 501. India
KUNSHAN NSK	P: 0755-25904886 F: 0755-25904883 C: 86 CO., LTD. 258 South Huang Pu Jiang Rd., Kunshan Economic & Technical Development	NEK INDIV EVI	P:01284-264281 F:01284-264280 C:91 LES CO.PVT.LTD.
	Zone, Jiangsu, China (215335) P: 0512-5771-5654 F: 0512-5771-5689 C: 86	CHENNAI	6th Floor, Bannari Amman Towers, No.29 Dr. Radhakrishnan Salai, Mylapore, Chennai-600 004 Tamil Nadu, India P.044-2847-9600 F.044-2847-9601 C:91
OFFICE/PLANT	K NEEDLE BEARING CO., LTD. No. 66 Dongnan Road, Changshu Southeast Economic Development Zone, Changshu City, Jiangsu, China (215500) P: 0512-9230-1111 F: 0512-5230-0611 C: 86	GURGAON	Unit No-202, 2nd Floor, Block-A, Iris Tech Park, Sector-48, Gurgaon, Haryana-122008, India P:0124-4104-530 F:0124-4104-532 C:91
NSK STEERING OFFICE/PLANT	P: 0512-5230-1111 F: 0512-5230-6011 C: 86 i SYSTEMS DONGGUAN CO., LTD. High-tech Park, Shillong Road, Guanlong Section, Dongguan, Guangdong, China (523119)	KOLKATA	502, Trinity Towers, 83, Topsia Road, Kolkata-700 046, India P:033-4001-2062 F:033-4001-2064 C:91
	P: 0769-2262-0960 F: 0769-2316-2867 C: 86 G NSK PRECISION MACHINERY CO., LTD.	MUMBAI	321, 'A' Wing, Ahura Centre, 82, Mahakali Caves Road, Andheri (East), Mumbai -400 093, India
OFFICE/PLANT	No. 34 Zhenxing Road, Zhangjiagang Economic Development Zone, Zhangjiagang City, Jiangsu, China (215600)	NSK-ABC BEA OFFICE/PLANT	P:022-2838-7787 F:022-2838-5191 C:91 KRINGS LTD. Plot No.A2, SIPCOT Growth Centre, Oragadam, Mathur Village, Sriperumbudur Taluk,
SUZHOU NSK E	P: 0512-5867-6496 F: 0512-5818-0970 C: 86 BEARINGS CO., LTD. No. 22 Taishan Road, Suzhou New District, Jiangsu, China (215129)		Kancheepuram District, Tamil Nadu-602 105, India P:044-2714-3000 F:044-2714-3099 C:91
NSK (CHINA) R	P: 0512-6665-5666 F: 0512-6665-9138 C: 86 ESEARCH & DEVELOPMENT CO., LTD.	Indonesia: PT. NSK BEAR	RINGS MANUFACTURING INDONESIA F Blok M4, Kawasan Berikat MM2100 Industrial Town Cikarang Barat, Bekasi
JIANGSU	No.8 NSK Rd., Huaqiao Economic Development Zone, Kunshan, Jiangsu, China (215332) P: 0512-5796-3000 F: 0512-5796-3300 C: 86	JANANIA FLANI	17520, Indonesia P: 021-898-0155 F: 021-898-0156 C: 62
HEAD OFFICE	Al) TRADING CO., LTD. No.8 NSK Rd., Huaqiao Economic Development Zone, Kunshan, Jiangsu, China (215332) P: 0512-5796-3000 F: 0512-5796-3300 C: 86	PT. NSK INDOI JAKARTA	Summitmas II, 6th Floor, Jl. Jend Sudirman Kav. 61-62, Jakarta 12190, Indonesia
NSK (CHINA) IN	IVESTMENT CO., LTD. No.8 NSK Rd., Huaqiao Economic Development Zone, Kunshan, Jiangsu, China (215332)	PT. NSK-WARI	P: 021-252-3458 F: 021-252-3223 C: 62 NER INDONESIA
BEIJING	P: 0512-5796-3000 F: 0512-5796-3300 C: 86 Room 2116, Beijing Fortune Bldg., 5 Dong San Huan Bei Lu, Chao Yang District,	BEKASI Korea:	MM2100 Industrial Town, Cikarang Barat, Bekasi 17520, Indonesia P: 021-8998-3216 F: 021-8998-3218 C: 62
TIAN JIN	Beijing, China (100004) P: 010-6590-8161 F: 010-6590-8166 C: 86 Room 06, 09F The Exchange Tower 2, No. 189 NanJing Road, Heping District,	NSK KOREA C SEOUL	Posco Center (West Wing) 9F, 892, Daechi-4Dong, Kangnam-Ku, Seoul, 135-777, Korea
TIAN SIN	P: 022-8319-5030 F: 022-8319-5033 C: 86	CHANGWON PLANT	P: 02-3287-0300 F: 02-3287-0345 C: 82 60, Seongsan-Dong, Changwon, Kyungsangnam-Do, 642-315, Korea P: 055-287-8001 F: 055-285-9882 C: 82
CHANGCHUN	Room 1001, Building A, Zhongyin Building, 727 Xi'an Road, Changchun, Jilin, China (130061)	Malavsia:	S (MALAYSIA) SDN. BHD.
SHENYANG	P: 0431-8898-8682 F: 0431-8898-8670 C: 86 Room 1101, China Resources Building, No. 286 Qingnian Street, Heping District, Shenyang Liaoning, China (110004) P: 024-2334-2688 F: 024-2334-2688 C: 86	HEAD OFFICE	No. 2, Jalan Pemaju, U1/15, Seksyen U1, Hicom Glenmarie Industrial Park, 40150 Shah Alam, Selangor, Malaysia P: 03-7804-8859 F: 03-7806-5982 C: 60
DALIAN	P: 024-2334-2868 F: 024-2334-2058 C: 86 Room 1805 Xiwang Tower, No.136 Zhongshan Road, Zhongshan District, Dallan, Liaoning, China (116001)	PRAI JOHOR BAHRU	No.36, Jalan kikik, Taman Inderawasih, 13600 Prai, Penang, Malaysia P: 04-3902275 F: 04-3991830 C: 60 88 Jalan Ros Merah 2/17, Taman Johor Jaya, 81100 Johor Bahru, Johor, Malaysia
NANJING	P: 0411-8800-8168 F: 0411-8800-8160 C: 86 Room A1 22F, Golden Eagle International Plaza, No.89 Hanzhong Road, Nanjing, Jiangsu, China (210029)	IPOH	88 Jalan Hos Meran 2717, 1aman Jonor Jaya, 81100 Johor Banru, Jonor, Maiaysia P: 07-3546290 F: 07-3546291 C: 60 Gr. Floor, 89 Jalan Bendahara, 31650 Ipoh, Perak, Malaysia P: 05-2553000 F: 05-255330
FUZHOU	P:025-8472-6671 F:025-8472-6687 C:86 Room 1801-1811, B1#1A Class Office Building, Wanda Plaza, No.8 Aojiang Road, Fuzhou, China (350009)	NSK MICRO PI MALAYSIA PLANT	RECISION (M) SDN. BHD. No.43 Jalan Taming Dua, Taman Taming Jaya 43300 Balakong, Selangor Darul Ehsan, Malaysia
WUHAN	P: 0591-8380-1030 F: 0591-8380-1225 C: 86 Room 2108, New World International Trade Tower I, No.568 Jianshe Road, Wuhan, Hubel, China (430000)	New Zealand:	P: 03-8961-3960 F: 03-8961-3968 C: 60
QINGDAO	P: 027-8556-9630 F: 027-8556-9615 C: 86 Room 802, Farglory International Plaza, No.26 Xianggang Zhong Road, Shinan District, Oingdao, Shandong, China (266071)	NSK NEW ZEA AUCKLAND	3 Te Apunga Place, Mt. Wellington, Auckland, New Zealand P: 09-276-4992 F: 09-276-4082 C: 64
GUANGZHOU	P: 0532-5568-3877 F: 0532-5568-3876 C: 86 Room 2302, TalKoo Hui Tower 1, No.385 Tianhe Road, Tianhe District, Guangzhou, China (510620)	NSK REPRESE MANILA	ENTATIVE OFFICE 8th Floor The Salcedo Towers 169 H.V. dela Costa St., Salcedo Village Makati City, Philippines 1227
CHANGSHA	P: 020-3817-7800 F: 020-3788-4501 C: 86 Room 1048, 10/F, Zhongtlan Plaza, No.766 WuyiRoad, Changsha, Hunan, China (410005) P: 0731-8571-3255 C: 86	Singapore:	P: 02-893-9543 F: 02-893-9173 C: 63
LUOYANG	P: 0/31-8571-3100 F: 0/31-8571-3255 C: 86 Room 1108, Fangda Hotel, 6 XiYuan Road, LuoYang HeNan, China (471003) P: 0379-6069-6188 F: 0379-6069-6180 C: 86	SINGAPORE	TIONAL (SINGAPORE) PTE LTD. 238A, Thomson Road, #24-01/05, Novena Square Tower A, Singapore 307684 P: 6496-8000 F: 6250-5845 C: 65
XI'AN	P: 0379-0009-6188 F: 0379-0009-6180 C: 86 Room 1007, B Changan Metropolls Center88 Nanguanzheng Steet, Xi'an, Shanxi, China (710068) P: 029-8765-1896 F: 029-8765-1895 C: 86		P: 6496-8000 F: 6250-5845 G: 65 PRE (PRIVATE) LTD. 238A, Thomson Road, #24-01/05, Novena Square Tower A, Singapore 307684 P: 6496-8000 F: 6250-5845 C: 65

Worldwide Sales Offices and Manufacturing Plants

TAIWAN NSK I	PRECISION CO., LT	D.	
TAIPEI		ng Rd., Jhongshan Distri	ct, Taipei City 104, Taiwan R.O.
	P: 02-2509-3305	F: 02-2509-1393	C: 886
TAICHUNG	107-7, Sec. 3, Wen Xir	ng Rd., Taichung City 40	7, Taiwan R.O.C.
TAINIANI	P: 04-2311-7978	F: 04-2311-2627	C: 886
TAINAN	5F. No.8, Daye 1st Hd. Taiwan R.O.C.	., Southern Taiwan Scien	ice Park, Tainan City 741,
	P: 06-505-5861	F: 06-505-5061	C: 886
TAIMAN NEW	TECHNOLOGY CO.		0.800
TAIWAN NON	11E No 87 Song Jian	, LTD. na Rd. Jhonashan Distri	ct, Taipei City 104, Taiwan R.O.
1741 21	P: 02-2509-3305	F: 02-2509-1393	C: 886
TAICHUNG		Junggang Rd., Taichung	
	P: 04-2358-2945	F: 04-2358-7682	C: 886
TAINAN	5F. No.8, Daye 1st Rd.	, Southern Taiwan Scien	ice Park, Tainan City 741,
	Taiwan R.O.C.		
	P: 06-505-5861	F: 06-505-5061	C: 886
Thailand:			
NSK BEARING	S (THAILAND) CO.,	LTD.	
BANGKOK			District, Bangkok 10250, Thaila
NOV DEADING	P: 02320-2555	F: 02320-2826	C: 66
OFFICE/PLANT	S MANUFACTURIN	IG (THAILAND) CO.	., LID. e, T.Donhualor, A.Muangchonbi
OI I ICE/FLANT	Chonburi 20000, Thaila		e, i.poniluaior, A.iviuarigenonbi
	P: 038-454-010	F: 038-454-017	C: 66
SIAM NSK STE	ERING SYSTEMS		5.50
OFFICE/PLANT	90 Moo 9, Wellgrow In	dustrial Estate, Km.36 B	angna-Trad Rd., Bangwao,
	Bangpakong, Chachoe	engsao 24180, Thailand	
	P: 038-522-343	F: 038-522-351	C: 66
NSK ASIA PAC	IFIC TECHNOLOG	Y CENTRE (THAILA	ND) CO., LTD.
CHONBURI	700/430 Moo 7, Amata	Nakorn Industrial Estate	e, T.Donhualor, A.Muangchonbi
	Chonburi 20000, Thaila		
	P: 038-454-631	F: 038-454-634	C: 66
Vietnam:			
NSK VIETNAM	CO., LTD.		
HEAD OFFICE		204-205, Thang Long In	dustrial Park, Dong Anh District
	Hanoi, Vietnam	F: 04-3955-0158	C: 84
NEW DEDDEED	P: 04-3955-0159	F: U4-3955-U158	C: 84
HO CUI MINU CITY	NTATIVE OFFICE	n Building 225 Dong Kh	oi Street, District 1,HCMC, Vietr
TIO OTILIVIIIVIT OTITI	P: 08-3822-7907	F: 08-3822-7910	C: 84
●Europe			
NSK EUROPE	LTD. (EUROPEAN I	HEADQUARTERS)	
NSK EUROPE	Belmont Place, Belmo	nt Road, Maidenhead, B	
NSK EUROPE MAIDENHEAD	LTD. (EUROPEAN I Belmont Place, Belmon P: 01628-509-800	HEADQUARTERS) nt Road, Maidenhead, B F: 01628-509-808	erkshire SL6 6TB, U.K. C: 44
NSK EURÖPE MAIDENHEAD France:	Belmont Place, Belmon P: 01628-509-800	nt Road, Maidenhead, B	
NSK EUROPE MAIDENHEAD France: NSK FRANCE	Belmont Place, Belmon P: 01628-509-800 S.A.S.	nt Road, Maidenhead, B F: 01628-509-808	C: 44
NSK EURÖPE MAIDENHEAD France:	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2	nt Road, Maidenhead, B F: 01628-509-808 P. Rue Georges Guyneme	C: 44 r, 78283 Guyancourt, France
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS	Belmont Place, Belmon P: 01628-509-800 S.A.S.	nt Road, Maidenhead, B F: 01628-509-808	C: 44
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS Germany:	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39	nt Road, Maidenhead, B F: 01628-509-808 P. Rue Georges Guyneme	C: 44 r, 78283 Guyancourt, France
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39	nt Road, Maidenhead, B F: 01628-509-808 Price Georges Guyneme F: 01-30-57-00-01	C: 44 r, 78283 Guyancourt, France C: 33
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 HLAND GMBH Harkortstrasse 15, D-4	nt Road, Maidenhead, B F: 01628-509-808 P: Rue Georges Guyneme F: 01-30-57-00-01	C: 44 #, 78283 Guyancourt, France C: 33
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH HEAD OFFICE	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 **ILAND GMBH** Harkortstrasse 15, D-4 P: 02102-4810	nt Road, Maidenhead, B F: 01628-509-808 R: Rue Georges Guyneme F: 01-30-57-00-01 10880 Ratingen, German F: 02102-4812-290	C: 44 r, 78283 Guyancourt, France C: 33 y C: 49
NSK EURÖPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH HEAD OFFICE	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 **ILAND GMBH** Harkortstrasse 15, D-4 P: 02102-4810	nt Road, Maidenhead, B F: 01628-509-808 P: Rue Georges Guyneme F: 01-30-57-00-01	C: 44 r, 78283 Guyancourt, France C: 33 y C: 49
NSK EURÔPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH HEAD OFFICE STUTTGART	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 HLAND GMBH Harkortstrasse 15, D-4 P: 02102-4810 Liebknechtstrasse 33, P: 0711-79082-0	nt Road, Maidenhead, B F: 01628-509-808 P. Rue Georges Guyneme F: 01-30-57-00-01 00880 Ratingen, German F: 02102-4812-290 D-70565 Stuttgart-Valhin F: 0711-79082-289	C: 44 r, 78283 Guyancourt, France C: 33 y C: 49 ngen, Germany C: 49
NSK EURÔPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCH HEAD OFFICE STUTTGART	Belmont Place, Belmon P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 HLAND GMBH Harkortstrasse 15, D-4 P: 02102-4810 Liebknechtstrasse 33, P: 0711-79082-0	nt Road, Maidenhead, B F: 01628-509-808 PRUG Georges Guyneme F: 01-30-57-00-01 10880 Ratingen, German F: 02102-4812-290 D-70565 Stuttgart-Vailbu	C: 44 r, 78283 Guyancourt, France C: 33 y C: 49 ngen, Germany C: 49
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NSK EUROPE MAIDENHEAD France: NSK FRANCE: PARIS Germany: NSK DEUTSCHEAD OFFICE STUTTGART WOLFSBURG NEUWEG FER	Belmont Place, Belmo P: 01628-509-800 S.A.S. Quartier de l'Europe, 2 P: 01-30-57-39-39 +LAND GMBH Harkortstrasse 15, D-4 P: 02102-4810 Liebknechtstrasse 33, P: 0711-79082-0 Heinrich-Nordhoff-Stre P: 05361-27647-10	nt Road, Maldenhead, B F: 01628-509-808 P. Rue Georges Guyneme F: 01-30-57-00-01 10880 Ratingen, German F: 02102-4812-290 D-70565 Suttgart-Valhi F: 0711-79082-289 ssse 101, D-38440 Wolfst F: 05361-27647-70	C: 44 y, 78283 Guyancourt, France C: 33 y C: 49 ngen, Germany C: 49 burg, Germany C: 49 rmany
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