Large Bearings

CAT.No.2250-8/E

CAT.No.2250-8/E 26.03.00 NI/NI

Table of Contents

Remarks: ULTAGE is a trademark of **NTN** (Japan Trademark Number 4635022)

NTN

Large Bearings

Engineering Section Table of Contents

1. Load rating and life

1.1 Bearing life

Even in bearings operating under normal conditions, the surfaces of the raceway and rolling elements are constantly being subjected to repeated compressive stresses which cause **spalling** (flaking) of these surfaces to occur. This spalling is due to material fatigue and will eventually cause bearings to fail.

The effective life of a bearing is usually defined **in terms of the total number of revolutions** a bearing can undergo before **spalling** of either the raceway surface or the rolling element surfaces occurs.

Other causes of bearing failure are often attributed to problems such as seizing, abrasions, cracking, chipping, gnawing, rust, etc. However, these so-called "causes" of bearing failure are usually themselves caused by improper installation, insufficient or improper lubrication, faulty sealing or inaccurate bearing selection.

Since the above-mentioned "causes" of bearing failure can be avoided by taking the proper precautions, and are not simply caused by material fatigue, they are considered separately from the flaking aspect.

1.2 Basic rated life and basic dynamic load rating

A group of seemingly identical bearings when subjected to identical load and operating conditions will exhibit a wide diversity in their durability. This "life" disparity can be accounted for by the difference in the fatigue of the bearing material itself.

This disparity is considered statistically when calculating bearing life, and **the basic rating life** is defined as follows.

The basic rating life is **based on a 90 % statistical model which is expressed as the total number of revolutions 90 % of the bearings in an identical group of bearings subjected to identical operating conditions will attain or surpass before spalling due to material fatigue. For bearings operating at fixed constant speeds, the basic rating life (90 % reliability) is expressed in the total number of hours of operation.** Basic dynamic load rating expresses a rolling bearing's capacity to support a dynamic load.

The basic dynamic load rating is **the load which a bearing can theoretically endure for a basic rating life of one million revolutions**. This is expressed as pure radial load for radial bearings and pure axial load for thrust bearings. These are referred to as "**basic dynamic radial load rating (C_r)**" and "**basic dynamic axial load rating (C_a)**".

The basic dynamic load ratings given in the bearing tables of this catalog are for bearings constructed of **NTN** high quality bearing materials and of good manufacturing quality.

The relationship between the basic rating life, the basic dynamic load rating and the dynamic equivalent load is shown in formula (1.1) and formula (1.2).

For ball bearings : $L_{10} = \left(\frac{C}{P}\right)^3 \cdots\cdots\cdots (1.1)$

For roller bearings: $L_{10} = \left(\frac{C}{P}\right)^{10/3} \cdots\cdots (1.2)$

Where:

L_{10} : Basic rating life 10^6 revolutions

C : Basic dynamic load rating, N

Radial bearing: C_r

Thrust bearing: C_a

P : Dynamic equivalent load, N[1)]

Radial bearing: P_r

Thrust bearing: P_a

n : Rotational speed, min^{-1}

Note: 1) For more details, please refer to the section "2. Bearing load calculation".

The relationship between rotational speed n and speed factor f_n as well as the relationship between life factor f_h and basic rating life L_{10h} are shown in **Table 1.1** and **Fig. 1.1**.

Table 1.1 Bearing basic rating life, life factor, and speed factor

Division	Ball bearing	Roller bearing
Basic rating life L_{10h}, h	$\frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = 500 f_h^{\,3}$	$\frac{10^6}{60n}\left(\frac{C}{P}\right)^{10/3} = 500 f_h^{\,10/3}$
Life factor f_h	$f_n \frac{C}{P}$	$f_n \frac{C}{P}$
Speed factor f_n	$\left(\frac{33.3}{n}\right)^{1/3}$	$\left(\frac{33.3}{n}\right)^{3/10}$

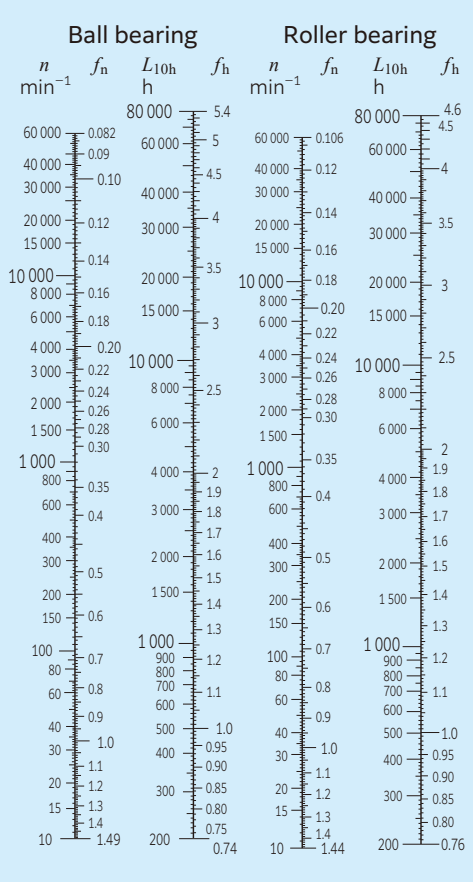


Fig. 1.1 Bearing life rating scale

When several bearings are incorporated in machines or equipment as complete units, all the bearings in the unit are considered as a whole when computing bearing system life (see formula 1.3).

$$L = \frac{1}{\left(\frac{1}{L_1{}^e} + \frac{1}{L_2{}^e} + \cdots \frac{1}{L_n{}^e}\right)^{1/e}} \quad \cdots\cdots (1.3)$$

Where:

L : Total basic rating life of entire unit, h

$L_1, L_2 \cdots L_n$: Basic rating life of individual bearings 1, 2, ⋯ n, h

$e = 10/9$ ····· For ball bearings

$e = 9/8$ ····· For roller bearings

When the load conditions vary at regular intervals, the life can be given by formula (1.4).

$$L_m = \left(\frac{\phi_1}{L_1} + \frac{\phi_2}{L_2} + \cdots\cdots \frac{\phi_j}{L_j}\right)^{-1} \cdots\cdots (1.4)$$

Where:

L_m : Total life of bearing, h

ϕ_j : Frequency of individual load conditions ($\Sigma\phi_j = 1$)

L_j : Life under individual conditions, h

If dynamic equivalent load P and rotational speed n are operating conditions of the bearing, basic rated dynamic load C that satisfies required life of the bearing is determined using **Table 1.1** and formula (1.5). Bearings that satisfy the required C can be selected from the bearing dimensions table provided in the catalog.

$$C = P\frac{f_h}{f_n} \quad \cdots\cdots (1.5)$$

1.3 Adjusted rating life

The basic bearing rating life can be calculated through the formulas mentioned earlier in Section 1.2. However, in some applications bearing reliability higher than 90 % may be required. In addition, bearing life may be enhanced by the use of specialty bearing materials or manufacturing processes. Bearing life is also sometimes affected by operating conditions such as lubrication, temperature and rotational speed.

Basic rating life adjusted to compensate for reliability, special bearing materials and enhancements, and specific operation conditions is called "**adjusted rating life**", and is determined using formula (1.6).

$$L_{na} = a_1 \cdot a_2 \cdot a_3 \cdot L_{10} \quad \cdots\cdots (1.6)$$

Where:

L_{na} : Adjusted rating life 10^6 revolutions

a_1 : Life adjustment factor for reliability

a_2 : Life adjustment factor for special bearing properties

a_3 : Life adjustment factor for operating conditions

1.3.1 Life adjustment factor for reliability a_1

The value of life adjustment factor for reliability a_1 is provided in **Table 1.2** for reliability of 90 % or greater.

1.3.2 Life adjustment factor for special bearing properties a_2

Bearing characteristics concerning life vary according to bearing material, quality of material and if using a special manufacturing process. In this case, life is adjusted using **life adjustment factor for special bearing properties a_2**.

The basic dynamic load ratings listed in the catalog are based on **NTN**'s standard material and the adjustment factor used is $a_2 = 1$. However, an adjustment factor of a_2 other than 1 may be used for bearings with specially enhanced materials and manufacturing methods. [NOTE: $a_2 < 1$ may occur for temperature stabilization] $a_2 > 1$ may be used for bearings with specially improved materials and manufacturing methods.

Bearings made of high carbon chrome bearing steel, conventionally heat treated, may experience dimensional changes during operation if used at high temperatures for extended periods of time. Temperature stabilization treatment (**TS treatment**) can be used to provide increased dimensional stability of bearing materials at high operational temperatures. However, the dimensional stabilization treatment results in a lower overall hardness of heat treated bearing materials; therefore, the life is adjusted by multiplying by life adjustment factor for special bearing properties a_2 given in **Table 1.3**.

For further clarification please consult with **NTN** Engineering.

Table 1.2 Life adjustment factor for reliability a_1

Reliability %	L_n	Life adjustment factor for reliability a_1
90	L_{10}	1
95	L_5	0.64
96	L_4	0.55
97	L_3	0.47
98	L_2	0.37
99	L_1	0.25
99.2	$L_{0.8}$	0.22
99.4	$L_{0.6}$	0.19
99.6	$L_{0.4}$	0.16
99.8	$L_{0.2}$	0.12
99.9	$L_{0.1}$	0.093
99.92	$L_{0.08}$	0.087
99.94	$L_{0.06}$	0.080
99.95	$L_{0.05}$	0.077

Table 1.3 Treatment for dimensional stabilization

Code	Max. operating temperature °C	Life adjustment factor for special bearing properties a_2
TS2	160	1.00
TS3	200	0.73
TS4	250	0.48

Please consult with **NTN** Engineering for life adjustment factor for special bearing properties (a_2) when using dimensional stabilization treatment combined with any specialty bearing material.

1.3.3 Life adjustment factor for operating conditions a_3

Life adjustment factor for operating conditions a_3 is used to compensate for when lubrication condition worsens due to a rise in temperature or rotational speed, the lubricant deteriorates or it becomes contaminated with foreign matter.

Generally speaking, when lubricating conditions are satisfactory, the a_3 factor has a value of 1.0; and when lubricating conditions are exceptionally favorable, and all other operating conditions are normal, a_3 can have a value greater than 1.0. The factor a_3 may be less than 1.0 due to the following cases:

- Dynamic viscosity of lubrication is too low for bearing operating temperature (13 mm²/s or less for ball bearings, 20 mm²/s or less for roller bearings as a standard)
- Rotational speed is particularly low (when the product of pitch diameter D_{pw} mm and rotational speed n min⁻¹ is $D_{pw} \cdot n < 10\,000$)
- Lubricant contaminated with foreign matter or moisture

For bearings used under special operating conditions, please consult with **NTN** Engineering.

Even if $a_2 > 1$ is used for specialty bearings made of enhanced materials or produced by special manufacturing methods, $a_2 \times a_3 < 1$ is used if lubricating conditions are not favorable.

When an excessively heavy load is applied, harmful plastic distortion may result at the contact surfaces between the rolling elements and raceways. The formulas for determining basic rating life (1.1, 1.2, and 1.6) do not apply if P_r exceeds either C_{0r} or $0.5C_r$ for radial bearings, or if P_a exceeds $0.5C_a$ for thrust bearings.

1.4 Modified rating life

1.4.1 Background

Adjusted rating life L_{na} of bearings is as shown in formula (1.6). System conditions corresponding to a_2 and a_3 are considered independently in that approach. However, it is desirable to consider the integrated system as a whole, resulting in adoption of ISO 281:2007. This approach considers **life modification factor a_{ISO}**, which provides a more practical method to consider the influence of lubrication, contamination and fatigue load on bearing life. Based on these decisions in ISO 281, JIS B 1518 was similarly revised in 2013.

Modified rating life L_{nm} using life modification factor a_{ISO} can be obtained by formula (1.7).

$$L_{nm} = a_1 \cdot a_{ISO} \cdot L_{10} \quad \cdots\cdots (1.7)$$

1.4.2 Life modification factor a_{ISO}

The life modification factor, a_{ISO}, is a function of lubrication, contamination, material characteristics, and load as shown in formula (1.8).

$$a_{ISO} = f\left(\frac{e_C C_u}{P},\ \kappa\right) \quad \cdots\cdots (1.8)$$

Where:

C_u : Fatigue load limit

The fatigue load limit is a load applied on bearings that results in the fatigue limit stress at the maximum loaded contact within the raceway. This depends on the bearing type, internal specifications, quality, and material strength. In ISO 281:2007, 1.5 GPa is recommended as contact stress corresponding to C_u for the bearings made of commonly used high quality material and good manufacturing quality. The fatigue load limit values with respect to the **NTN** bearing numbers are specified in each specification table.

e_C : Contamination factor

The presence of hard particle contaminants in the lubricant (oil) has the potential to form indentations on the raceway surface, resulting in surface initiated damage and in reduction in bearing life. Contamination factor e_C considers this and depends on the level of contamination, bearing size, and lubricant viscosity (oil film thickness). As shown in **Table 1.4**, approximate values are determined by the bearing size [may be substituted by rolling element pitch diameter D_{pw}, average bearing diameter $(d + D)/2$], filtration and seal structures (including presence of pre-washing).

κ : Viscosity ratio

Bearings are used on the assumption that the rolling contact surface is separated by the lubricant. However, when the viscosity of the lubricant is low, separation becomes insufficient and metal to metal contact occurs, causing surface initiated damage. Viscosity ratio κ considers this effect and is represented by formula (1.9) by the ratio of dynamic viscosity ν in use with respect to reference dynamic viscosity ν_1 of the lubricant.

$$\kappa = \nu/\nu_1 \quad \cdots\cdots (1.9)$$

Reference dynamic viscosity ν_1 depends on rotational speed n and size (D_{pw}), and can be obtained by **Fig. 1.2** or formula (1.10) and formula (1.11).

Table 1.4 Value of contamination factor e_C

Level of contamination	e_C	
	D_{pw} < 100 mm	D_{pw} ≥ 100 mm
Extreme cleanliness Particle size of the order of lubricant film thickness; laboratory conditions	1	1
High cleanliness Oil filtered through extremely fine filter; conditions typical of bearing greased for life and sealed	0.8-0.6	0.9-0.8
Normal cleanliness Oil filtered through fine filter; conditions typical of bearings greased for life and shielded	0.6-0.5	0.8-0.6
Slight contamination Slight contamination in lubricant	0.5-0.3	0.6-0.4
Typical contamination Conditions typical of bearings without integral seals; course filtering; wear particles and ingress from surroundings	0.3-0.1	0.4-0.2
Severe contamination Bearing environment heavily contaminated and bearing arrangement with inadequate sealing	0.1-0	0.1-0
Very severe contamination	0	0

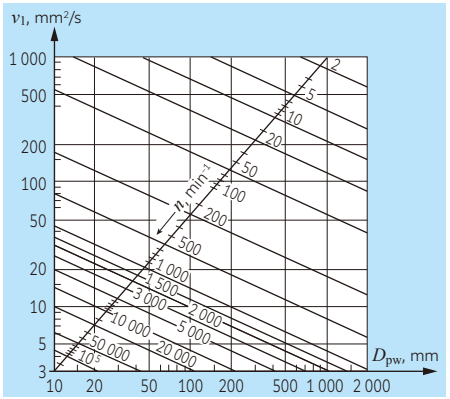


Fig. 1.2 Diagram for reference dynamic viscosity ν_1

In the case of $n < 1\,000$ min^{-1},

$$\nu_1 = 45\,000 n^{-0.83} D_{pw}^{-0.5} \quad \cdots\cdots (1.10)$$

In the case of $n \geq 1\,000$ min^{-1},

$$\nu_1 = 4\,500 n^{-0.5} D_{pw}^{-0.5} \quad \cdots\cdots (1.11)$$

Fig. 1.3 shows the relationship among C_u/P, e_C, κ and, a_{ISO} of radial ball bearings. Using the figure has the following restrictions:

1) For practical use, the life modification factor shall be limited $a_{ISO} \leq 50$.
2) In the case of $\kappa > 4$, $\kappa = 4$. The same approach does not apply in the case of $\kappa < 0.1$.

Diagrams for radial roller bearings, thrust ball bearings, and thrust roller bearings have also been presented (see **Fig. 1.4** through **Fig.1.6**). The diagrams can be applied regardless of lubrication types; however, for grease lubrication, special additives, and special rotating behaviors, consult with **NTN** Engineering.

1.4.3 Applicable bearings of modified rating life

Fatigue load limit C_u used for the calculation of life modification factor a_{ISO} depends on the bearing materials. **NTN** bearings that have undergone standard heat treatment through hardening (immersion quenching) and is made of bearing steel, the fatigue load limit value with respect to each bearing number is specified in each dimension table, and a_{ISO} can be applied.

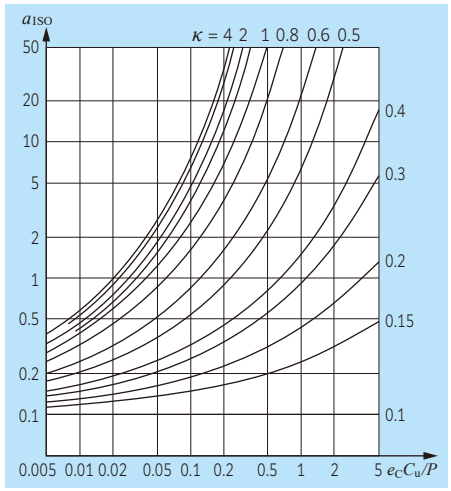


Fig. 1.3 Life modification factor a_{ISO} (radial ball bearing)

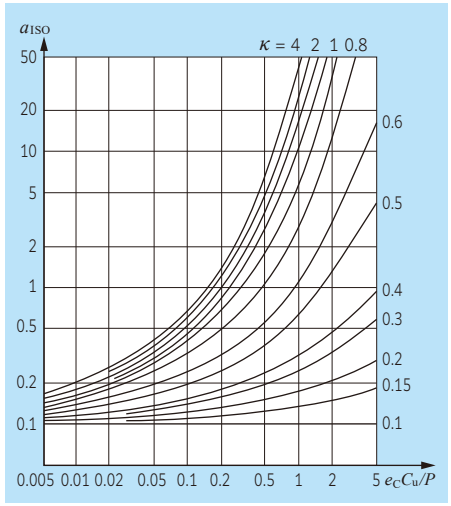


Fig. 1.4 Life modification factor a_{ISO} (radial roller bearing)

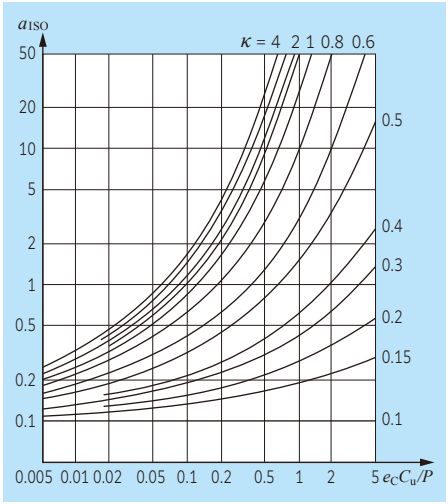


Fig. 1.5 Life modification factor a_{ISO} (thrust ball bearing)

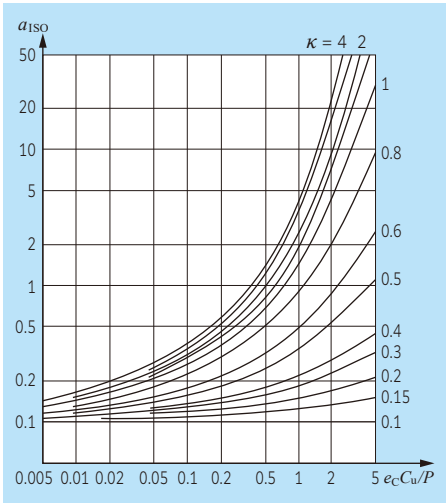


Fig. 1.6 Life modification factor a_{ISO} (thrust roller bearing)

1.5 Basic static load rating

It has been found through experience that a permanent deformation of 0.0001 times the diameter of the rolling element, occurring at the most heavily stressed contact point between the raceway and the rolling elements, can be tolerated without any subsequent impairment of bearing operation.

Roller bearings: 4 000 MPa
Ball bearings
(excluding self-aligning ball bearings): 4 200 MPa
Self-aligning ball bearings: 4 600 MPa

Testing indicates the above level of permanent deformation corresponds to a calculated contact stress as shown below. The basic static load rating is defined as the static applied load which results in such a contact stress at the center of the contact patch between the raceway and the rolling element receiving the maximum load.

Referred to as "**basic static radial load rating**" for radial bearings and "**basic static axial load rating**" for thrust bearings, the basic static load rating is expressed as C_{0r} or C_{0a} respectively and is provided in the bearing dimensions table.

1.6 Allowable static equivalent load

Generally, the static equivalent load which can be permitted (refer to page A-14) is limited by the basic static load rating as stated in Section 1.5. However, depending on application requirements regarding friction and smooth operation, these limits may be greater or lesser than the basic static load rating.

This is generally determined by taking the safety factor S_0 expressed by formula (1.12) and guidelines of **Table 1.5** into account.

$$S_0 = C_0 / P_0 \quad \cdots\cdots (1.12)$$

Where:
S_0 : Safety factor
C_0 : Basic static load rating, N
Radial bearing: C_{0r}
Thrust bearing: C_{0a}
P_0 : Static equivalent load, N
Radial bearing: P_{0r}
Thrust bearing: P_{0a}

Table 1.5 Minimum safety factor values S_0

Operating conditions	Ball bearing	Roller bearing
Applications that require quiet rotation	2	3
Applications subjected to impact loads	1.5	3
Normal rotation applications	1	1.5

Note: 1. For thrust spherical roller bearings, min. S_0 value = 4.
2. When vibration and/or shock loads are present, a load factor based on the shock load needs to be included in the P_0 max value.
3. If a large axial load is applied to deep groove ball bearings or angular ball bearings, the contact ellipse may exceed the raceway surface. For more information, please contact **NTN** Engineering.
4. When an As type raceway washer is used in a thrust bearing, min. S_0 value = 3.

1.7 Review of basic dynamic load ratings

As a result of continuous improvement related to material cleanliness, and production techniques, years of in-house durability testing has confirmed **NTN** bearings produced today have a longer operating life compared with past products. Based on this bearing life test data, the basic dynamic load ratings of ball and roller bearings were reviewed and updated to more accurately reflect true bearing performance.

The basic dynamic load ratings for many **NTN** products have been formally increased and can be found in the dimensional tables for each bearing type within this catalog.

*Some bearings use the same basic dynamic load rating as conventional products.

1.8 Bearing life calculation tool

The basic rating life of bearings can be calculated using the bearing technical calculation tool on the **NTN** website (https:// www.ntnglobal.com).

2. Bearing load calculation

To compute bearing loads, the forces which act on the shaft being supported by the bearing must be determined. Loads which act on the shaft and its related parts include weight of the rotating components, load produced when the machine performs work, and load produced by transmission of dynamic force. These can be mathematically calculated, but calculation is difficult in many cases.

A method of calculating loads that act upon shafts that convey dynamic force, which is the primary application of bearings, is provided herein.

2.1 Load acting on shafts

2.1.1 Load factor

There are many instances where the actual operational shaft load is much greater than the theoretically calculated load, due to shock. This actual shaft load can be estimated by using formula (2.1).

$$K = f_w \cdot K_c \quad \cdots\cdots (2.1)$$

Where:

K : Actual shaft load, N
f_w : Load factor (see **Table 2.1**)
K_c : Theoretically calculated value, N

Table 2.1 Load factor f_w

Amount of shock	f_w	Machine application examples
Very little or no shock	1.0-1.2	Electric machines, machine tools, measuring instruments.
Light shock	1.2-1.5	Railway vehicles, automobiles, rolling mills, metal working machines, paper making machines, printing machines, aircraft, textile machines, electrical units, office machines.
Heavy shock	1.5-3.0	Crushers, agricultural equipment, construction equipment, cranes.

2.2 Mean load

The load on bearings used in machines under normal circumstances will, in many cases, fluctuate according to a fixed time period or planned operation schedule. The load on bearings operating under such conditions can be converted to a mean load (F_m). This is a load which gives bearings the same life they would have under constant operating conditions.

(1) Fluctuating stepped load (see Fig. 2.1)

The mean bearing load, F_m, for stepped loads is calculated from formula (2.2). F_1, F_2 ····· F_n are the loads acting on the bearing; n_1, n_2 ····· n_n and t_1, t_2 ····· t_n are the bearing speeds and operating times, respectively.

$$F_m = \left[\frac{\Sigma (F_i{}^p n_i t_i)}{\Sigma (n_i t_i)} \right]^{1/p} \quad \cdots\cdots (2.2)$$

Where:

$p = 3$ For ball bearings
$p = 10/3$ For roller bearings

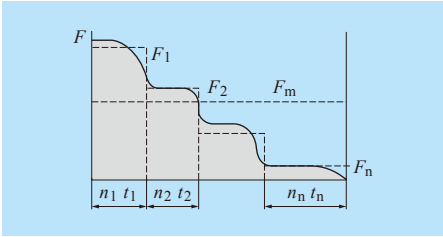


Fig. 2.1 Stepped load

(2) Continuously fluctuating load (see Fig. 2.2)

Where it is possible to express the function $F(t)$ in terms of load cycle t_o and time t, the mean load is found by using formula (2.3).

$$F_m = \left[\frac{1}{t_o} \int_o^{t_o} F(t)^p \, d_t \right]^{1/p} \quad \cdots\cdots (2.3)$$

Where:

$p = 3$ For ball bearings
$p = 10/3$ For roller bearings

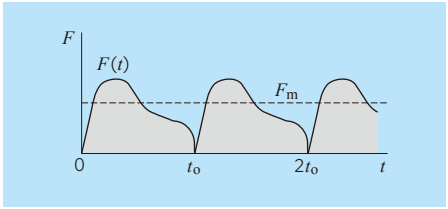


Fig. 2.2 Load that fluctuated as function of time

(3) Linear fluctuating load (see Fig. 2.3)

The mean load, F_m, can be approximated by formula (2.4).

$$F_m = \frac{F_{min} + 2F_{max}}{3} \quad \cdots\cdots (2.4)$$

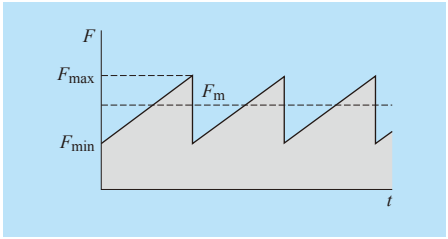


Fig. 2.3 Linear fluctuating load

(4) Sinusoidal fluctuating load (see Fig. 2.4)

The mean load, F_m, can be approximated by formula (2.5) and formula (2.6).

Case (a) $F_m = 0.75F_{max}$ ····· (2.5)
Case (b) $F_m = 0.65F_{max}$ ····· (2.6)

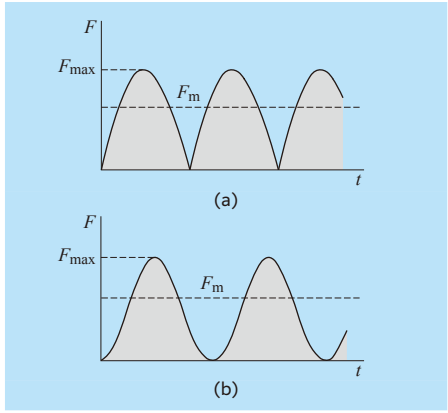


Fig. 2.4 Sinusoidal variable load

2.3 Equivalent load

2.3.1 Dynamic equivalent load

When both dynamic radial loads and dynamic axial loads act on a bearing at the same time, **the hypothetical load acting on the center of the bearing which gives the bearings the same life** as if they had only a radial load or only an axial load **is called the dynamic equivalent load**.

For radial bearings, this load is expressed as pure radial load and is called the dynamic equivalent radial load. For thrust bearings, it is expressed as pure axial load, and is called the dynamic equivalent axial load.

(1) Dynamic equivalent radial load

The dynamic equivalent radial load is expressed by formula (2.7).

$$P_r = XF_r + YF_a \quad \cdots\cdots (2.7)$$

Where:

P_r : Dynamic equivalent radial load, N
F_r : Actual radial load, N
F_a : Actual axial load, N
X : Radial load factor
Y : Axial load factor

The values for X and Y are listed in the bearing tables.

(2) Dynamic equivalent axial load

As a rule, standard thrust bearings with α contact angle of 90° cannot carry radial loads. However, thrust spherical roller bearings can accept some radial load. The dynamic equivalent axial load for these bearings is expressed by formula (2.8).

$$P_a = F_a + 1.2F_r \quad \cdots\cdots (2.8)$$

Where:

P_a : Dynamic equivalent axial load, N
F_a : Actual axial load, N
F_r : Actual radial load, N

Provided that $F_r / F_a \leq 0.55$ only.

2.3.2 Static equivalent load

The static equivalent load is **a hypothetical load which would cause the same total permanent deformation at the most heavily stressed contact point between the rolling elements and the raceway** as under actual load conditions; that is when both static radial loads and static axial loads are simultaneously applied to the bearing.

For radial bearings this hypothetical load refers to pure radial loads, and for thrust bearings it refers to pure centric axial loads. These loads are designated static equivalent radial loads and static equivalent axial loads respectively.

(1) Static equivalent radial load

For radial bearings the static equivalent radial load can be found by using formula (2.9) or formula (2.10). The greater of the two resultant values is always taken for P_{0r}.

$$P_{0r} = X_0 F_r + Y_0 F_a \quad \cdots\cdots (2.9)$$

$$P_{0r} = F_r \quad \cdots\cdots (2.10)$$

Where:

P_{0r} : Static equivalent radial load, N
F_r : Actual radial load, N
F_a : Actual axial load, N
X_0 : Static radial load factor
Y_0 : Static axial load factor

The values for X_0 and Y_0 are listed in the bearing tables.

(2) Static equivalent axial load

For thrust spherical roller bearings the static equivalent axial load is expressed by formula (2.11).

$$P_{0a} = F_a + 2.7F_r \quad \cdots\cdots (2.11)$$

Where:

P_{0a} : Static equivalent axial load, N
F_a : Actual axial load, N
F_r : Actual radial load, N

Provided that $F_r / F_a \leq 0.55$ only.

2.3.3 Load calculation for angular contact ball bearings and tapered roller bearings

For angular contact ball bearings and tapered roller bearings the pressure cone apex (load center) is located as shown in **Fig. 2.5**, and their values are listed in the bearing tables.

When radial loads act on these types of bearings a component force is induced in the axial direction. For this reason, these bearings are used in pairs. For load calculation this component force must be taken into consideration and is expressed by formula (2.12).

$$F_a = \frac{0.5F_r}{Y} \quad \cdots\cdots (2.12)$$

Where:

F_a : Axial component force, N
F_r : Actual radial load, N
Y : Axial load factor

The axial loads for these bearing pairs are given in **Table 2.2**.

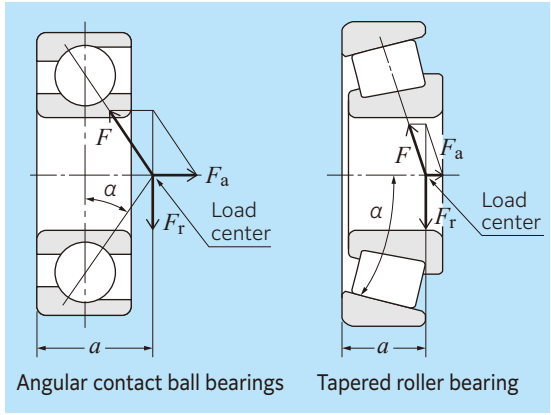
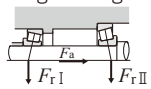
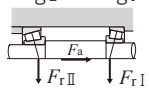
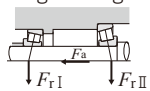
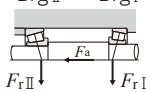


Fig. 2.5 Pressure cone apex and axial component force

Table 2.2 Bearing arrangement and equivalent load

Load center	Load conditions	Axial load
Rear 	$\frac{0.5F_{rI}}{Y_I} \leq \frac{0.5F_{rII}}{Y_{II}} + F_a$	$F_{aI} = \frac{0.5F_{rII}}{Y_{II}} + F_a$ ———
Front 	$\frac{0.5F_{rI}}{Y_I} > \frac{0.5F_{rII}}{Y_{II}} + F_a$	——— $F_{aII} = \frac{0.5F_{rI}}{Y_I} - F_a$
Rear 	$\frac{0.5F_{rII}}{Y_{II}} \leq \frac{0.5F_{rI}}{Y_I} + F_a$	——— $F_{aII} = \frac{0.5F_{rI}}{Y_I} + F_a$
Front 	$\frac{0.5F_{rII}}{Y_{II}} > \frac{0.5F_{rI}}{Y_I} + F_a$	$F_{aI} = \frac{0.5F_{rII}}{Y_{II}} - F_a$ ———

Note: 1. Applies when preload is zero.
2. Radial forces in the opposite direction to the arrow in the above illustration are also regarded as positive.
3. Dynamic equivalent radial load is calculated by using the table on the right of the size table of the bearing after axial load is obtained for X and Y factor.

3. Bearing tolerances

3.1 Dimensional and rotational accuracy

Bearing "tolerances" or dimensional accuracy and running accuracy, are regulated by ISO and JIS standards, JIS B 1514 (rolling bearing tolerances) series. For **dimensional accuracy**, these standards prescribe the tolerances necessary when installing bearings on shafts or in housings. **Running accuracy** is defined as the allowable limits for bearing runout during operation.

Dimensional accuracy

Dimensional accuracy constitutes the acceptable values for bore diameter, outside diameter, assembled bearing width, and bore diameter uniformity as seen in chamfer dimensions, allowable inner ring tapered bore deviation and shape error. Also included are variation of mean bore diameter within a plane, outside diameter within a plane, mean outside diameter within a plane, as well as raceway thickness (for thrust bearings).

Running accuracy

Running accuracy constitutes the acceptable values for inner and outer ring radial runout and axial runout, inner ring side surface squareness, and outer ring outside diameter squareness.

Allowable rolling bearing tolerances have been established according to precision classes. Bearing precision is stipulated as JIS Class 6, Class 5, Class 4, or Class 2, with precision rising from ordinary precision indicated by JIS Class 0.

Table 3.1 indicates which standards and precision classes are applicable to the major bearing types. **Table 3.2** shows a relative comparison between JIS B 1514 precision class standards and other standards.

For details of allowable limitations and values, refer to **Table 3.3** through **Table 3.10**, which are described in the application table column of **Table 3.1**. Allowable values for chamfer dimensions are shown in **Table 3.11**. Allowable limitations and values for radial bearing inner ring tapered bores are shown in **Table 3.12**.

Table 3.1 Bearing types and applicable tolerance

Bearing type		Applicable standard	Accuracy class					Tolerance table
Deep groove ball bearings		JIS B 1514-1 (ISO 492)	Class 0	Class 6	Class 5	Class 4	Class 2	Table 3.3
Angular contact ball bearings			Class 0	Class 6	Class 5	Class 4	Class 2	
Self-aligning ball bearings			Class 0	—	—	—	—	
Cylindrical roller bearings			Class 0	Class 6	Class 5	Class 4	Class 2	
Spherical roller bearings			Class 0	—	—	—	—	
Tapered roller bearings	Metric series (single-row)	JIS B 1514-1	Class 0, 6X	Class 6[1)]	Class 5	Class 4	—	Table 3.4
	Metric series (double-row/four-row)	—	Class 0[1)]	—	—	—	—	Table 3.6
	Inch series	ANSI/ABMA Std.19	Class 4	Class 2	Class 3	Class 0	Class 00	Table 3.5
Thrust ball bearings		JIS B 1514-2 (ISO 199)	Class 0	Class 6	Class 5	Class 4	—	Table 3.7
Thrust cylindrical roller bearings			Class 0	Class 6	Class 5	Class 4	—	
Thrust spherical roller bearings			Class 0	—	—	—	—	Table 3.8
Thrust tapered roller bearings	Metric series	**NTN** standard	Class 0	—	—	—	—	Table 3.9
	Inch series	ANSI/ABMA Std.23	Class 2	—	—	—	—	Table 3.10

1) The class is the **NTN** standard class.

Table 3.2 Comparison of tolerance classifications of national standards

Standard	Applicable standard	Accuracy class					Bearing type
Japanese industrial standards (JIS)	JIS B 1514-1	Class 0, 6	Class 6	Class 5	Class 4	Class 2	Radial bearings
	JIS B 1514-2	Class 0	Class 6	Class 5	Class 4	—	Thrust bearings
International Organization for Standardization (ISO)	ISO 492	Normal class Class 6X	Class 6	Class 5	Class 4	Class 2	Radial bearings
	ISO 199	Normal class	Class 6	Class 5	Class 4	—	Thrust bearings
	ISO 578	Class 4	—	Class 3	Class 0	Class 00	Tapered roller bearings (Inch series)
Deutsches Institut fur Normung (DIN)	DIN 620	P0	P6	P5	P4	P2	All types
American National Standards Institute (ANSI)	ANSI/ABMA Std.20[1)]	ABEC-1 RBEC-1	ABEC-3 RBEC-3	ABEC-5 RBEC-5	ABEC-7	ABEC-9	Radial bearings (excluding tapered roller bearings)
American Bearing Manufacturers Association (ABMA)	ANSI/ABMA Std.19	Class 4	Class 2	Class 3	Class 0	Class 00	Tapered roller bearings (Inch series)

1) "ABEC" is applied to ball bearings and "RBEC" to roller bearings.
Note: 1. JIS B 1514 series, ISO 492, 199, and DIN 620 have the same specification level.
2. The tolerance and allowance of JIS B 1514 series are slightly different from those of ABMA standards.

Table 3.3 Tolerance of radial bearings (except tapered roller bearings)

Table 3.3 (1) Inner rings

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}										Variation of bore diameter in a single plane V_{dsp}															
		Class 0		Class 6		Class 5		Class 4[1]		Class 2[1]		Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4					
												Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Max.					Max.					Max.				
80	120	0	−20	0	−15	0	−10	0	−8	0	−5	25	19	10	8	5	25	19	8	6	5	15	11	8	6	5
120	150	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
150	180	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
180	250	0	−30	0	−22	0	−15	0	−12	0	−8	38	28	15	12	8	38	28	12	9	8	23	17	12	9	8
250	315	0	−35	0	−25	0	−18	—	—	—	—	44	31	18	—	—	44	31	14	—	—	26	19	14	—	—
315	400	0	−40	0	−30	0	−23	—	—	—	—	50	38	23	—	—	50	38	18	—	—	30	23	18	—	—
400	500	0	−45	0	−35	—	—	—	—	—	—	56	44	—	—	—	56	44	—	—	—	34	26	—	—	—
500	630	0	−50	0	−40	—	—	—	—	—	—	63	50	—	—	—	63	50	—	—	—	38	30	—	—	—
630	800	0	−75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
800	1 000	0	−100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 000	1 250	0	−125	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 600	2 000	0	−200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane.
However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and also to all the diameter series for Class 2.

Variation of mean bore diameter V_{dmp}					Radial runout of inner ring of assembled bearing K_{ia}					Perpendicularity of inner ring face with respect to the bore S_d			Axial runout of inner ring of assembled bearing S_{ia}[2]			Deviation of a single inner ring width Δ_{Bs}								Variation of inner ring width V_{Bs}				
																Normal bearings						Duplex bearings[3]					
																Class 0		Class 5				Class 0		Class 5			
Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 6		Class 4		Class 2		Class 6		Class 4		Class 0	Class 6	Class 5	Class 4	Class 2
Max.					Max.					Max.			Max.			Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Max.				
15	11	5	4	2.5	25	13	6	5	2.5	9	5	2.5	9	5	2.5	0	−200	0	−200	0	−200	0	−380	0	−380	25	25	7	4	2.5
19	14	7	5	3.5	30	18	8	6	2.5	10	6	2.5	10	7	2.5	0	−250	0	−250	0	−250	0	−500	0	−380	30	30	8	5	2.5
19	14	7	5	3.5	30	18	8	6	5	10	6	4	10	7	5	0	−250	0	−250	0	−250	0	−500	0	−380	30	30	8	5	4
23	17	8	6	4	40	20	10	8	5	11	7	5	13	8	5	0	−300	0	−300	0	−300	0	−500	0	−500	30	30	10	6	5
26	19	9	—	—	50	25	13	—	—	13	—	—	15	—	—	0	−350	0	—	—	—	0	−500	0	—	35	35	13	—	—
30	23	12	—	—	60	30	15	—	—	15	—	—	20	—	—	0	−400	0	—	—	—	0	−630	0	—	40	40	15	—	—
34	26	—	—	—	65	35	—	—	—	—	—	—	—	—	—	0	−450	—	—	—	—	—	—	—	—	50	45	—	—	—
38	30	—	—	—	70	40	—	—	—	—	—	—	—	—	—	0	−500	—	—	—	—	—	—	—	—	60	50	—	—	—
55	—	—	—	—	80	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	70	—	—	—	—
75	—	—	—	—	90	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	80	—	—	—	—
94	—	—	—	—	100	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	100	—	—	—	—
120	—	—	—	—	120	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	120	—	—	—	—
150	—	—	—	—	140	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	140	—	—	—	—

2) Applies to ball bearings such as deep groove ball bearings and angular ball bearings.
3) Applies to individual raceway rings manufactured for combined bearing use.

Table 3.3 (2) Outer rings

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}										Variation of outside diameter in a single plane V_{Dsp} Open bearing															
		Class 0		Class 6		Class 5		Class 4[4]		Class 2[4]		Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4					
												Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Max.					Max.					Max.				
80	120	0	−15	0	−13	0	−10	0	−8	0	−5	19	16	10	8	5	19	16	8	6	5	11	10	8	6	5
120	150	0	−18	0	−15	0	−11	0	−9	0	−5	23	19	11	9	5	23	19	8	7	5	14	11	8	7	5
150	180	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
180	250	0	−30	0	−20	0	−15	0	−11	0	−8	38	25	15	11	8	38	25	11	8	8	23	15	11	8	8
250	315	0	−35	0	−25	0	−18	0	−13	0	−8	44	31	18	13	8	44	31	14	10	8	26	19	14	10	8
315	400	0	−40	0	−28	0	−20	0	−15	0	−10	50	35	20	15	10	50	35	15	11	10	30	21	15	11	10
400	500	0	−45	0	−33	0	−23	—	—	—	—	56	41	23	—	—	56	41	17	—	—	34	25	17	—	—
500	630	0	−50	0	−38	0	−28	—	—	—	—	63	48	28	—	—	63	48	21	—	—	38	29	21	—	—
630	800	0	−75	0	−45	0	−35	—	—	—	—	94	56	35	—	—	94	56	26	—	—	55	34	26	—	—
800	1 000	0	−100	0	−60	—	—	—	—	—	—	125	75	—	—	—	125	75	—	—	—	75	45	—	—	—
1 000	1 250	0	−125	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 600	2 000	0	−200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2 000	2 500	0	−250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane.
However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and also to all the diameter series for Class 2.

Variation of mean outside diameter V_{Dmp}					Radial runout of outer ring of assembled bearing K_{ea}					Perpendicularity of outer ring outside surface with respect to the face S_D			Axial runout of outer ring of assembled bearing S_{ea}[5]			Deviation of a single outer ring width Δ_{Cs}	Variation of outer ring width V_{Cs}			
Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	All classes	Class 0,6	Class 5	Class 4	Class 2
Max.					Max.					Max.			Max.				Max.			
11	10	5	4	2.5	35	18	10	6	5	9	5	2.5	11	6	5	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing	Depends on tolerance of V_{Bs} in relation to d of the same bearing	8	4	2.5
14	11	6	5	2.5	40	20	11	7	5	10	5	2.5	13	7	5			8	5	2.5
19	14	7	5	3.5	45	23	13	8	5	10	5	2.5	14	8	5			8	5	2.5
23	15	8	6	4	50	25	15	10	7	11	7	4	15	10	7			10	7	4
26	19	9	7	4	60	30	18	11	7	13	8	5	18	10	7			11	7	5
30	21	10	8	5	70	35	20	13	8	13	10	7	20	13	8			13	8	7
34	25	12	—	—	80	40	23	—	—	15	—	—	23	—	—			15	—	—
38	29	14	—	—	100	50	25	—	—	18	—	—	25	—	—			18	—	—
55	34	18	—	—	120	60	30	—	—	20	—	—	30	—	—			20	—	—
75	45	—	—	—	140	75	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	160	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	190	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	220	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	250	—	—	—	—	—	—	—	—	—	—			—	—	—

5) Applies to ball bearings such as deep groove ball bearings and angular contact ball bearings.

Table 3.4 Tolerance of tapered roller bearings (metric series)

Table 3.4 (1) Inner rings

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}						Variation of bore diameter in a single plane V_{dsp}				Variation of mean bore diameter V_{dmp}				Radial runout of inner ring of assembled bearing K_{ia}				Perpendicularity of inner ring face with respect to the bore S_d	
		Class 0		Class 6 [1]		Class 4 [2]		Class 0				Class 0				Class 0					
		Class 6X		Class 5				Class 6X	Class 6 [1]	Class 5	Class 4	Class 6X	Class 6 [1]	Class 5	Class 4	Class 6X	Class 6 [1]	Class 5	Class 4	Class 5	Class 4
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Max.				Max.				Max.				Max.	
80	120	0	−20	0	−15	0	−10	20	15	11	8	15	11	8	5	30	13	8	5	9	5
120	180	0	−25	0	−18	0	−13	25	18	14	10	19	14	9	7	35	18	11	6	10	6
180	250	0	−30	0	−22	0	−15	30	22	17	11	23	16	11	8	50	20	13	8	11	7
250	315	0	−35	—	—	—	—	35	—	—	—	26	—	—	—	60	—	—	—	—	—
315	400	0	−40	—	—	—	—	40	—	—	—	30	—	—	—	70	—	—	—	—	—
400	500	0	−45	—	—	—	—	45	—	—	—	34	—	—	—	80	—	—	—	—	—
500	630	0	−50	—	—	—	—	50	—	—	—	38	—	—	—	90	—	—	—	—	—
630	800	0	−75	—	—	—	—	75	—	—	—	56	—	—	—	105	—	—	—	—	—
800	1 000	0	−100	—	—	—	—	100	—	—	—	75	—	—	—	120	—	—	—	—	—
1 000	1 250	0	−125	—	—	—	—	125	—	—	—	94	—	—	—	140	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	160	—	—	—	120	—	—	—	160	—	—	—	—	—

1) Class 6 is the **NTN** standard class.
2) The dimensional difference Δ_{ds} of the measured bore diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane.

Table 3.4 (2) Outer rings

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}						Variation of outside diameter in a single plane V_{Dsp}				Variation of mean outside diameter V_{Dmp}				Radial runout of outer ring of assembled bearing K_{ea}				Perpendicularity of outer ring outside surface with respect to the face S_D [3]	
		Class 0		Class 6 [1]		Class 4 [4]		Class 0				Class 0				Class 0					
		Class 6X		Class 5				Class 6X	Class 6 [1]	Class 5	Class 4	Class 6X	Class 6 [1]	Class 5	Class 4	Class 6X	Class 6 [1]	Class 5	Class 4	Class 5	Class 4
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Max.				Max.				Max.				Max.	
80	120	0	−18	0	−13	0	−10	18	13	10	8	14	10	7	5	35	18	10	6	9	5
120	150	0	−20	0	−15	0	−11	20	15	11	8	15	11	8	6	40	20	11	7	10	5
150	180	0	−25	0	−18	0	−13	25	18	14	10	19	14	9	7	45	23	13	8	10	5
180	250	0	−30	0	−20	0	−15	30	20	15	11	23	15	10	8	50	25	15	10	11	7
250	315	0	−35	0	−25	0	−18	35	25	19	14	26	19	13	9	60	30	18	11	13	8
315	400	0	−40	0	−28	0	−20	40	28	22	15	30	21	14	10	70	35	20	13	13	10
400	500	0	−45	—	—	—	—	45	—	—	—	34	—	—	—	80	—	—	—	—	—
500	630	0	−50	—	—	—	—	60	—	—	—	38	—	—	—	100	—	—	—	—	—
630	800	0	−75	—	—	—	—	75	—	—	—	56	—	—	—	120	—	—	—	—	—
800	1 000	0	−100	—	—	—	—	100	—	—	—	75	—	—	—	140	—	—	—	—	—
1 000	1 250	0	−125	—	—	—	—	125	—	—	—	84	—	—	—	165	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	160	—	—	—	120	—	—	—	190	—	—	—	—	—
1 600	2 000	0	−200	—	—	—	—	200	—	—	—	150	—	—	—	230	—	—	—	—	—

3) Does not apply to bearings with flange.
4) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane.

Unit: μm

Axial runout of inner ring of assembled bearing S_{ia}		Deviation of a single inner ring width Δ_{Bs}						Deviation of the actual assembled bearing width Δ_{Ts}					
		Class 0				Class 5		Class 0				Class 5	
Class 4		Class 6		Class 6X		Class 4		Class 6		Class 6X		Class 4	
Max.		Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
5		0	−200	0	−50	0	−400	+200	−200	+100	0	+200	−200
7		0	−250	0	−50	0	−500	+350	−250	+150	0	+350	−250
8		0	−300	0	−50	0	−600	+350	−250	+150	0	+350	−250
—		0	−350	0	−50	—	—	+350	−250	+200	0	—	—
—		0	−400	0	−50	—	—	+400	−400	+200	0	—	—
—		0	−450	—	—	—	—	—	—	—	—	—	—
—		0	−500	—	—	—	—	—	—	—	—	—	—
—		0	−750	—	—	—	—	—	—	—	—	—	—
—		0	−1 000	—	—	—	—	—	—	—	—	—	—
—		0	−1 200	—	—	—	—	—	—	—	—	—	—
—		0	−1 500	—	—	—	—	—	—	—	—	—	—

Unit: μm

Axial runout of outer ring of assembled bearing S_{ea}	Deviation of a single outer ring width Δ_{Cs}			
	Class 0, Class 6 [1]			
Class 4	Class 5, Class 4		Class 6X [5]	
Max.	Upper	Lower	Upper	Lower
6	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing		0	−100
7			0	−100
8			0	−100
10			0	−100
10			0	−100
13			0	−100
—			0	−100
—			0	−100
—			—	—
—			—	—
—			—	—
—			—	—
—			—	—

5) Applies to bearings with a nominal bore diameter d over 80 mm and 400 mm or less.

Table 3.4 (3) Effective width of inner subunits and outer rings

Unit: μm

Nominal bearing bore diameter d mm		Deviation of the actual effective width of inner subunit assembled with a master outer ring Δ_{T1s}				Deviation of the actual effective width of outer ring assembled with a master inner subunit Δ_{T2s}			
		Class 0		Class 6X		Class 0		Class 6X	
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
80	120	+100	−100	+50	0	+100	−100	+50	0
120	180	+150	−150	+50	0	+200	−100	+100	0
180	250	+150	−150	+50	0	+200	−100	+100	0
250	315	+150	−150	+100	0	+200	−100	+100	0
315	400	+200	−200	+100	0	+200	−200	+100	0

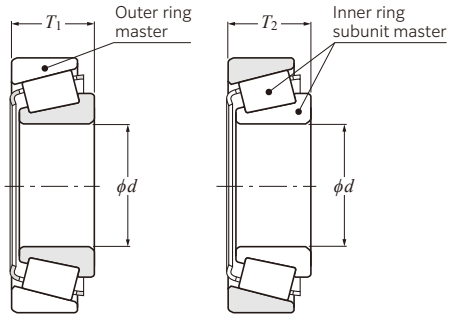


Table 3.5 Tolerance of tapered roller bearings (inch series)

Table 3.5 (1) Inner rings

Unit: μm

Nominal bearing bore diameter d mm(inch) Over	Incl.	Deviation of a single bore diameter Δ_{ds} Class 4 Upper	Lower	Class 2 Upper	Lower	Class 3 Upper	Lower	Class 0 Upper	Lower	Class 00 Upper	Lower
76.2(3)	266.7(10.5)	+25	0	+25	0	+13	0	+13	0	+8	0
266.7(10.5)	304.8(12)	+25	0	+25	0	+13	0	+13	0	—	—
304.8(12)	609.6(24)	+51	0	+51	0	+25	0	—	—	—	—
609.6(24)	914.4(36)	+76	0	—	—	+38	0	—	—	—	—
914.4(36)	1 219.2(48)	+102	0	—	—	+51	0	—	—	—	—
1 219.2(48)	— —	+127	0	—	—	+76	0	—	—	—	—

Table 3.5 (2) Outer rings

Unit: μm

Nominal bearing outside diameter D mm(inch) Over	Incl.	Deviation of a single outside diameter Δ_{Ds} Class 4 Upper	Lower	Class 2 Upper	Lower	Class 3 Upper	Lower	Class 0 Upper	Lower	Class 00 Upper	Lower
— —	266.7(10.5)	+25	0	+25	0	+13	0	+13	0	+8	0
266.7(10.5)	304.8(12)	+25	0	+25	0	+13	0	+13	0	—	—
304.8(12)	609.6(24)	+51	0	+51	0	+25	0	—	—	—	—
609.6(24)	914.4(36)	+76	0	+76	0	+38	0	—	—	—	—
914.4(36)	1 219.2(48)	+102	0	—	—	+51	0	—	—	—	—
1 219.2(48)	— —	+127	0	—	—	+76	0	—	—	—	—

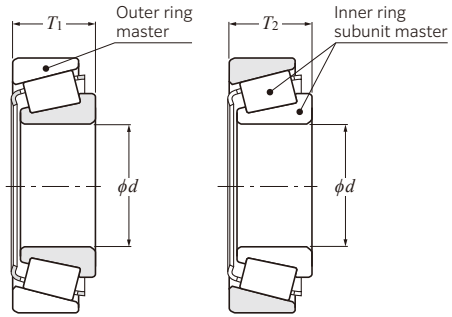
Table 3.5 (3) Assembly width of single-row bearings, combination width of 4-row bearings, effective width of inner ring subunits, effective width of outer rings

Nominal bearing bore diameter d mm(inch) Over	Incl.	Nominal outside diameter D mm(inch) Over	Incl.	Deviation of the actual assembled single row bearing width Δ_{Ts} Class 4 Upper	Lower	Class 2 Upper	Lower	Class 3 Upper	Lower	Class 0, 00 Upper	Lower	Deviation of four-row bearing overall width Δ_{B2s}, Δ_{C2s} Class 4, 2, 3, 0 Upper	Lower
—	101.6 (4)			+203	0	+203	0	+203	−203	+203	−203	+1 524	−1 524
101.6 (4)	304.8 (12)			+356	−254	+203	0	+203	−203	+203	−203	+1 524	−1 524
304.8 (12)	609.6 (24)	—	508.0 (20)	+381	−381	+381	−381	+203	−203	—	—	+1 524	−1 524
304.8 (12)	609.6 (24)	508.0 (20)	—	+381	−381	+381	−381	+381	−381	—	—	+1 524	−1 524
609.6 (24)	—			+381	−381	—	—	+381	−381	—	—	+1 524	−1 524

Table 3.5 (4) Radial runout of inner and outer rings

Unit: μm

Nominal bearing outside diameter D mm(inch) Over	Incl.	Radial runout of inner ring of assembled bearing K_{ia} / Radial runout of outer ring of assembled bearing K_{ea} Class 4 Max.	Class 2 Max.	Class 3 Max.	Class 0 Max.	Class 00 Max.
—	304.8(14)	51	38	8	4	2
304.8(14)	609.6(24)	51	38	18	—	—
609.6(24)	914.4(36)	76	51	51	—	—
914.4(36)	—	76	—	76	—	—



Unit: μm

Deviation of the actual effective width of inner subunit assembled with a master outer ring Δ_{T1s} Class 4 Upper	Lower	Class 2 Upper	Lower	Class 3 Upper	Lower	Deviation of the actual effective width of outer ring assembled with a master inner subunit Δ_{T2s} Class 4 Upper	Lower	Class 2 Upper	Lower	Class 3 Upper	Lower
+102	0	+102	0	+102	−102	+102	0	+102	0	+102	−102
+152	−152	+102	0	+102	−102	+203	−102	+102	0	+102	−102
—	—	+178	−178 1)	+102	−102 1)	—	—	+203	−203 1)	+102	−102 1)
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—

1) Applies to nominal bearing bore diameters d of 406.400 mm (16 inch) or less.

Table 3.6 Tolerance of double-row and four-row tapered roller bearings (metric series)

Table 3.6 (1) Inner rings

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}		Variation of bore diameter in a single plane V_{dsp}	Variation of mean bore diameter V_{dmp}	Radial runout of inner ring of assembled bearing K_{ia}	Deviation of a single inner ring width Δ_{Bs}		Deviation of bearing overall width			
									Double row bearing Δ_{B1s}		Four-row bearing Δ_{B2s}	
Over	Incl.	Upper	Lower	Max.	Max.	Max.	Upper	Lower	Upper	Lower	Upper	Lower
80	120	0	−20	20	15	30	0	−200	+400	−400	+500	−500
120	180	0	−25	25	19	35	0	−250	+500	−500	+600	−600
180	250	0	−30	30	23	50	0	−300	+600	−600	+750	−750
250	315	0	−35	35	26	60	0	−350	+700	−700	+900	−900
315	400	0	−40	40	30	70	0	−400	+800	−800	+1 000	−1 000
400	500	0	−45	45	34	80	0	−450	+900	−900	+1 200	−1 200
500	630	0	−60	60	40	90	0	−500	+1 000	−1 000	+1 200	−1 200
630	800	0	−75	75	45	100	0	−750	+1 500	−1 500	+1 500	−1 500
800	1 000	0	−100	100	55	115	0	−1 000	+1 500	−1 500	+1 500	−1 500
1 000	1 250	0	−125	125	65	130	0	−1 250	+1 500	−1 500	+1 500	−1 500
1 250	1 600	0	−160	160	80	150	0	−1 600	+1 500	−1 500	+1 500	−1 500
1 600	2 000	0	−200	200	100	170	0	−2 000	+1 500	−1 500	+1 500	−1 500

Note: This standard is the **NTN** standard.

Table 3.6 (2) Outer rings

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}		Variation of outside diameter in a single plane V_{Dsp}	Variation of mean outside diameter V_{Dmp}	Radial runout of outer ring of assembled bearing K_{ea}	Deviation of a single outer ring width Δ_{Cs}		Deviation of bearing overall width			
									Double row bearing Δ_{C1s}		Four-row bearing Δ_{C2s}	
Over	Incl.	Upper	Lower	Max.	Max.	Max.	Upper	Lower	Upper	Lower	Upper	Lower
80	120	0	−18	18	14	35	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing		Depends on tolerance of Δ_{B1s} in relation to d of the same bearing		Depends on tolerance of Δ_{B2s} in relation to d of the same bearing	
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						
500	630	0	−50	60	38	100						
630	800	0	−75	80	55	120						
800	1 000	0	−100	100	75	140						
1 000	1 250	0	−125	130	90	160						
1 250	1 600	0	−160	170	100	180						
1 600	2 000	0	−200	210	110	200						
2 000	2 500	0	−250	265	120	220						

Note: For nominal bearing outside diameter D exceeding 1 600 mm, the **NTN** standard is followed.

Table 3.7 Tolerance of thrust ball bearings and thrust cylindrical roller bearings

Table 3.7 (1) Shaft raceway washer

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}				Variation of bore diameter in a single plane V_{dsp}		Variation in thickness between shaft washer raceway and back face S_i			
		Class 0, 6, 5		Class 4		Class 0, 6, 5	Class 4	Class 0	Class 6	Class 5	Class 4
Over	Incl.	Upper	Lower	Upper	Lower	Max.		Max.			
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	55	40	40	25	13	8
800	1 000	0	−100	—	—	75	—	45	30	15	—

Table 3.7 (2) Housing raceway washer

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}				Variation of outside diameter in a single plane V_{Dsp}		Variation in thickness between shaft washer raceway and back face S_e
		Class 0, 6, 5		Class 4		Class 0, 6, 5	Class 4	Class 0, 6, 5 4
Over	Incl.	Upper	Lower	Upper	Lower	Max.		Max.
80	120	0	−22	0	−13	17	10	Depends on tolerance of S_i against d of the same bearings
120	180	0	−25	0	−15	19	11	
180	250	0	−30	0	−20	23	15	
250	315	0	−35	0	−25	26	19	
315	400	0	−40	0	−28	30	21	
400	500	0	−45	0	−33	34	25	
500	630	0	−50	0	−38	38	29	
630	800	0	−75	0	−45	55	34	
800	1 000	0	−100	0	−60	75	45	
1 000	1 250	0	−125	—	—	95	—	

Table 3.7 (3) Bearing height

Unit: μm

Nominal bearing bore diameter d mm		Deviation of the actual bearing height, single-direction bearing [1] Δ_{Ts}	
Over	Incl.	Upper	Lower
80	120	0	−150
120	180	0	−175
180	250	0	−200
250	315	0	−225
315	400	0	−300
400	500	0	−350
500	630	0	−400
630	800	0	−500
800	1 000	0	−600

1) Applies to flat back face bearing of Class 0.
The values are the **NTN** standard.

Table 3.8 Tolerance of thrust spherical roller bearings

Table 3.8 (1) Shaft raceway washer

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}		Variation of bore diameter in a single plane V_{dsp}	Perpendicularity of shaft washer back face with respect to the bore [1] S_d	Deviation of the actual bearing height [1] Δ_{Ts}	
Over	Incl.	Upper	Lower	Max.	Max.	Upper	Lower
80	120	0	−20	15	25	+200	−200
120	180	0	−25	19	30	+250	−250
180	250	0	−30	23	30	+300	−300
250	315	0	−35	26	35	+350	−350
315	400	0	−40	30	40	+400	−400
400	500	0	−45	34	45	+450	−450
500	630	0	−50	38	50	+500	−500
630	800	0	−75	55	60	+750	−750

1) The standard conforms to JIS B 1539.

Table 3.8 (2) Housing raceway washer

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}	
Over	Incl.	Upper	Lower
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	0	−100
1 000	1 250	0	−125
1 250	1 600	0	−160

Table 3.9 Tolerance of thrust tapered roller bearings of metric series

Table 3.9 (1) Shaft raceway washer

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}		Deviation of the actual bearing height Δ_{Ts}	
Over	Incl.	Upper	Lower	Upper	Lower
80	120	0	−20	0	−150
120	180	0	−25	0	−175
180	250	0	−30	0	−200
250	315	0	−35	0	−225
315	400	0	−40	0	−300
400	500	0	−45	0	−350
500	630	0	−50	0	−400
630	800	0	−75	0	−500
800	1 000	0	−100	0	−600

Table 3.9 (2) Housing raceway washer

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}	
Over	Incl.	Upper	Lower
180	250	0	−30
250	315	0	−35
315	400	0	−40
400	500	0	−45
500	630	0	−60
630	800	0	−75
800	1 000	0	−100
1 000	1 250	0	−125

Table 3.10 Tolerance of thrust tapered roller bearings of inch series

Table 3.10 (1) Shaft raceway washer

Unit: μm

Nominal bearing bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}		Deviation of the actual bearing height Δ_{Ts}	
Over	Incl.	Upper	Lower	Upper	Lower
—	304.800	+25	0	+381	−381
304.800	609.600	+51	0	+381	−381
609.600	914.400	+76	0	+381	−381
914.400	1 219.200	+102	0	+381	−381

Table 3.10 (2) Housing raceway washer

Unit: μm

Nominal bearing outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}	
Over	Incl.	Upper	Lower
—	304.800	+25	0
304.800	609.600	+51	0
609.600	914.400	+76	0
914.400	1 219.200	+102	0
1 219.200	—	+127	0

3.2 Chamfer measurements and tolerance or allowable values of tapered bore

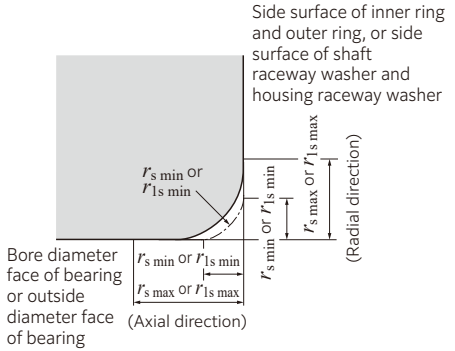


Table 3.11 Allowable critical-value of bearing chamfer

Table 3.11 (1) Radial bearings (except tapered roller bearing)

Unit: mm

$r_{s\,min}$[1] or $r_{1s\,min}$	Nominal bearing bore diameter d Over	Incl.	$r_{s\,max}$ or $r_{1s\,max}$ Radial direction	Axial direction
0.6	—	40	1	2
	40	—	1.3	2
1	—	50	1.5	3
	50	—	1.9	3
1.1	—	120	2	3.5
	120	—	2.5	4
1.5	—	120	2.3	4
	120	—	3	5
2	—	80	3	4.5
	80	220	3.5	5
	220	—	3.8	6
2.1	—	280	4	6.5
	280	—	4.5	7
2.5	—	100	3.8	6
	100	280	4.5	6
	280	—	5	7
3	—	280	5	8
	280	—	5.5	8
4	—	—	6.5	9
5	—	—	8	10
6	—	—	10	13
7.5	—	—	12.5	17
9.5	—	—	15	19
12	—	—	18	24
15	—	—	21	30
19	—	—	25	38

1) These are the allowable minimum dimensions of the chamfer dimension "r" or "r_1" and are described in the dimensional table.

Table 3.11 (2) Tapered roller bearings of metric series

Unit: mm

$r_{s\,min}$[2] or $r_{1s\,min}$	Nominal bearing bore diameter d [3] or nominal bearing outside diameter D Over	Incl.	$r_{s\,max}$ or $r_{1s\,max}$ Radial direction	Axial direction
0.3	—	40	0.7	1.4
	40	—	0.9	1.6
0.6	—	40	1.1	1.7
	40	—	1.3	2
1	—	50	1.6	2.5
	50	—	1.9	3
1.5	—	120	2.3	3
	120	250	2.8	3.5
	250	—	3.5	4
2	—	120	2.8	4
	120	250	3.5	4.5
	250	—	4	5
2.5	—	120	3.5	5
	120	250	4	5.5
	250	—	4.5	6
3	—	120	4	5.5
	120	250	4.5	6.5
	250	400	5	7
	400	—	5.5	7.5
4	—	120	5	7
	120	250	5.5	7.5
	250	400	6	8
	400	—	6.5	8.5
5	—	180	6.5	8
	180	—	7.5	9
6	—	180	7.5	10
	180	—	9	11

2) These are the allowable minimum dimensions of the chamfer dimension "r" or "r_1" and are described in the dimensional table.
3) Inner rings shall be in accordance with the division of "d" and outer rings with that of "D".
Note: The standard applies to the bearings whose dimensional series (refer to the dimensional table) are specified in the standard ISO 355 or JIS B 1512-3. For further information concerning bearings outside of these standards or tapered roller bearings using a US customary unit, please contact **NTN** Engineering.

Table 3.11 (3) Thrust bearings

Unit: mm

$r_{s\,min}$ or $r_{1s\,min}$[4]	$r_{s\,max}$ or $r_{1s\,max}$ Radial and axial directions
0.6	1.5
1	2.2
1.1	2.7
1.5	3.5
2	4
2.1	4.5
3	5.5
4	6.5
5	8
6	10
7.5	12.5
9.5	15
12	18
15	21
19	25

4) These are the allowable minimum dimensions of the chamfer dimension "r" or "r_1" and are described in the dimensional table.

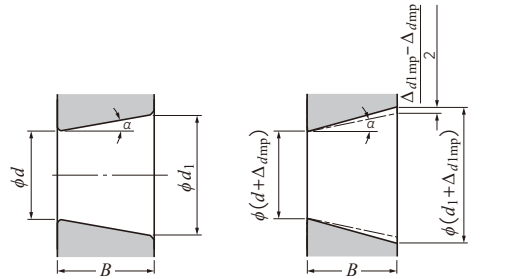


Table 3.12 (1) Tolerance of tapered bores of radial bearings and tapered bores with allowable standard taper ratio 1:12 (Class 0)

Unit: μm

d mm Over	Incl.	Δ_{dmp} Upper	Lower	$\Delta_{d1mp}-\Delta_{dmp}$ Upper	Lower	V_{dsp}[1) 2)] Max.
80	120	+54	0	+35	0	22
120	180	+63	0	+40	0	40
180	250	+72	0	+46	0	46
250	315	+81	0	+52	0	52
315	400	+89	0	+57	0	57
400	500	+97	0	+63	0	63
500	630	+110	0	+70	0	70
630	800	+125	0	+80	0	—
800	1 000	+140	0	+90	0	—
1 000	1 250	+165	0	+105	0	—
1 250	1 600	+195	0	+125	0	—

Table 3.12 (2) Tolerance of tapered bores of radial bearings and tapered bores with allowable standard taper ratio 1:30 (Class 0)

Unit: μm

d mm Over	Incl.	Δ_{dmp} Upper	Lower	$\Delta_{d1mp}-\Delta_{dmp}$ Upper	Lower	V_{dsp}[1) 2)] Max.
80	120	+20	0	+35	0	22
120	180	+25	0	+40	0	40
180	250	+30	0	+46	0	46
250	315	+35	0	+52	0	52
315	400	+40	0	+57	0	57
400	500	+45	0	+63	0	63
500	630	+50	0	+70	0	70

1) Applies to all radial flat planes of tapered bores.
2) Does not apply to diameter series 7 and 8.
Note: Quantifiers

For a standard taper ratio of $\frac{1}{12}$, $d_1 = d + \frac{1}{12}B$

For a standard taper ratio of $\frac{1}{30}$, $d_1 = d + \frac{1}{30}B$

Δ_{dmp} : Dimensional difference of the mean bore diameter within the flat surface at the theoretical small end of the tapered bore
Δ_{d1mp} : Dimensional difference of the mean bore diameter within the flat surface at the theoretical large end of the tapered bore
V_{dsp} : Unevenness of the bore diameter with the flat surface
B : Nominal width of inner ring
α : $\frac{1}{2}$ of the tapered bore's standard taper angle

For a standard taper ratio of $\frac{1}{12}$
α = 2°23′9.4″
= 2.38594°
= 0.041643 rad

For a standard taper ratio of $\frac{1}{30}$
α = 0°57′17.4″
= 0.95484°
= 0.016665 rad

4. Bearing fits

4.1 Resultant fits

For rolling bearings, it is necessary to fix inner and outer rings on the shaft or in the housing so that relative movement does not occur between fitting surfaces during operation or under load. This relative movement between the mating surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. Types of resultant fit include **tight**, **transition** and **loose fits**, which describe whether or not there is interference between the bearing and the shaft or housing. It is also necessary to select a reliable axial fixing method such as tightening nuts, bolts, retaining rings, etc. For more information on fixing of bearings, see section "8.1 Fixing of bearings".

The most effective way to fix the mating surfaces between a bearing and shaft or housing is to apply a "tight fit". The advantage of a tight fit for thin walled bearings is that it provides uniform load support over the entire ring circumference without any loss of load carrying capacity. However, with a tight fit, ease of installation and disassembly is lost; and when using a non-separable bearing as the floating-side bearing, axial displacement is not possible. For this reason, a tight fit cannot be recommended in all cases.

4.2 The necessity of a proper fit

In some cases, an improper fit may lead to damage and shorten bearing life. Therefore it is necessary to carefully select the proper fit. Some possible bearing failures caused by an improper fit are listed below.

- Raceway cracking, early spalling and displacement of raceway
- Raceway and shaft or housing abrasion caused by creeping and fretting corrosion
- Seizing caused by negative internal clearances
- Increased noise and deteriorated rotational accuracy due to raceway groove deformation

4.3 Fit selection

Selection of a proper fit is dependent upon thorough analysis of bearing operating conditions, including consideration of:

- Shaft and housing material, wall thickness, surface finish accuracy, etc.
- Machinery operating conditions (nature and magnitude of load, rotational speed, temperature, etc.)

4.3.1 "Tight fit" or "Loose fit"

(1) For raceways under rotating loads, a **tight fit** is necessary (refer to **Table 4.1**). "Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction.
For raceways under static loads, on the other hand, a **loose fit** is sufficient.

(2) For non-separable bearings, such as deep groove ball bearings, it is generally recommended that either the inner ring or outer ring be given a **loose fit**.

Table 4.1 Radial load and bearing fit

Design	Bearing rotation	Ring load	Fit
Static load	Inner ring: Rotating Outer ring: Stationary	Rotating inner ring load Static outer ring load	Inner ring: Tight fit Outer ring: Loose fit
Unbalanced load	Inner ring: Stationary Outer ring: Rotating		
Static load	Inner ring: Stationary Outer ring: Rotating	Static inner ring load Rotating outer ring load	Inner ring: Loose fit Outer ring: Tight fit
Unbalanced load	Inner ring: Rotating Outer ring: Stationary		

4.3.2 Recommended fits

Bearing fit is governed by the tolerances selected for bearing shaft diameters and housing bore diameters.

Widely used fits for Class 0 tolerance bearings and various shaft and housing bore diameter tolerances are shown in **Fig. 4.1**.

Generally used, standard fits for most types of bearings and operating conditions are shown in **Table 4.2** through **Table 4.5**.

Table 4.2: Fits for radial bearings
Table 4.3: Fits for thrust bearings
Table 4.4: Fits for electric motor bearings
Table 4.5: Inch series tapered roller bearings Fits of (ANSI/ABMA CLASS 4)
Table 4.6: Inch series tapered roller bearings Fits of (ANSI/ABMA CLASS 3, CLASS 0)

4.3.3 Interference minimum and maximum values

The following points should be considered when it is necessary to calculate the interference for an application:

- Lower limit values
  1) Reduced interference due to radial loads
  2) Reduced interference due to differences between bearing temperature and ambient temperature
  3) Reduced interference due to variation in mating surface
  4) Reduced interference due to deformation
- Upper limit values

The upper limit value should not exceed 1/ 1 000 of the shaft diameter.

Required interference calculations are shown in the next page.

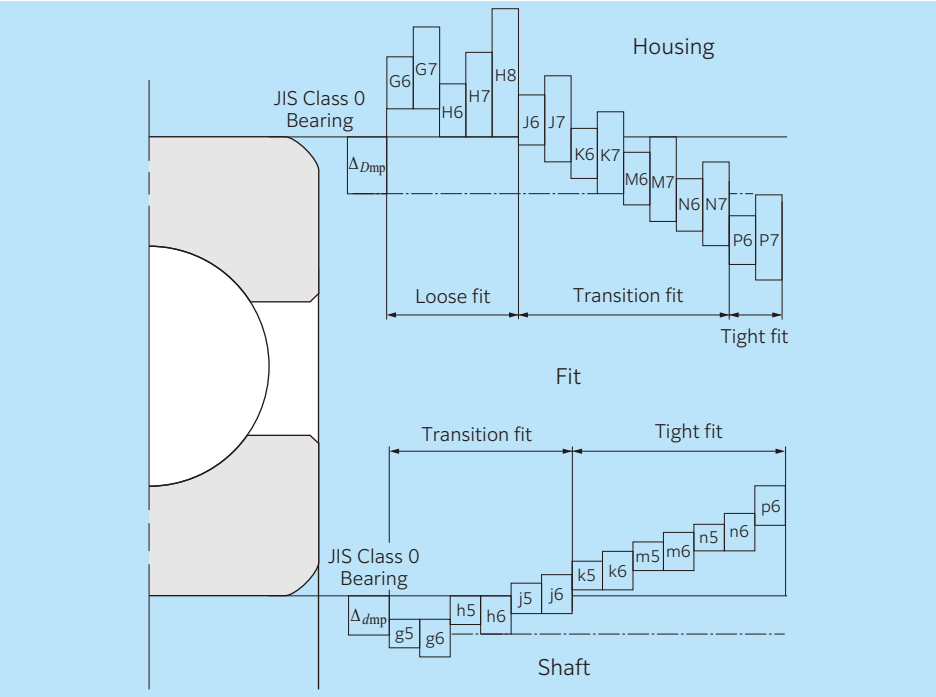


Fig 4.1 State of resultant fit

(1) Mating surface variation and interference

Interference decreases because the mating surface is smoothed by the resultant fit (surface roughness is reduced). The amount the interference decreases depends on the roughness of the mating surfaces. It is generally necessary to anticipate the following decrease in interference.

For ground surface finish: 1.0 to 2.5 μm
For turned surface finish: 5.0 to 7.0 μm

The interference including this decrease amount is called effective interference.

(2) Radial loads and required interference

Interference of the inner ring and shaft decreases when a radial load is applied to the bearing. The interference required for installation to solid shafts is expressed by formula (4.1) and formula (4.2) for each load condition.

General applications ($F_r \leq 0.3C_{0r}$)

$$\Delta d_F = 0.08(d \cdot F_r / B)^{1/2} \quad \cdots\cdots\cdots\cdots\cdots\cdots (4.1)$$

Under heavy load conditions ($F_r > 0.3C_{0r}$)

$$\Delta d_F = 0.02(F_r / B) \quad \cdots\cdots\cdots\cdots\cdots\cdots (4.2)$$

Where:

Δd_F : Required effective interference according to radial load, μm
d : Bearing bore diameter, mm
B : Inner ring width, mm
F_r : Actual radial load, N
C_{0r} : Basic static load rating, N

For hollow shafts, please contact **NTN** Engineering.

(3) Temperature difference and required interference

Interference between inner rings and steel shafts is reduced as a result of temperature increases (difference between bearing temperature and ambient temperature, ΔT) caused by bearing rotation. Calculation of the minimum required amount of interference in such cases is shown in formula (4.3).

$$\Delta d_T = 0.0015 \cdot d \cdot \Delta T \quad \cdots\cdots\cdots\cdots\cdots\cdots (4.3)$$

Where:

Δd_T : Required effective interference for temperature difference, μm
ΔT : Difference between bearing temperature and ambient temperature, °C
d : Bearing bore diameter, mm

(4) Maximum interference

When bearing rings are installed with an interference fit, tensile or compressive stress may occur along their raceways. If interference is too great, this may cause damage to the rings and reduce bearing life. The maximum stress due to the resultant fit must not exceed approximately 127 MPa for safety. If the value is to be exceeded, consult **NTN** Engineering.

(5) Interference change amount when materials other than steel are used for shafts and housings

When materials other than steel are used for shafts and housings, the fits between the inner ring and the shaft and the outer ring and the housing change because of the difference in the linear expansion coefficient of each material as the temperature rises during the rotation of the bearing. Therefore, it is necessary to set the resultant fit with linear expansion coefficients in consideration. Calculation of the change in interference is shown in formula (4.4).

$$\Delta d_{TE} = (\alpha_1 - \alpha_2) \times d \times \Delta T \quad \cdots\cdots\cdots\cdots (4.4)$$

Where:

Δd_{TE} : Change in interference caused by the difference in the linear expansion coefficients, mm
α_1 : Bearing linear expansion coefficient, 1/°C
α_2 : Shaft and housing linear expansion coefficient, 1/°C
d : Reference dimension of resultant fit, mm
ΔT : Temperature increase by bearing rotation, °C

4.3.4 Other details

(1) Large interference fits are recommended for,
- Operating conditions with large vibrations or shock loads
- Applications using hollow shafts or housings with thin walls
- Applications using housings made of light alloys or plastic

(2) Small interference fits are preferable for,
- Applications requiring high running accuracy
- Applications using small-sized bearings or thin-walled bearings

(3) A particular type of fit is recommended for SL-type cylindrical roller bearings (refer to page C-73).

(4) Bearing dimensions are measured and managed at a temperature of 20 °C.

Table 4.2 General standards for radial bearing fits (JIS Class 0, 6X, 6)

Table 4.2 (1) Tolerance class of shafts commonly used for radial bearings (Classes 0, 6X and 6)

Condition		Ball bearing		Cylindrical roller bearing Tapered roller bearing		Spherical roller bearing		Shaft tolerance class	Remarks
		Shaft diameter (mm)							
		Over	Incl.	Over	Incl.	Over	Incl.		
Cylindrical bore bearing (Classes 0, 6X and 6)									
Inner ring rotational load or load of undetermined direction	Light load [1] or Fluctuating load	18 100 —	100 200 —	— 40 140	40 140 200	— — —	— — —	js6 k6 m6	When greater accuracy is required js5, k5, and m5 may be substituted for js6, k6, and m6.
	Normal load [1]	18 100 140 200 — —	100 140 200 280 — —	— 40 100 140 200 —	40 100 140 200 400 —	— 40 65 100 140 280	40 65 100 140 280 500	k5 m5 m6 n6 p6 r6	Alteration of inner clearances to accommodate fit is not a consideration with single-row angular contact bearings and tapered roller bearings. Therefore, k5 and m5 may be substituted for k6 and m6.
	Heavy load [1] or Impact load	— — —	— — —	50 140 200	140 200 —	50 100 140	100 140 200	n6 p6 r6	Use bearings with larger internal clearances than CN clearance bearings.
Static inner ring load	Inner ring must move easily over shaft	Overall shaft diameter						g6	When greater accuracy is required use g5. For large bearings, f6 will suffice to facilitate movement.
	Inner ring does not have to move easily over shaft	Overall shaft diameter						h6	When greater accuracy is required use h5.
Center axial load		Overall shaft diameter						js6	Generally, shaft and inner rings are not fixed using resultant fits.
Tapered bore bearing (Class 0) (with adapter or withdrawal sleeve)									
Full load		Overall shaft diameter						h9/IT5 [2]	h10/IT7 [2] will suffice for power transmitting shafts.

Table 4.2 (2) Fit with shaft [fits for tapered bore bearings (Class 0) with adapter assembly/ withdrawal sleeve]

Full load	All bearing types	Tolerance class	h9 /IT5 [2]	General applications
			h10/IT7 [2]	Transmission shafts, etc.

1) Standards for light loads, normal loads, and heavy loads
- Light loads: dynamic equivalent radial load ≤ $0.05C_r$
- Normal loads: $0.05C_r$ < dynamic equivalent radial load ≤ $0.10C_r$
- Heavy loads: $0.10C_r$ < dynamic equivalent radial load

2) IT5 and IT7 show shaft roundness tolerances, cylindricity tolerances, and related values.

Note: 1. All values and fits listed in the above tables are for solid steel shafts.
2. For ULTAGE™ series spherical roller bearings, refer to **Table 2** (page B-181) in Section "Spherical Roller Bearings".

Table 4.2 (3) Tolerance class of housing bores commonly used for radial bearings (Classes 0, 6X and 6)

Conditions				Housing bore tolerance class	Remarks
Housing	Load type, etc.		Outer ring axial direction movement 3)		
Single housing or Split housing	Static outer ring load	All types of loads	Yes	H7	G7 can be used for large bearings or bearings with large temperature differential between the outer ring and housing.
		Light load 1) or normal load 1)	Yes	H8	——
		Shaft and inner ring become hot	Easily	G7	F7 can be used for large bearings or bearings with large temperature differential between the outer ring and housing.
Single housing		Requires precise rotation under light or normal loads	As a rule, it cannot move.	K6	Primarily applies to roller bearings.
			Yes	JS6	Primarily applies to ball bearings.
		Requires low noise operation	Yes	H6	——
	Indeterminate load	Light load or normal load	Yes	JS7	If high accuracy is required, JS6 and K6 are used in place of JS7 and K7.
		Normal load or heavy load 1)	As a rule, it cannot move.	K7	
		High impact load	No	M7	——
	Rotating outer ring load	Light load or fluctuating load	No	M7	——
		Normal load or heavy load	No	N7	Primarily applies to ball bearings.
		Heavy load or large impact load with thin wall housing 2)	No	P7	Primarily applies to roller bearings.

1) Standards for light loads, normal loads, and heavy loads
Light loads: dynamic equivalent radial load ≤ $0.05C_r$
Normal loads: $0.05C_r$ < dynamic equivalent radial load ≤ $0.10C_r$
Heavy loads: $0.10C_r$ < dynamic equivalent radial load
2) The axial direction needs to be secured because the outer ring may move in the shaft direction, causing problems, depending on the use (Example: planetary gear, etc.).
3) Indicates whether or not outer ring axial movement is possible with non-separable type bearings.
Note: 1. All values and fits listed in the above tables are for cast iron or steel housings.
2. If only a center axial load is applied to the bearing, select a tolerance class that provides clearance for the outer ring in the radial direction.

Table 4.3 Standard fits for thrust bearings (JIS Class 0 and 6)
Table 4.3 (1) Shaft fits

Bearing type	Load conditions		Fit	Shaft diameter mm Over Incl.	Tolerance class
All thrust bearings	Centered axial load only		Transition fit	Overall shaft diameter	js6 or h6
Thrust spherical roller bearings	Combined load	Static inner ring load	Transition fit	Overall shaft diameter	js6
		Rotating inner ring load or Indeterminate load	Transition fit Tight fit	- 200 200 - 400 400 -	k6 or js6 m6 or k6 n6 or m6

Table 4.3 (2) Housing fits

Bearing type	Load conditions		Fit	Tolerance class	Remarks
All thrust bearings	Centered axial load only		Loose fit	Select a tolerance class that will provide clearance between outer ring and housing.	
				H8	Greater accuracy required with thrust ball bearings
Thrust spherical roller bearings	Combined load	Static outer ring load		H7	——
		Indeterminate load or Rotating outer ring load	Transition fit	K7	Normal operating conditions
				M7	For relatively large radial loads

Note: All values and fits listed in the above tables are for cast iron or steel housings.

Table 4.4: Fits for electric motor bearings

Bearing type	Shaft fits		Housing fits	
	Shaft diameter mm Over Incl.	Tolerance class	Housing bore diameter	Tolerance class
Deep groove ball bearings	18 - 100 100 - 160	k5 m5	All sizes	H6 or J6
Cylindrical roller bearings	40 - 160 160 - 200	m5 n6	All sizes	H6 or J6

Table 4.5 General fit standards for tapered roller bearings using US customary unit (ANSI Class 4)

Table 4.5 (1) Fit with shaft

Unit: μm

Operating conditions		Nominal bearing bore diameter d mm Over	Incl.	Bore diameter tolerance Δ_{ds} Upper	Lower	Shaft diameter tolerance Upper	Lower	Fit [1]	Remarks
Rotating inner ring load	Normal load	76.2	304.8	+25	0	+ 64	+ 38	64T - 13T	Applicable when a slight impact load is applied as well.
		304.8	609.6	+51	0	+127	+ 76	127T - 25T	
		609.6	914.4	+76	0	+191	+114	191T - 38T	
	Heavy load Impact load	76.2	304.8	+25	0	0.5 μm mean interference per 1 mm of inner ring bore diameter. Minimum interference is 25 μm. Tolerance for the shaft is adjusted to match tolerance of bearing bore diameter.			
		304.8	609.6	+51	0				
		609.6	914.4	+76	0	+457	+381	457T - 305T	
Rotating outer ring load	Inner ring does not have to move easily over shaft with an ordinary load.	76.2	304.8	+25	0	+ 25	0	25T - 25L	Not applicable when impact load is applied.
		304.8	609.6	+51	0	+ 51	0	51T - 51L	
		609.6	914.4	+76	0	+ 76	0	76T - 76L	
	Inner ring must move easily over shaft with an ordinary load.	76.2	304.8	+25	0	0	− 25	0 - 51L	
		304.8	609.6	+51	0	0	− 51	0 - 102L	
		609.6	914.4	+76	0	0	− 76	0 - 152L	

Table 4.5 (2) Fit with housing

Unit: μm

Operating conditions		Nominal bearing outside diameter D mm Over	Incl.	Outside diameter dimensional tolerance Δ_{Ds} Upper	Lower	Housing bore diameter tolerance Upper	Lower	Fit [1]	Types of fits
Rotating inner ring load	When used on floating or fixed side	76.2	127.0	+25	0	+ 76	+ 51	25L - 76L	Loose fit
		127.0	304.8	+25	0	+ 76	+ 51	25L - 76L	
		304.8	609.6	+51	0	+152	+102	51L - 152L	
		609.6	914.4	+76	0	+229	+152	76L - 229L	
	When outer ring is adjusted in axial direction	76.2	127.0	+25	0	+ 25	0	25T - 25L	Transition fit
		127.0	304.8	+25	0	+ 51	0	25T - 51L	
		304.8	609.6	+51	0	+ 76	+ 25	25T - 76L	
		609.6	914.4	+76	0	+127	+ 51	25T - 127L	
	When outer ring is not adjusted in axial direction	76.2	127.0	+25	0	− 25	− 51	76T - 25T	Tight fit
		127.0	304.8	+25	0	− 25	− 51	76T - 25T	
		304.8	609.6	+51	0	− 25	− 76	127T - 25T	
		609.6	914.4	+76	0	− 25	−102	178T - 25T	
Rotating outer ring load	When outer ring is not adjusted in axial direction	76.2	127.0	+25	0	− 25	− 51	76T - 25T	
		127.0	304.8	+25	0	− 25	− 51	76T - 25T	
		304.8	609.6	+51	0	− 25	− 76	127T - 25T	
		609.6	914.4	+76	0	− 25	−102	178T - 25T	

1) Fit symbol "L" indicates clearance and "T" indicates interference.

Table 4.6 General fit standards for tapered roller bearings using US customary unit (ANSI Classes 3 and 0)

Table 4.6 (1) Fit with shaft

Unit: μm

Operating conditions		Nominal bearing bore diameter d mm Over	Incl.	Bore diameter tolerance Δ_{ds} Upper	Lower	Shaft diameter tolerance Upper	Lower	Fit [1]
Rotating inner ring load	Precision machine tool spindles	—	304.8	+13	0	+ 30	+18	30T - 5T
		304.8	609.6	+25	0	+ 64	+38	64T - 13T
		609.6	914.4	+38	0	+102	+64	102T - 25T
	Heavy load Impact load High-speed rotation	—	304.8	+13	0	Minimum interference is 0.25 μm per 1 mm of inner ring bore diameter		
		304.8	609.6	+25	0			
		609.6	914.4	+38	0			
Rotating outer ring load	Precision machine tool spindles	—	304.8	+13	0	+ 30	+18	30T - 5T
		304.8	609.6	+25	0	+ 64	+38	64T - 13T
		609.6	914.4	+38	0	+102	+64	102T - 25T

Note: For Class 0, nominal bore diameter d applies to 304.8 mm or less.

Table 4.6 (2) Fit with housing

Unit: μm

Operating conditions		Nominal bearing outside diameter D mm Over	Incl.	Outside diameter dimensional tolerance Δ_{Ds} Upper	Lower	Housing bore diameter tolerance Upper	Lower	Fit [1]	Types of fits
Rotating inner ring load	When used for floating-side	—	152.4	+13	0	+38	+25	13L - 38L	Loose fit
		152.4	304.8	+13	0	+38	+25	13L - 38L	
		304.8	609.6	+25	0	+64	+38	13L - 64L	
		609.6	914.4	+38	0	+89	+51	13L - 89L	
	When used for fixed side	—	152.4	+13	0	+25	+13	0 - 25L	
		152.4	304.8	+13	0	+25	+13	0 - 25L	
		304.8	609.6	+25	0	+51	+25	0 - 51L	
		609.6	914.4	+38	0	+76	+38	0 - 76L	
	When outer ring is ajusted in axial direction	—	152.4	+13	0	+13	0	13T - 13L	Transition fit
		152.4	304.8	+13	0	+25	0	13T - 25L	
		304.8	609.6	+13	0	+25	0	25T - 25L	
		609.6	914.4	+38	0	+38	0	38T - 38L	
	When outer ring is not adjusted in axial direction	—	152.4	+13	0	0	−13	25T - 0	Tight fit
		152.4	304.8	+13	0	0	−25	38T - 0	
		304.8	609.6	+25	0	0	−25	51T - 0	
		609.6	914.4	+38	0	0	−38	76T - 0	
Rotating outer ring load	Normal load When outer ring is not adjusted in axial direction	—	152.4	+13	0	−13	−25	38T - 13T	
		152.4	304.8	+13	0	−13	−38	51T - 13T	
		304.8	609.6	+25	0	−13	−38	64T - 13T	
		609.6	914.4	+38	0	−13	−51	89T - 13T	

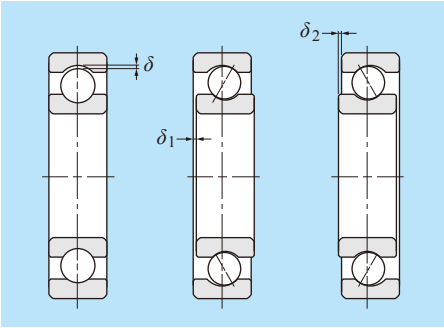
1) Fit symbol "L" indicates clearance and "T" indicates interference.
Note: For Class 0, nominal bearing outside diameter D applies to 304.8 mm or less.

5. Bearing internal clearance

5.1 Bearing internal clearance

Bearing internal clearance is the amount of internal free movement before mounting. As shown in **Fig. 5.1**, when either the inner ring or the outer ring is fixed and the other ring is free to move, displacement can take place in either an axial or radial direction. This amount of displacement (radially or axially) is termed the internal clearance and, depending on the direction, is called **the radial internal clearance** or **the axial internal clearance**.

The internal clearance values for each bearing class are shown in **Table 5.2** through **Table 5.9**.



Radial internal clearance = δ Axial internal clearance = $\delta_1 + \delta_2$

Fig. 5.1 Internal clearance

5.2 Selection of internal clearance

The **internal clearance** of a bearing **under operating conditions** (effective clearance) is **usually smaller** than the initial clearance before being installed and operated. This is due to several factors including bearing fit, the difference in temperature between the inner and outer rings, etc. As a bearing's operating clearance has an effect on bearing life, heat generation, vibration, noise, etc.; care must be taken in selecting the most suitable operating clearance.

5.2.1 Criteria for selecting bearing internal clearance

A bearing's life is theoretically at its maximum when operating clearance is slightly negative in steady operation. However, in reality it is difficult to constantly maintain this optimal condition. If the negative clearance becomes larger by fluctuating operating conditions, heat will be produced and the life will decrease severely. Under normal circumstances, a **study should be performed to select an operating clearance slightly larger than zero**.

For ordinary operating conditions, use fitting for ordinary loads. If rotational speed and operating temperature are ordinary, selecting normal clearance enables you to obtain the proper operating clearance.

Table 5.1 gives examples applying internal clearances other than CN (normal) clearance.

Table 5.1 Examples of applications where bearing clearances other than CN (normal) clearance are used

Operating conditions	Applications	Selected clearance
With a heavy or shock load, high fit.	Railway vehicle axles	C3
	Vibrating screens	C3, C4
With an indeterminate load, both inner and outer rings are tight fit.	Railway vehicle traction motors	C4
	Tractors and final reduction gear	C4
Shaft or inner ring is heated.	Paper making machines and driers	C3, C4
	Table rollers for rolling mill	C3
Adjustment of clearance to minimize shaft runout.	Main spindles of lathes (Double-row cylindrical roller bearings)	C9NA, C0NA

5.2.2 Calculation of operating clearance

Operating clearance of a bearing can be calculated from initial bearing internal clearance and considering the decrease in clearance due to fitting and the difference in temperature of the inner and outer rings using formula (5.1).

$$\Delta_e = \Delta_0 - (\delta_f + \delta_t) = \Delta_f - \delta_t \quad \cdots\cdots\cdots\cdots (5.1)$$

Where:

Δ_e : Effective internal clearance, mm
Δ_0 : Bearing internal clearance (initial), mm
Δ_f : Residual clearance (clearance after preloading), mm
δ_f : Reduced amount of clearance due to fitting, mm
δ_t : Reduced amount of clearance due to temperature differential of inner and outer rings, mm

(1) Reduced internal clearance due to fitting

When bearings are installed with interference fits on shafts and in housings, the inner ring will expand and the outer ring will contract; **thus reducing the bearings' internal clearance**. The amount of expansion or contraction varies depending on the shape of the bearing, the shape of the shaft or housing, dimensions of the respective parts, and the type of materials used. The differential can range from **approximately 70 to 90 % of the effective interference**. Therefore, the reduced amount of clearance due to fitting is expressed by formula (5.2).

$$\delta_f = (0.70 \text{ to } 0.90)\Delta d_{eff} \quad \cdots\cdots\cdots\cdots\cdots (5.2)$$

Where:

δ_f : Reduced amount of clearance due to interference, mm
Δd_{eff} : Effective interference, mm

(2) Reduced internal clearance due to inner/outer ring temperature difference

During operation, normally the outer ring will range from 5 to 10 °C cooler than the inner ring or rotating parts. However, if the cooling effect of the housing is large, the shaft is connected to a heat source, or a heated substance is conducted through the hollow shaft; the temperature difference between the two rings can be even greater. **The amount of internal clearance is thus further reduced** by the differential expansion of the two rings. The reduced amount is expressed by formula (5.3).

$$\delta_t = \alpha \cdot \Delta T \cdot D_o \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (5.3)$$

Where:

δ_t : Reduced amount of clearance due to temperature differential of inner and outer rings, mm
α : Linear thermal expansion coefficient of bearing material, 12.5×10^{-6}/°C
ΔT: Inner/outer ring temperature differential, °C
D_o: Outer ring raceway diameter, mm

Outer ring raceway diameter, D_o, values can be approximated by using formula (5.4) or formula (5.5).

For ball bearings and spherical roller bearings,

$$D_o = 0.20(d+4.0D) \quad \cdots\cdots\cdots\cdots\cdots\cdots (5.4)$$

For roller bearings (except spherical roller bearings),

$$D_o = 0.25(d+3.0D) \quad \cdots\cdots\cdots\cdots\cdots\cdots (5.5)$$

d : Bearing bore diameter, mm
D : Bearing outside diameter, mm

For the ULTAGE™ series bearings, consult **NTN** Engineering.

Note that the formula in item 5.2.2 only applies to steel bearings, shafts and housings.

Table 5.2 Radial internal clearance of deep groove ball bearings

Unit: μm

Nominal bearing bore diameter d mm		C2		CN		C3		C4		C5	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
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	520
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	700
630	710	20	130	110	260	240	400	380	570	540	780
710	800	20	140	120	290	270	450	430	630	600	860
800	900	20	160	140	320	300	500	480	700	670	960
900	1 000	20	170	150	350	330	550	530	770	740	1 040
1 000	1 120	20	180	160	380	360	600	580	850	820	1 150
1 120	1 250	20	190	170	410	390	650	630	920	890	1 260

Table 5.3 Radial internal clearance of double row and duplex angular contact ball bearings

Unit: μm

Nominal bearing bore diameter d mm		C1		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
80	100	3	13	13	22	22	40	40	60	95	120
100	120	3	15	15	30	30	50	50	75	110	140
120	150	3	16	16	33	35	55	55	80	130	170
150	180	3	18	18	35	35	60	60	90	150	200
180	200	3	20	20	40	40	65	65	100	180	240
200	225	3	25	25	50	50	75	75	115	210	270
225	250	3	25	25	50	50	75	80	130	230	300
250	280	3	30	30	55	55	85	90	150	260	340
280	315	3	30	30	55	55	85	100	170	300	380
315	400	—	—	40	65	60	85	110	180	—	—
400	500	—	—	40	65	60	85	110	180	—	—

Note: 1. The clearance group in the table is applied only to contact angles in the table below.
2. This table shows **NTN** standard clearances.

Contact angle code	Nominal contact angle	Applicable clearance 2)
C	15°	C1, C2
A 1)	30°	C2, CN, C3
B	40°	CN, C3, C4

1) Usually not to be indicated
2) For information concerning clearance other than applicable clearance, please contact **NTN** Engineering.

Table 5.4 Radial internal clearance of bearings for electric motor

Unit: μm

Nominal bearing bore diameter d mm		CM			
		Deep groove ball bearings		Cylindrical roller bearings	
Over	Incl.	Min.	Max.	Min.	Max.
80	100	18	30	35	55
100	120	18	30	35	60
120	140	24	38	40	65
140	160	24	38	50	80
160	180	—	—	60	90
180	200	—	—	65	100

Note: 1. Suffix CM is added to bearing numbers.
Example: 6220 CM
2. Clearance not interchangeable for cylindrical roller bearings.

Table 5.5 Interchangeable radial internal clearance for cylindrical roller bearing (cylindrical bore)

Unit: μm

Nominal bearing bore diameter d mm		C2		CN		C3		C4		C5	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
80	100	15	50	50	85	75	110	105	140	155	190
100	120	15	55	50	90	85	125	125	165	180	220
120	140	15	60	60	105	100	145	145	190	200	245
140	160	20	70	70	120	115	165	165	215	225	275
160	180	25	75	75	125	120	170	170	220	250	300
180	200	35	90	90	145	140	195	195	250	275	330
200	225	45	105	105	165	160	220	220	280	305	365
225	250	45	110	110	175	170	235	235	300	330	395
250	280	55	125	125	195	190	260	260	330	370	440
280	315	55	130	130	205	200	275	275	350	410	485
315	355	65	145	145	225	225	305	305	385	455	535
355	400	100	190	190	280	280	370	370	460	510	600
400	450	110	210	210	310	310	410	410	510	565	665
450	500	110	220	220	330	330	440	440	550	625	735
500	560	120	240	240	360	360	480	480	600	—	—
560	630	140	260	260	380	380	500	500	620	—	—
630	710	145	285	285	425	425	565	565	705	—	—
710	800	150	310	310	470	470	630	630	790	—	—
800	900	180	350	350	520	520	690	690	860	—	—
900	1 000	200	390	390	580	580	770	770	960	—	—
1 000	1 120	220	430	430	640	640	850	850	1 060	—	—
1 120	1 250	230	470	470	710	710	950	950	1 190	—	—

Note: For nominal bearing bore diameter d exceeding 500 mm, the **NTN** standard is followed.

Table 5.6 Non-interchangeable radial internal clearance for cylindrical roller bearings

Unit: μm

Nominal bearing bore diameter d mm		Cylindrical bore bearing											
		C1NA		C2NA		NA 1)		C3NA		C4NA		C5NA	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
80	100	10	25	25	45	45	70	80	105	105	125	155	180
100	120	10	25	25	50	50	80	95	120	120	145	180	205
120	140	15	30	30	60	60	90	105	135	135	160	200	230
140	160	15	35	35	65	65	100	115	150	150	180	225	260
160	180	15	35	35	75	75	110	125	165	165	200	250	285
180	200	20	40	40	80	80	120	140	180	180	220	275	315
200	225	20	45	45	90	90	135	155	200	200	240	305	350
225	250	25	50	50	100	100	150	170	215	215	265	330	380
250	280	25	55	55	110	110	165	185	240	240	295	370	420
280	315	30	60	60	120	120	180	205	265	265	325	410	470
315	355	30	65	65	135	135	200	225	295	295	360	455	520
355	400	35	75	75	150	150	225	255	330	330	405	510	585
400	450	45	85	85	170	170	255	285	370	370	455	565	650
450	500	50	95	95	190	190	285	315	410	410	505	625	720
500	560	—	—	100	210	210	320	350	450	450	550	720	815
560	630	—	—	110	230	230	350	380	500	500	615	800	910
630	710	—	—	130	260	260	400	435	570	570	695	900	1 030
710	800	—	—	140	290	290	450	485	635	635	780	1 000	1 140
800	900	—	—	160	330	330	500	540	700	700	860	1 130	1 290
900	1 000	—	—	180	360	360	560	600	780	780	970	1 270	1 440
1 000	1 120	—	—	200	400	400	620	670	900	900	1 100	1 410	1 620
1 120	1 250	—	—	220	440	440	690	750	1 000	1 000	1 220	1 580	1 820

1) For bearings with normal clearance, only NA is added to bearing numbers. Example: NU320NA

Table 5.7 Axial internal clearance for double row and duplex tapered roller bearings (metric series)

Table 5.7 (1) Contact angle $\alpha \leq 27°$

Unit: μm

Nominal bearing bore diameter d mm		Contact angle $\alpha \leq 27°$ ($e \leq 0.76$)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
80	100	45	150	150	260	280	390	390	500
100	120	45	175	175	305	350	480	455	585
120	140	45	175	175	305	390	520	500	630
140	160	60	200	200	340	400	540	520	660
160	180	80	220	240	380	440	580	600	740
180	200	100	260	260	420	500	660	660	820
200	225	120	300	300	480	560	740	720	900
225	250	160	360	360	560	620	820	820	1 020
250	280	180	400	400	620	700	920	920	1 140
280	315	200	440	440	680	780	1 020	1 020	1 260
315	355	220	480	500	760	860	1 120	1 120	1 380
355	400	260	560	560	860	980	1 280	1 280	1 580
400	500	300	600	620	920	1 100	1 400	1 440	1 740
500	560	350	650	750	1 050	1 250	1 550	1 650	1 950
560	630	400	700	850	1 150	1 400	1 700	1 850	2 150
630	710	500	850	1 000	1 350	1 650	2 000	2 100	2 450
710	800	550	950	1 100	1 500	1 800	2 200	2 300	2 700
800	900	650	1 050	1 250	1 650	2 000	2 400	2 550	2 950
900	1 000	700	1 100	1 400	1 800	2 200	2 600	2 900	3 300
1 000	1 120	750	1 250	1 500	2 000	2 500	3 000	3 250	3 750
1 120	1 250	850	1 350	1 700	2 200	2 850	3 350	3 700	4 200
1 250	1 400	1 000	1 500	2 000	2 500	3 000	3 500	4 000	4 500

Note: 1. This table applies to bearings contained in the catalog. For information concerning other bearings or bearings using US customary unit, please contact **NTN** Engineering.
2. The correlation of axial internal clearance (Δ_a) and radial internal clearance (Δ_r) is expressed as $\Delta_r = 0.667 \times e \times \Delta_a$.
e: Constant (see dimension table)
3. The table does not apply to the bearing series 329X, 330, 322C, and 323C, 303C, and T4CB.

Unit: μm

Tapered bore bearing												Nominal bearing bore diameter d mm	
C9NA 2)		C0NA 2)		C1NA		C2NA		NA 1)		C3NA			
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Over	Incl.
10	25	20	35	25	45	45	70	80	105	105	125	80	100
10	25	20	35	25	50	50	80	95	120	120	145	100	120
15	30	25	40	30	60	60	90	105	135	135	160	120	140
15	35	30	45	35	65	65	100	115	150	150	180	140	160
15	35	30	45	35	75	75	110	125	165	165	200	160	180
20	40	30	50	40	80	80	120	140	180	180	220	180	200
20	45	35	55	45	90	90	135	155	200	200	240	200	225
25	50	40	65	50	100	100	150	170	215	215	265	225	250
25	55	40	65	55	110	110	165	185	240	240	295	250	280
30	60	45	75	60	120	120	180	205	265	265	325	280	315
30	65	45	75	65	135	135	200	225	295	295	360	315	355
35	75	50	90	75	150	150	225	255	330	330	405	355	400
45	85	60	100	85	170	170	255	285	370	370	455	400	450
50	95	70	115	95	190	190	285	315	410	410	505	450	500
—	—	—	—	100	210	210	320	350	450	450	550	500	560
—	—	—	—	110	230	230	350	380	500	500	615	560	630
—	—	—	—	130	260	260	400	435	570	570	695	630	710
—	—	—	—	140	290	290	450	485	635	635	780	710	800
—	—	—	—	160	330	330	500	540	700	700	860	800	900
—	—	—	—	180	360	360	560	600	780	780	970	900	1 000
—	—	—	—	200	400	400	620	670	900	900	1 100	1 000	1 120
—	—	—	—	220	440	440	690	750	1 000	1 000	1 220	1 120	1 250

2) C9NA, C0NA and C1NA clearances are applied only to precision bearings of JIS Class 5 and higher.

Table 5.7 (2) Contact angle $\alpha > 27°$

Unit: μm

Nominal bearing bore diameter d mm		Contact angle $\alpha > 27°$ ($e > 0.76$)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
80	100	20	70	70	120	130	180	180	230
100	120	20	70	70	120	150	200	210	260
120	140	20	70	70	120	160	210	210	260
140	160	30	100	100	160	180	240	240	300
160	180	40	110	110	180	200	270	280	340
180	200	50	120	120	190	230	300	310	380
200	225	60	140	140	200	260	340	340	420
225	250	80	160	170	260	290	380	380	470
250	280	90	190	190	280	320	420	430	520
280	315	90	200	200	310	360	470	470	580
315	355	100	220	230	350	400	510	520	630
355	400	120	260	260	400	450	590	590	730
400	500	140	280	280	420	510	640	650	780
500	630	160	310	310	460	530	650	680	820
630	800	180	350	350	520	590	760	760	930

Note: 1. This table applies to bearings contained in the catalog. For information concerning other bearings or bearings using US customary unit, please contact **NTN** Engineering.
2. The correlation of axial internal clearance (Δ_a) and radial internal clearance (Δ_r) is expressed as $\Delta_r = 0.667 \times e \times \Delta_a$.
e: Constant (see dimension table)
3. The table does not apply to the bearing series 329X, 330, 322C, and 323C, 303C, and T4CB.

Table 5.8 Axial internal clearance of double row and duplex tapered roller bearings (inch series)

Table 5.8 (1) Contact angle α < 12°

Unit: μm

Nominal bearing bore diameter 1) d mm		Contact angle α < 12° (e < 0.32)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
63.5	127	55	165	290	400	400	510	510	620
127	203.2	85	230	320	470	470	620	620	770
203.2	304.8	140	320	370	550	550	730	730	910
304.8	406.4	200	420	660	880	880	1 100	1 100	1 320
406.4	508	260	520	710	970	970	1 230	1 230	1 490
508	609.6	340	640	790	1 090	1 090	1 390	1 390	1 690
609.6	711.2	430	780	1 120	1 470	1 470	1 820	1 820	2 170
711.2	762	—	—	—	—	—	—	—	—
762	914.4	—	—	—	—	—	—	—	—

1) Nominal bore diameter is the minimum size among the same series.
Note: This table shows **NTN** standard clearances.

Table 5.8 (2) 12° ≤ Contact angle α < 15°

Unit: μm

Nominal bearing bore diameter 1) d mm		12° ≤ Contact angle α < 15° (0.32 ≤ e < 0.40)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
63.5	127	45	135	240	330	330	420	420	510
127	203.2	70	190	270	390	390	510	510	630
203.2	304.8	120	270	310	460	460	610	610	760
304.8	406.4	160	340	550	730	730	910	910	1 090
406.4	508	210	420	590	800	800	1 010	1 010	1 220
508	609.6	280	530	650	900	900	1 150	1 150	1 400
609.6	711.2	350	640	930	1 220	1 220	1 510	1 510	1 800
711.2	762	420	750	990	1 320	1 320	1 650	1 650	1 980
762	914.4	520	890	1 070	1 440	1 440	1 810	1 810	2 180

1) Nominal bore diameter is the minimum size among the same series.
Note: This table shows **NTN** standard clearances.

Table 5.8 (3) 15° ≤ Contact angle α < 20°

Unit: μm

Nominal bearing bore diameter 1) d mm		15° ≤ Contact angle α < 20° (0.40 ≤ e < 0.55)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
63.5	127	35	105	190	260	260	330	330	400
127	203.2	55	155	210	310	310	410	410	510
203.2	304.8	90	210	240	360	360	480	480	600
304.8	406.4	130	270	440	580	580	720	720	860
406.4	508	170	340	470	640	640	810	810	980
508	609.6	220	420	520	720	720	920	920	1 120
609.6	711.2	280	510	740	970	970	1 200	1 200	1 430
711.2	762	340	600	780	1 040	1 040	1 300	1 300	1 560
762	914.4	410	700	850	1 140	1 140	1 430	1 430	1 720

1) Nominal bore diameter is the minimum size among the same series.
Note: This table shows **NTN** standard clearances.

Table 5.8 (4) 20° ≤ Contact angle α < 30°

Unit: μm

Nominal bearing bore diameter 1) d mm		20° ≤ Contact angle α < 30° (0.55 ≤ e < 0.87)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
63.5	127	30	80	140	190	190	240	240	290
127	203.2	40	110	160	230	230	300	300	370
203.2	304.8	70	160	180	270	270	360	360	450
304.8	406.4	95	195	320	420	420	520	520	620
406.4	508	120	240	350	470	470	590	590	710
508	609.6	160	310	380	530	530	680	680	830
609.6	711.2	210	380	540	710	710	880	880	1 050
711.2	762	250	440	580	770	770	960	960	1 150
762	914.4	300	520	630	850	850	1 070	1 070	1 290

1) Nominal bore diameter is the minimum size among the same series.
Note: This table shows **NTN** standard clearances.

Table 5.8 (5) 30° ≤ Contact angle α

Unit: μm

Nominal bearing bore diameter 1) d mm		30° ≤ Contact angle α (0.87 ≤ e)							
		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
63.5	127	15	50	90	125	125	160	160	200
127	203.2	25	70	100	145	145	190	190	240
203.2	304.8	45	100	110	170	170	230	230	290
304.8	406.4	60	130	200	270	270	340	340	410
406.4	508	80	160	220	300	300	380	380	460
508	609.6	100	200	—	—	—	—	—	—
609.6	711.2	130	250	—	—	—	—	—	—
711.2	762	160	290	—	—	—	—	—	—
762	914.4	190	330	—	—	—	—	—	—

1) Nominal bore diameter is the minimum size among the same series.
Note: This table shows **NTN** standard clearances.

Table 5.9 Radial internal clearance of spherical roller bearings

Unit: μm

Nominal bearing bore diameter d mm		Cylindrical bore bearing										Tapered bore bearing										Nominal bearing bore diameter d mm	
		C2		CN		C3		C4		C5		C2		CN		C3		C4		C5			
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Over	Incl.
80	100	35	60	60	100	100	135	135	180	180	225	55	80	80	110	110	140	140	180	180	230	80	100
100	120	40	75	75	120	120	160	160	210	210	260	65	100	100	135	135	170	170	220	220	280	100	120
120	140	50	95	95	145	145	190	190	240	240	300	80	120	120	160	160	200	200	260	260	330	120	140
140	160	60	110	110	170	170	220	220	280	280	350	90	130	130	180	180	230	230	300	300	380	140	160
160	180	65	120	120	180	180	240	240	310	310	390	100	140	140	200	200	260	260	340	340	430	160	180
180	200	70	130	130	200	200	260	260	340	340	430	110	160	160	220	220	290	290	370	370	470	180	200
200	225	80	140	140	220	220	290	290	380	380	470	120	180	180	250	250	320	320	410	410	520	200	225
225	250	90	150	150	240	240	320	320	420	420	520	140	200	200	270	270	350	350	450	450	570	225	250
250	280	100	170	170	260	260	350	350	460	460	570	150	220	220	300	300	390	390	490	490	620	250	280
280	315	110	190	190	280	280	370	370	500	500	630	170	240	240	330	330	430	430	540	540	680	280	315
315	355	120	200	200	310	310	410	410	550	550	690	190	270	270	360	360	470	470	590	590	740	315	355
355	400	130	220	220	340	340	450	450	600	600	750	210	300	300	400	400	520	520	650	650	820	355	400
400	450	140	240	240	370	370	500	500	660	660	820	230	330	330	440	440	570	570	720	720	910	400	450
450	500	140	260	260	410	410	550	550	720	720	900	260	370	370	490	490	630	630	790	790	1 000	450	500
500	560	150	280	280	440	440	600	600	780	780	1 000	290	410	410	540	540	680	680	870	870	1 100	500	560
560	630	170	310	310	480	480	650	650	850	850	1 100	320	460	460	600	600	760	760	980	980	1 230	560	630
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	630	710
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	710	800
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	800	900
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	900	1 000
1 000	1 120	290	530	530	780	780	1 020	1 020	1 330	1 330	1 720	530	770	770	1 030	1 030	1 300	1 300	1 670	1 670	2 050	1 000	1 120
1 120	1 250	320	580	580	860	860	1 120	1 120	1 460	1 460	1 870	570	830	830	1 120	1 120	1 420	1 420	1 830	1 830	2 250	1 120	1 250
1 250	1 400	350	640	640	950	950	1 240	1 240	1 620	1 620	2 080	620	910	910	1 230	1 230	1 560	1 560	2 000	2 000	2 470	1 250	1 400
1 400	1 600	400	720	720	1 060	1 060	1 380	1 380	1 800	—	—	680	1 000	1 000	1 350	1 350	1 720	1 720	2 200	—	—	1 400	1 600
1 600	1 800	450	810	810	1 180	1 180	1 550	1 550	2 000	—	—	750	1 110	1 110	1 500	1 500	1 920	1 920	2 400	—	—	1 600	1 800

Note: For nominal bearing bore diameter d exceeding 1 000 mm, the **NTN** standard is followed.

5.3 Necessary minimum load

In general, when a bearing is operated under no load or a very light load, slippage may occur between the rolling element and the raceway.

Therefore, it is necessary to apply a minimum load to prevent slippage during bearing operation. A rough standard for the necessary minimum radial loads for radial bearings is shown below.

Ball bearings
(except self-aligning ball bearings): $0.023C_{0r}$
Self-aligning ball bearings : $0.018C_{0r}$
Roller bearings : $0.040C_{0r}$

Where:

C_{0r}: Basic static load rating, N

* Consult with **NTN** Engineering for the necessary minimum axial loads for thrust bearings.

6. Lubrication

6.1 Purpose of lubrication

The purpose of rolling bearing lubrication is to prevent direct metallic contact between the various rolling and sliding elements. This is accomplished through the formation of a thin oil (or grease) film on the contact surfaces. Lubricant is necessary for operating rolling bearings. For rolling bearings, lubrication has the following advantages:

(1) **Reduction** of **friction** and **wear**
It prevents direct metallic contact between the rolling and sliding elements of bearing components and reduces friction and wear.

(2) **Prolonged** bearing **life**
The rolling fatigue life is prolonged by forming an oil film on the rolling contact surface part.

(3) **Friction heat dissipation** and cooling
Circulating lubrication can dissipate heat generated from friction or conducted from the outside.

(4) Others
It **prevents foreign materials from entering** inside the bearing and suppresses corrosion (rust) by covering the bearing surface with oil.

In order to exhibit these effects, a lubrication method that matches service conditions is required. In addition to this, a quality lubricant must be selected, the proper amount of lubricant must be used and the bearing must be designed to prevent foreign matter from getting in or lubricant from leaking out. If lubrication is insufficient, friction is not reduced, causing excessive rise in bearing temperature or abnormal wear. Therefore, an appropriate lubrication and lubrication method should be selected.

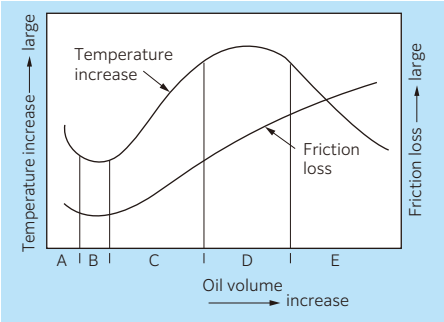


Fig. 6.1

Fig. 6.1 shows the relationship between oil volume, friction loss, and temperature rise. **Table 6.1** details the characteristics of this relationship.

Table 6.1 Oil volume, friction loss, and temperature increase (see Fig. 6.1)

Range	Characteristics	Lubrication method
A	When oil volume is extremely low, direct metallic contact occurs in places between the rolling elements and raceway surfaces. Bearing abrasion and seizing may occur.	——
B	A thin oil film develops over all surfaces, friction is minimal and bearing temperature is low.	Grease lubrication Oil mist Air-oil lubrication
C	As oil volume increases, heat buildup is balanced by cooling.	Circulating lubrication
D	Regardless of oil volume, temperature increases at a fixed rate.	Circulating lubrication
E	As oil volume increases, cooling dominates and bearing temperature decreases.	Forced circulation lubrication Oil jet lubrication

6.2 Lubrication methods and characteristics

Lubrication methods for bearings can be roughly divided into **grease** and **oil lubrication**. Each of these has its own features, so the lubrication method that best offers the required function must be selected.

Characteristics of each method are shown in **Table 6.2**.

Table 6.2 Comparison of grease lubrication and oil lubrication characteristics

Concern \ Method	Grease lubrication	Oil lubrication
Handling	◎	△
Reliability	○	◎
Cooling effect	×	○ (Circulation necessary)
Seal structure	○	△
Power loss	○	○
Environment contamination	○	△
High-speed rotation	×	○

◎ : Very good ○ : Good △ : Fair × : Poor

6.3 Grease lubrication

Grease lubricants are relatively easy to handle and require only the simplest sealing devices. For these reasons, grease is the most widely used lubricant for rolling bearings. It is used in a bearing that is pre-sealed with grease (sealed/shielded bearing), or if using an unsealed bearing, fill the bearing and housing with the proper amount of grease, and replenish or change the grease regularly.

With sealed bearings, the proper grease amount does not cause leakage; however, under use conditions including a lot of vibrations, which cause grease to flow easily, or under high speed outer ring rotation, in which a large centrifugal force is applied on the grease, the grease may purge (in rare cases). Please consult **NTN** Engineering.

6.3.1 Types and characteristics of grease

Lubricating grease is composed of either a mineral base oil or a synthetic base oil. **To this base a thickener and other additives are added**. The properties of all greases are mainly determined by the kind of base oil used and by the combination of thickening agent and various additives. **Table 6.5** shows general grease varieties and characteristics, and **Table 6.6** shows grease brand names and their characteristics (refer to page A-52 and page A-53). As performance characteristics of even the same type of grease will vary widely from brand to brand, **it is necessary to check the manufacturers' data when selecting grease**.

(1) Base oil
Mineral oil or synthetics such as **ester oil**, **synthetic hydrocarbon oil**, or **ether oil** are used as the base of greases.

Generally, greases with low viscosity base oils are best suited for low temperatures and high speeds; grease using high viscosity base oil has superior high temperature and heavy load characteristics.

(2) Thickening agents
Thickening agents are compounded with base oils to maintain the semi-solid state of the grease. Thickening agents consist of two types of bases: metallic soaps and non-soaps. Metallic soap thickeners include: **lithium**, **sodium**, **calcium**, etc. Non-soap base thickeners are divided into two groups: inorganic (**silica gel**, **bentonite**, etc.) and organic (**polyurea**, **fluorocarbon**, etc.). The various special characteristics of a grease, such as **limiting temperature range**, **mechanical stability**, water resistance, etc., depend largely on the type of **thickening agent used**. For example, a sodium based grease is generally poor in water resistance properties, while greases with bentone, polyurea and other non-metallic soaps as the thickening agent are generally superior in high temperature properties.

(3) Additives
Various additives are added to grease depending on the purpose. Typical additives include **anti-oxidants**, **high-pressure additives** (EP additives), **rust preventives**, and **anti-corrosives**. For bearings subject to heavy loads and/ or shock loads, grease containing high-pressure additives should be used. Antioxidants are added to grease used in most types of rolling bearings.

(4) Consistency
Consistency is an index that indicates hardness and fluidity of grease. **The higher the NLGI number, the HARDER the grease is**. For the lubrication of rolling bearings, greases with the NLGI consistency numbers of 1, 2, and 3 are used. General relationships between consistency and application of grease are shown in **Table 6.3**.

Table 6.3 Consistency of grease

NLGI consistency No.	JIS [ASTM] 60 times blend consistency	Application
0	355 - 385	For centralized greasing use
00	400 - 430	For centralized greasing use
1	310 - 340	For general use and sealed bearing use
2	265 - 295	For general use, high temperature use, and sealed bearing use
3	220 - 250	
4	175 - 205	For special use

(5) Mixing different types of greases
When greases of different kinds are mixed together, the consistency of the greases will change (usually softer), the operating temperature range will be lowered, and other changes in characteristics will occur. **As a rule, grease should not be mixed with grease of any other brand.** However, if different greases must be mixed, at least greases with the same base oil and thickening agent should be selected.

6.3.2 Amount of grease

The amount of grease used in any given situation will depend on many factors relating to the size and shape of the housing, space limitations, bearing's rotating speed and type of grease used. As a rule of thumb, **bearings should be filled to 30 to 40 % of their space** and **housing should be filled to 30 to 60 %**. Where speeds are high and temperature rises need to be kept to a minimum, a reduced amount of grease should be used. **Excessive amounts of grease cause temperature rises which in turn cause the grease to soften and may allow leakage. Oxidation and deterioration of excessive grease fills may cause the lubricating efficiency to be lowered.** Moreover, the standard bearing space can be found by formula (6.1).

$$V = K \cdot W \quad \cdots\cdots (6.1)$$

Where:

V : Quantity of bearing space open type (approx.), cm^3

K : Bearing space factor (see **Table 6.4**)

W : Mass of bearing, kg

A predetermine amount of grease is filled in the bearing with a grease gun or a syringe. After sealing it is not possible to spread the grease by hand - only by rotating the bearing by hand.

Table 6.4 Bearing space factor K

Bearing type 1)			Cage type	K
Deep groove ball bearings 2)			Pressed cage	61
Angular contact ball bearings			Pressed cage	54
			Machined cage	33
			Resin cage	33
Cylindrical roller bearings	NU type 3)		Pressed cage	50
			Machined cage	36
	N type 5)		Pressed cage	55
			Machined cage	37
	ULTAGE™ series (EA type) E type	NU type 4)	Machined cage	33
			Resin cage	33
		N type 4)	Machined cage	34
			Resin cage	35
Tapered roller bearings			Pressed cage	46
Spherical roller bearings	Type B Type 213		Machined cage	28
	ULTAGE™ series	Type EA	Pressed cage	33
		Type EM	Machined cage	31

1) Does not apply to model numbers that are not specified in the catalog.
2) Does not apply to 160 series bearings.
3) Does not apply to NU4 series.
4) Applies to G1 machined cages only.
5) Does not apply to N4 series.

6.4 Solid grease

"Solid grease" is a lubricant composed mainly of lubricating grease and ultra-high polymer polyethylene. Solid grease begins as grease that has the same viscosity as a more traditional grease. After being heated and cooled, a process known as "calcination", the grease hardens while maintaining a large quantity of lubricant within the polymer structure. The result of this solidification is that the grease does not easily leak from the bearing, even when the bearing is subjected to strong vibrations or centrifugal force.

Bearings with solid grease are available in two types: the spot-pack type in which solid grease is injected into the cage, and the full-pack type in which all free space around the rolling elements is completely filled with solid grease.

Spot-pack solid grease is available for deep groove ball bearings, small diameter ball bearings, and bearing units. Full-pack solid grease is available for self-aligning ball bearings and spherical roller bearings. Grease filling examples are shown in **Fig. 6.2** and **Fig. 6.3**.

Primary advantages:

(1) Minimal grease leakage

(2) Low bearing torque with spot-pack type solid grease

For details, see the special catalog "**Bearings with solid grease (CAT. No. 3022/E)**".

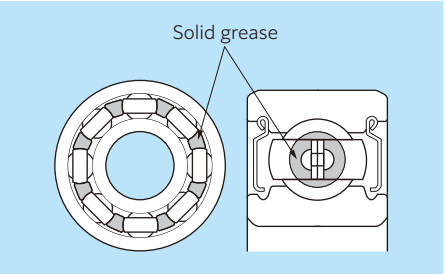


Fig. 6.2 Deep groove ball bearing with spot-pack solid grease (ZZ shield) (Available for deep groove ball bearings)

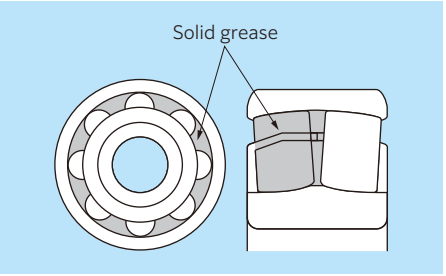


Fig. 6.3 Spherical roller bearing with full-pack solid grease (Available for spherical roller bearings)

Table 6.5 Grease varieties and characteristics [1)]

	Soap-based				
	Lithium (Li) grease				Calcium (Ca) grease
Thickening agent[2)]	Li soap			Li complexed soap	Ca soap (cup grease)
Base oil[3)]	Mineral oil	Ester oil	Silicone oil	Mineral oil	Mineral oil
Dropping point °C	170 to 190	170 to 190	200 to 210	>250	80 to 100
Operating temperature range °C	−30 to 120	−50 to 130	−50 to 160	−30 to 130	−20 to 70
Mechanical stability	Good	Good	Good	Good	OK
Pressure resistance	Good	Good	Poor	Good	OK
Water resistance	Good	Good	Good	Good	Good
Characteristics/ application	Balanced performance with less disadvantages All-purpose grease	Excellent low temperature and wear characteristics Suitable for miniature and small size ball bearings	Excellent characteristics at low and high temperatures Poor load resistance	Balanced performance with less disadvantages Usable for relatively high temperature	Used for low speed and light loads Unusable for high temperature

Soap-based		Non-soap-based			
Calcium (Ca) grease	Sodium (Na) grease	Organic			Inorganic
Ca complexed soap	Na soap	Urea	Urea	PTFE	Silica gel
Mineral oil	Mineral oil	Mineral oil	Synthetic oil	Fluorinated oil	Ester oil
200 to 280	170 to 200	>260	>260	None	>260
−20 to 130	−20 to 130	−30 to 140	−40 to 180	−40 to 250	−70 to 150
Good	Good	Good to Excellent	Good to Excellent	OK to Good	Good
Good to Excellent	Good	Good to Excellent	Good to Excellent	Good	Good
Good	Poor	Good to Excellent	Good to Excellent	Good	Good
Excellent pressure resistance	Some emulsification when water is introduced Usable for relatively high temperature	Excellent water resistance and oxidation stability	Excellent water resistance and oxidation stability Used for high temperature and high speed applications	Excellent chemical resistance Used for high temperature applications	Excellent characteristics at low temperature

1) Use the grease performance as rough standards because it differs depending on the manufacturer's additive formation.
2) Na soap-based grease may be emulsified by water and high humidity conditions.
Urea-based grease may deteriorate polyfluorocarbons and rubber.
3) Ester oil-based grease may swell acrylic materials, and silicone-based grease may swell silicone materials.
Some silicone-based greases and fluorine-based greases have poor noise performance and rustproofing performance.

Table 6.6 Grease brands and their nature

Brand	Code	Thickener	Base oil	Base oil viscosity mm²/s		60 times blend consistency		Dropping point °C	Operating temperature range °C	Characteristics
				40 °C	100 °C	Representative value	NLGI No.			
Alvania Grease S2	2AS	Li soap	Mineral oil	131	12.2	283	2	181	−25 to 120	All-purpose (standard grease for deep groove ball bearings)
Alvania Grease S3	3AS	Li soap	Mineral oil	131	12.2	242	3	182	−20 to 135	All-purpose (standard grease for ball bearings of bearing units)
Alvania EP Grease 2	8A	Li soap	Mineral oil	220	15.9	284	2	184	−20 to 110	Heavy load all-purpose
Multemp PS No. 2	1K	Li soap	Ester + PAO	15.9	—	270	2	190	−50 to 130	For low temperature and low torque
Multemp SRL	5K	Li soap	Ester	24.1	—	250	2 to 3	192	−40 to 150	For low temperature to high temperature, all-purpose (standard grease for miniature and small size ball bearings)
SH44M	4M	Li soap	Silicone	80	19	260	2 to 3	204	−40 to 160	For high temperature
ISOFLEX NBU15	15K	Ba complexed soap	Diester + mineral oil	23	5	280	2	220 or above	−40 to 130	For high speed
SHC POLYREE 462	L791	Urea	PAO	460	40	280	2	270	−20 to 170	For food machinery
SE-1	L749	Urea	PAO + ester	22	5	265	2	220 or above	−50 to 120	For high speed
ME-1	L700	Urea	Ester + PAO	61.3	9.3	231	3	250 or above	−30 to 160	For high temperature and high speed
EP-1	L542	Urea	PAO	46.8	—	220	3	260 or above	−40 to 160	For high temperature and high speed
NA103A	L756	Urea	PAO + ether	53.5	—	270	2	260 or above	−40 to 180	Brittle separation
MP-1	L448	Urea	Synthetic oil	40.6	7.1	243	3	250 or above	−40 to 150	For high temperature and high speed
Grease J	L353	Urea	Ester	75	10	305	1 to 2	280 or above	−20 to 180	For high temperature
Cosmo Wide Grease WR3	2M	Na terephthalate	Diester + mineral oil	31.6	6	238	3	230 or above	−40 to 150	For low temperature to high temperature, all-purpose
Mobilgrease 28	9B	Bentonite	PAO	30	5.7	293	1 to 2	307	−54 to 177	MIL-PRF-81322 For low temperature to high temperature
Aeroshell Grease 7	5S	Microgel	Diester	10.3	3.1	296	1 to 2	260 or above	−73 to 149	MIL-PRF-23827C

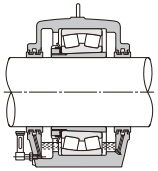
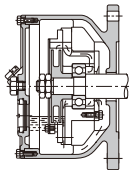
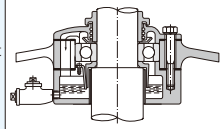
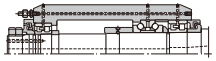
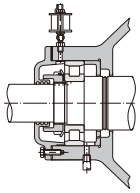
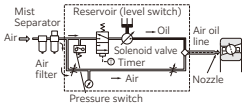
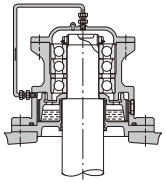
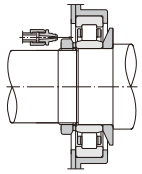
Note: 1. Representative values are shown for the base oil viscosity, consistency, and dropping point.
2. The upper and lower limits of the operating temperature range differ depending on the usage environment and requirement specifications. Please consult with **NTN** Engineering.

6.5 Oil lubrication

Oil lubrication is suitable for applications requiring that bearing-generated heat or heat applied to the bearing from other sources be carried away from the bearing and dissipated to the outside.

Table 6.7 shows the main methods of oil lubrication.

Table 6.7 Oil lubrication methods

Lubrication method	Example	Lubrication method	Example
(Oil bath lubrication) • Oil bath lubrication is the most generally used method of lubrication, and is widely used for low to moderate rotational speed applications. • For horizontal shaft applications, oil level should be maintained at approximately the center of the lowest rolling element, according to the oil gauge, when the bearing is at rest. For vertical shafts at low speeds, the oil level should be maintained at 50 to 80% submergence of the rolling elements.		**(Disc lubrication)** • In this method, a partially submerged disc rotates and pulls oil up into a reservoir from which it then drains down through the bearing, lubricating it.	
(Oil spray lubrication) • In this method, an impeller or similar device mounted on the shaft draws up oil and sprays it onto the bearing. This method can be used at considerably high speeds.		**(Oil mist lubrication)** • Using pressurized air, lubricating oil is atomized before passing through the bearing. • Due to the low lubricant resistance, this method is well suited to high speed applications.	
(Drip lubrication) • In this method, oil is collected above the bearing and allowed to drip down into the housing where it becomes a lubricating mist as it strikes the rolling elements. Another version allows only slight amounts of oil to pass through the bearing. • Used at relatively high speeds for light to normal load applications. • In most cases, oil volume is a few drops per minute.		**(Air-oil lubrication)** • In this method, the required minimum amount of lubricating oil is measured and fed to each bearing at ideal intervals using compressed air. • Fresh lubricating oil is constantly fed. • Because the required oil quantity is very small, the working environment can be kept clean.	
(Circulating lubrication) • Used for bearing cooling or for automatic oil supply systems in which the oil supply is centrally located. • One of the advantages of this method is that oil cooling devices and filters to maintain oil purity can be installed within the system. • In order for oil to thoroughly lubricate the bearing, oil inlets and outlets must be provided on opposite sides of the bearing.		**(Oil jet lubrication)** • This method lubricates by injecting oil under high pressure directly into the side of the bearing. This is a reliable system for high speed, high temperature or otherwise severe conditions. • Used for lubricating the bearings in jet engines, gas turbines, and other high speed equipment. • Under-race lubrication is one example of this type of lubrication.	

6.5.1 Selection of lubricating oil

Under normal operating conditions, **machine oil**, **turbine oil**, and other mineral oils are widely used for the lubrication of rolling bearings. However, for temperatures **below -30 °C** or **above 150 °C**, synthetic oils such as **ester oil**, **silicone oil**, and **fluorinated oil** are used.

For lubricating oils, viscosity is one of the most important properties and determines an oil's lubricating efficiency. If viscosity is too low, formation of the oil film will be insufficient, and damage to the rolling surface will occur. If viscosity is too high, viscous resistance will also be great, resulting in temperature increase and friction loss. In general, **for higher speed applications**, **a lower viscosity oil** should be used; **for heavier load applications**, **a higher viscosity oil** should be used.

Lubrication of rolling bearings requires dynamic viscosity shown in **Table 6.8**, which is dependent on the use conditions. **Fig 6.4** shows the relation between lubricating oil dynamic viscosity and temperature. This is used to select a lubrication oil with viscosity characteristics appropriate for the operating temperature.

For reference, **Table 6.9** lists the selection standards for lubricating oil viscosity based on bearing operating conditions.

Table 6.8 Required lubricating oil dynamic viscosity for bearings

Bearing type	Dynamic viscosity mm²/s
Ball bearings, Cylindrical roller bearings	13 or above
Spherical roller bearings, Tapered roller bearings	20 or above
Thrust spherical roller bearings	30 or above

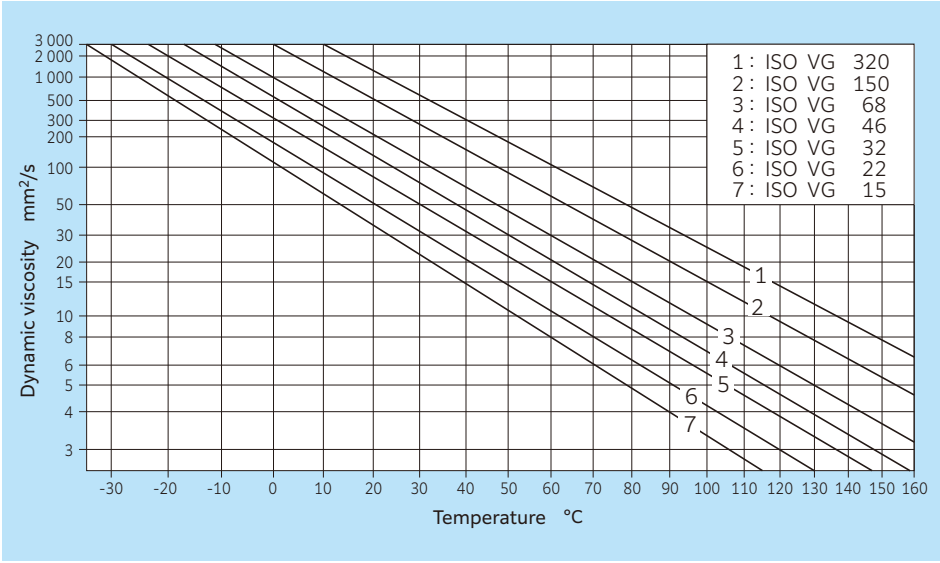


Fig 6.4 Relation between lubricating oil dynamic viscosity and temperature

Table 6.9 Standards for lubricating oil viscosity

Bearing operating temperature °C	dn-value 1)	Lubricating oil ISO viscosity grade (VG)		Suitable bearing
		Normal load	Heavy load or shock load	
−30 - 0	Up to allowable rotational speed	22, 32	46	All types
0 - 60	Up to 15 000	46, 68	100	All types
	15 000 - 80 000	32, 46	68	All types
	80 000 - 150 000	22, 32	32	All types but thrust ball bearings
	150 000 - 500 000	10	22, 32	Single row radial ball bearings, cylindrical roller bearings
60 - 100	Up to 15 000	150	220	All types
	15 000 - 80 000	100	150	All types
	80 000 - 150 000	68	100, 150	All types but thrust ball bearings
	150 000 - 500 000	32	68	Single row radial ball bearings, cylindrical roller bearings
100 - 150	Up to allowable rotational speed	320		All types
0 - 60	Up to allowable rotational speed	46, 68		Spherical roller bearings
60 - 100	Up to allowable rotational speed	150		

1) dn value: [dn = bearing bore diameter d (mm) × rotational speed n (min^{-1})]
Note: 1. Applied when lubrication method is either oil bath or circulating lubrication.
2. Please consult with **NTN** Engineering in cases where operating conditions fall outside the range covered by this table.

6.5.2 Oiling amount

When a bearing is to be supplied with oil forcibly, the amount of heat generated from the bearing is equal to the sum of the amount of heat dissipated from the housing and the amount of heat carried away by the oil.

The oiling amount that serves as a rough indication when a standard housing is used can be obtained by formula (6.2).

$$Q=K\cdot q \quad \cdots\cdots (6.2)$$

Where:

Q: oiling amount per bearing (cm^3/min)
K: coefficient determined by allowable temperature rise of oil (see **Table 6.10**)
q: oiling amount obtained by diagram (cm^3/min) (see **Fig. 6.5**)

The heat dissipation amount differs depending on the housing type. Therefore, in the actual operation, it is desirable to obtain the oiling amount suitable for the actual machine by adjusting the amount obtained by formula (6.2) to 1.5 to 2 times.

In addition, when calculating the oiling amount assuming that no heat is dissipated from the housing and the generated heat amount is completely carried away by the oil, use the shaft diameter in the diagram as d = 0.

Table 6.10 Value of K

Expelled oil temp minus supplied oil temp °C	K
10	1.5
15	1
20	0.75
25	0.6

(Example) For tapered roller bearing **30220U** mounted on a flywheel shaft with a radial load of 9.5 kN, operating at 1 800 min^{-1}, what is the amount of lubricating oil Q required to keep the bearing temperature rise below 15 °C?

d=100 mm,
dn=100×1 800=18×10^4
From **Fig. 6.5** q = 180 cm^3/min
Assume the bearing temperature is approximately equal to the expelled oil temperature,
from **Table 6.10**, since K = 1
$Q=K\times q=1\times 180=180$ cm^3/min

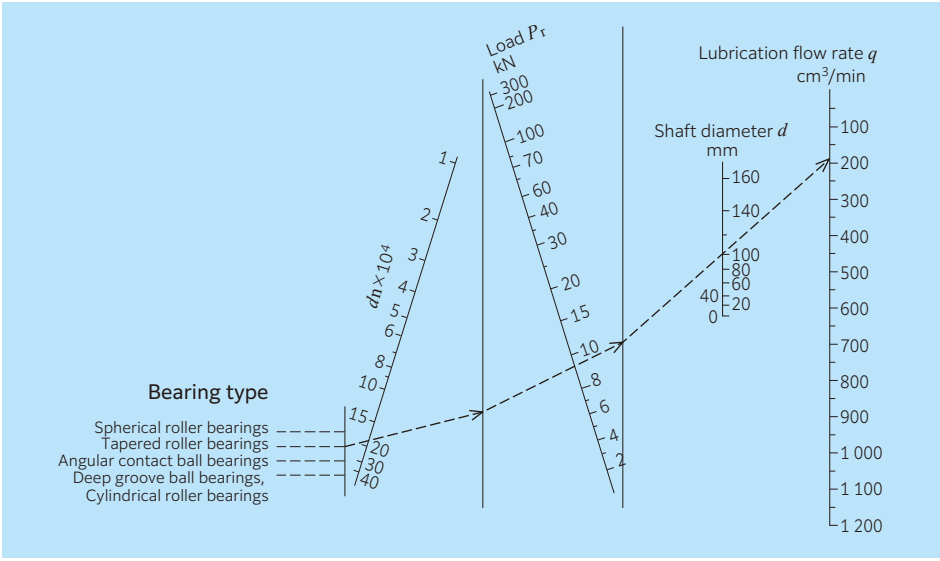


Fig. 6.5 Oil quantity guidelines

6.5.3 Relubrication intervals

The intervals at which lubricating oil should be changed varies depending upon operating conditions, oil quantity, and type of oil used. In general, for oil bath lubrication where the operating temperature is 50 °C or less, oil should be replaced once a year. When the operating temperature is between 80 to 100 °C, oil should be replaced at least once every three months. For important equipment, it is advisable that lubricating efficiency and oil purity deterioration be checked regularly to determine when oil replacement is necessary.

7. Bearing materials

7.1 Raceway and rolling element

While the contact surfaces of a bearing's raceways and rolling elements are subjected to repeated heavy stress, they must also maintain high precision and rotational accuracy.

To accomplish this, the raceways and rolling elements must be made of a material that has high hardness, is resistant to rolling fatigue, is wear resistant, and has good dimensional stability. The most common cause of fatigue in bearings is the inclusion of non-metallic inclusions in the steel. Nonmetallic inclusions contain hard oxides that can cause fatigue cracks. Clean steel with minimal non-metallic inclusions must therefore be used.

All **NTN** bearings use steel that is low in oxygen content and nonmetallic impurities, refined by a vacuum degassing process and outside hearth smelting. For bearings requiring especially high reliability and long life, steels of even higher in purity, such as vacuum melted steel (VIM / VAR) and electro-slag melted steel (ESR), are used.

7.1.1 Raceway and rolling element materials

1) High/mid carbon alloy steel

In general, steel types capable of being "**through hardened**" below the material surface are employed for raceways and rolling elements. Foremost among these is **high carbon chromium bearing steel**, which is widely used. For large type bearings and bearings with large cross sectional dimensions, induction hardened bearing steel is used, which incorporates manganese (Mn) or molybdenum (Mo). Mid-carbon steel incorporating silicon (Si) and manganese may also be used, which gives it hardening properties comparable to high carbon chromium steel.

SUJ2 is frequently used. SUJ3, with enhanced hardening characteristics containing a large quantity of Mn, is used for large bearings. SUJ5 is SUJ3 to which Mo has been added to further enhance hardening characteristics, and is used for oversized bearings or bearings with thick walls.

2) Carburizing (case hardened) steel

Carburizing hardens the steel from the surface to the proper depth, leaving a relatively soft core. This provides **hardness and toughness**, making the material **suitable for impact loads**. **NTN** uses carburizing (case hardened) steel for most of its tapered roller bearings.

In terms of case hardened steel for **NTN**'s other bearings, chromium steel and chrome molybdenum steel are used for small to medium sized bearings, and nickel chrome molybdenum steel is used for large sized bearings.

3) High temperature capable bearing steel

When bearings made of ordinary high carbon chromium steel which have undergone standard heat treatment are used for long durations at high temperatures, unacceptably large dimensional changes can occur. For this reason, **a dimension stabilizing treatment** (TS treatment) has been devised for very high temperature applications. This treatment however reduces the hardness of the material, thereby reducing rolling fatigue life (See section "1.3.2 Life adjustment factor for special bearing properties a_2" on page A-7). Note that dimensional changes can occur in normal use too.

Standard high temperature bearings for use at temperatures from **150 to 200 °C**, add silicon to the steel to improve heat resistance. This results in a bearing with excellent rolling fatigue life with minimal dimensional change or softening at high temperatures.

A variety of heat resistant steels are also incorporated in bearings to minimize softening and dimensional changes when used at high temperatures. Two of these are high speed molybdenum steel and high speed tungsten steel. For bearings requiring heat resistance in high speed applications, there is also heat resistant case hardening molybdenum steel.

4) Corrosion resistant bearing steel

For applications requiring high corrosion resistance, **stainless steel** is used. To achieve this corrosion resistance a large proportion of the alloying element chrome is added to martensite stainless steel.

5) Induction hardened steel

Besides the use of surface hardening steel, induction hardening is also utilized for bearing raceway surfaces, and for this purpose **mid-carbon steel** is mainly used for its lower carbon content instead of through hardening steel.

For deep hardened layers required for **larger bearings** and **bearings with large surface dimensions**, **mid-carbon steel is fortified with chromium and molybdenum**.

6) Other bearing materials

For ultra-high-speed applications and applications requiring very high level corrosion resistance, ceramic bearing materials such as Si_3N_4 are also available.

7.1.2 Characteristics of bearing materials

1) Dimensional change of bearings

Dimensions of bearings used for a long time may change depending on the use condition. This phenomenon is called dimensional change.

<Mechanism of dimensional change>

A standard bearing steel structure contains a small amount of austenite in the matrix of hard martensite. This austenite is partially retained austenite without being transformed into martensite in the cooling process of the bearing steel quenching process, and is called residual austenite.

Since the residual austenite is an unstable structure, it is transformed into a stable structure (martensite) when the bearing is being used. This structure transformation is the cause of the dimensional change of bearings.

Fig. 7.1 shows measured values of dimensional change of a standard bearing held at 120 °C over an extended period of time.

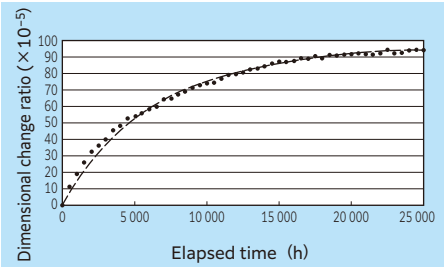


Fig. 7.1 Example of dimensional change rate of standard bearings that are held at 120 °C for a long time (measured values)

The dimensional change rate becomes larger as the elapsed time or the temperature of exposure increases.

Depending on the use condition, dimensional change may occur with bearings made of general bearing steel that did not reach 100 °C, which is the normal limit.

Bearings that underwent dimension stabilization treatment (TS treatment) have a significantly lower dimensional change. For details, please contact **NTN** Engineering.

<Dimensional change problems and countermeasures>

Among dimensional change, particular attention should be paid to inner ring expansion. When the inner ring expands by dimensional change, the interference between the inner ring and the shaft decreases, and the bearing may be heavily damaged by creeping or axial movement. Therefore, **when a bearing is to be used for a long time, the bearing specifications and fixing method must be determined with the interference decrease due to dimensional change taken into consideration.** For example, the interference can be increased (see section "4. Bearing fits") or fixing in the axial direction can be reinforced (see section "8. Shaft and housing design").

<Situations to monitor dimensional change>

The dimensional change of bearings is expressed by the bearing dimension × dimensional change rate. Therefore, under a given temperature and elapsed time, larger bearings show greater dimensional change. Pay particular attention to the amount of dimensional change when large bearings are to be used with fits with small interference.

In addition, dimensional change does not occur during the rotation inspection immediately following bearing installation. It is observed after a long-period operation. Therefore, for machines and parts used for a long time, periodic inspection is effective for preventing problems. For detailed consideration, please consult **NTN** Engineering beforehand.

7.2 Cage

Bearing cage materials must have the strength to withstand rotational vibrations and shock loads. These materials must also have a low friction coefficient, be lightweight, and be able to withstand bearing operating temperatures.

7.2.1 Metal materials

For **small** and **medium-sized bearings**, pressed steel cages of **cold** or **hot rolled material** with a low carbon content of approx. 0.1 % are used. However, depending on the application, **austenitic stainless steel** is also used. Machined cages are generally used for **large bearings. Carbon steel for machine structures** or **high-strength cast brass** is frequently used for the cages.

7.2.2 Resin materials

Recently resin cages are used in place of metals because the material is lightweight and easy to mold into complicated shapes. On the other hand, resins have disadvantages such as lower strength and heat resistance. Therefore, it is important to select resin materials that take advantage of their characteristics.

The resin materials are rarely used without being filled, and are usually reinforced with glass fiber (GF) or carbon fiber (CF).

[Characteristics of resin materials]

(Advantages)	(Disadvantages)
• Lightweight • High corrosion resistance • High self-lubricating performance with less abrasion powder • Low noise • Can easily be molded into complicated shapes and various designs • High productivity	• Lower strength compared with metal • Lower heat resistance compared with metal • The strength and elastic modulus largely vary widely with temperature. • The physical properties (strength) may change when resins are exposed to high temperatures for a long period. • The strength may deteriorate when resins are exposed to certain types of chemical or oils. • The thermal expansion coefficient is high, and the dimensional change is larger compared with metal.

<<Polyamide (PA): 66, 46>>

Polyamide is suitable for general cage materials because it is low cost and has high strength, heat resistance, wear resistance, and formability. This material has disadvantages such as high water absorbency, physical property deterioration and dimensional change due to water absorption. On the other hand, water absorption increases flexibility and toughness, enhancing the ease of assembly and shock resistance of cages.

However, the physical property (strength) may deteriorate rapidly at high temperatures when polyamide is exposed to lubricating oil containing an S (sulfur) type or P (phosphorus) type extreme pressure additive.

Polyamide 66 reinforced with glass fibers is the most used material because it has excellent performance as a cage material.

<<Polyphenylene sulfide (PPS)>>

Polyphenylene sulfide has high heat resistance (continuous operating temperature: 220 to 240 °C), chemical resistance, melt fluidity, and formability.

<<Polyetheretherketone (PEEK)>>

Polyetheretherketone has the highest heat resistance among thermoplastic resins (continuous operating temperature: 240 to 260 °C). It has excellent self-lubricating performance, shock resistance, and chemical resistance, but it is very expensive.

<<Fabric reinforced phenolic resin>>

Phenolic resin is a thermosetting resin. It overcomes the disadvantages of hard and brittle phenolic resin having low shock resistance using fabric reinforcement. It is lightweight and has high lubricity and good mechanical properties. Injection molding cannot be performed because of the thermosetting property, so cages are made by machining.

7.3 Rubber seal materials

Synthetic rubbers with high heat resistance and oil resistance are used as materials for seals. Different rubber is used depending on the degree of heat resistance.

<<Nitrile rubber (NBR)>>

Nitrile rubber has high oil resistance, heat resistance, and wear resistance, and is widely used as a general material for seals. The allowable temperature range is −20 to 120 °C.

<<Acrylic rubber (ACM)>>

Acrylic rubber has high heat resistance and can be used above the application temperature of NBR. It has excellent oil resistance but swells in ester oil. An ester oil resistant grade is also available. The allowable temperature range is −15 to 150 °C.

<<Fluorinated rubber (FKM)>>

Fluorinated rubber has excellent heat resistance, oil resistance, and chemical resistance. It is deteriorated by amine, so attention needs to be paid when combining fluorinated rubber with urea grease that precipitates amine at high temperatures. The allowable temperature range is −20 to 230 °C.

8. Shaft and housing design

Depending upon the design of a shaft or housing, the shaft may be influenced by an unbalanced load or other factors which can then cause large fluctuations in bearing efficiency. For example, depending on the dimensional accuracy and shape accuracy of the shaft and housing, there could be insufficient interference fit with the bearing, leading to material creep during operation. When the machining accuracy of the shaft or the housing is insufficient or when there is an error in the installation, the inner ring or the outer ring of the bearing can become misaligned. Operation under this condition may cause excessive loading at the edges of the inner and outer rings as well as rolling elements, deteriorating the fatigue life. Furthermore, chipping damage may occur on the rib face of roller bearings due to heavy contact with the rolling element end surface while operating under misalignment. A speed deferential between the rolling elements and cage may apply abnormal force to the cage, causing damage. For this reason, it is necessary to pay attention to the following when designing shaft and housing:

(1) Bearing arrangement; most effective fixing method for bearing arrangement.
(2) Selection of shoulder height and fillet radius of housing and shaft.
(3) Shape precision and fitting dimensions; runout tolerance of shoulder area.
(4) Machining precision and mounting error of housing and shaft suitable for allowable alignment angle and permissible misalignment of bearing.

When the housing rigidity is insufficient, excessive deformation of the inner and outer rings may lead to poor distribution of loading among rolling elements, causing abnormal noise and deterioration of fatigue life. Therefore, the housing requires sufficient rigidity.

When two or more bearings are to be attached to a shaft, one typically serves as a fixed end bearing and the other serves as a floating end bearing to compensate for axial mounting error and allow for thermal expansion. In addition, when two or more bearings are to be attached to a housing, the design must allow through hole machining to improve the accuracy of the housing.

8.1 Fixing of bearings

When a bearing that receives axial loads and preloads is to be attached to a shaft or a housing, an axial fixing method that is sufficient to withstand the axial loading such as a tightening nut, bolts, or snap rings should be selected because a serious problem may be caused when the raceway moves in the axial direction.

In addition, **cylindrical roller bearings (NU and N types) that are to be mainly used as floating side bearings also need to be fixed in the axial direction because the raceway may move in the axial direction when the shaft is bent by a moment load, damaging the bearing.**

Table 8.1 shows general bearing fixing methods, and **Table 8.2** shows fixing methods for bearings with tapered bores.

Table 8.1 General bearing fixing methods

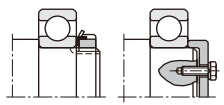
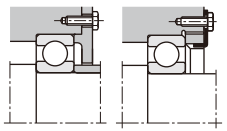
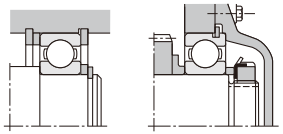
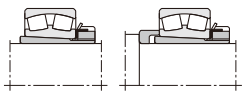
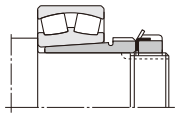
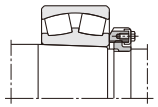
Inner ring clamp	Outer ring clamp	Snap ring
		
The most common method of fixing bearings in place is to use clamping nuts or bolts to hold the shaft or housing abutment against the ring end face. The tightening nuts and bolts must be fixed so that they will not be loosened by axial loads or vibration when the bearing is being used.		Use of snap rings regulated under JIS B 2804, B 2805, and B 2806, makes for a very simple construction. However, interference with chamfers, bearing installation dimensions, and other related specifications must be considered carefully. Snap rings are not suitable for applications requiring high accuracy or where the snap ring receives large axial loads.

Table 8.2 Fixing methods–bearings with tapered bores

Adapter sleeve mounting	Withdrawal sleeve mounting	Split ring mounting
		
When installing bearings on cylindrical shafts, adapter sleeves or withdrawal sleeves can be used to fix bearings in place axially. The adapter sleeve is fastened in place by frictional force between the shaft and bore diameter of the sleeve.		For installation of tapered bore bearings directly on tapered shafts, the bearing is held in place by a split ring inserted into a groove on the shaft, and is fixed in place with a split ring nut or screw.

8.2 Bearing fitting dimensions

8.2.1 Abutment height and fillet radius

The shaft and housing **abutment height** (h) should be **larger than the bearings' maximum allowable chamfer dimensions** ($r_{s\ max}$), such that the abutment directly contacts the flat part of the bearing end face. The **fillet radius** (r_a) must be **smaller than the bearing's minimum allowable chamfer dimension** ($r_{s\ min}$) so that it does not interfere with bearing seating.

Table 8.3 lists abutment height (h) and fillet radius (r_a). For bearings to be subjected to very large axial loads, shaft abutments (h) should be higher than the values in the table.

Table 8.3 Fillet radius and abutment height

Unit: mm

$r_{s\ min}$	$r_{as\ max}$	h (Min.)	
		Normal use[1]	Special use[2]
0.05	0.05	0.3	
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	1.25	1
0.6	0.6	2.25	2
1	1	2.75	2.5
1.1	1	3.5	3.25
1.5	1.5	4.25	4
2	2	5	4.5
2.1	2	6	5.5
2.5	2	6	5.5
3	2.5	7	6.5
4	3	9	8
5	4	11	10
6	5	14	12
7.5	6	18	16
9.5	8	22	20
12	10	27	24
15	12	32	29
19	15	42	38

1) If a bearing supports a large axial load, the height of the shoulder must exceed the value given here.
2) Used when an axial load is light. These values are not suitable for tapered roller bearings, angular contact ball bearings and spherical roller bearings.
Note: $r_{as\ max}$ indicates maximum allowable fillet radius.

8.2.2 For spacer and ground undercut

In cases where a fillet radius ($r_{a\ max}$) larger than the bearing chamfer dimension is required to strengthen the shaft or to relieve stress concentration [see **Fig. 8.1(a)**], or abutment height is too low to afford adequate contact surface with the bearing [see **Fig. 8.1(b)**], the use of a spacer may be beneficial.

Relief dimensions for ground shaft and housing fitting surfaces are given in **Table 8.4**.

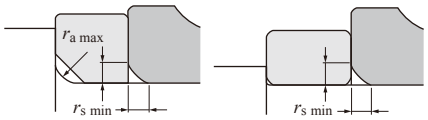
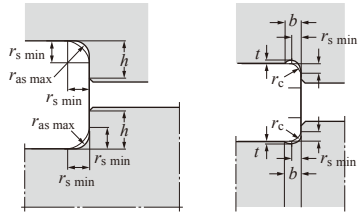


Fig. 8.1 Bearing mounting with spacer

Table 8.4 Relief dimensions for ground shaft

Unit: mm

$r_{s\ min}$	Relief dimensions		
	b	t	r_c
1	2	0.2	1.3
1.1	2.4	0.3	1.5
1.5	3.2	0.4	2
2	4	0.5	2.5
2.1	4	0.5	2.5
2.5	4	0.5	2.5
3	4.7	0.5	3
4	5.9	0.5	4
5	7.4	0.6	5
6	8.6	0.6	6
7.5	10	0.6	7



8.2.3 Fitting dimensions for thrust bearings

For thrust bearings, it is necessary to make the raceway washer back face sufficiently wide in relation to load and rigidity. Consequently, fitting dimensions from the dimension tables should be adopted (see **Fig. 8.2** and **Fig. 8.3**).

For this reason, **shaft and abutment heights will be larger than for radial bearings** (Refer to dimension tables for all thrust bearing fitting dimensions).

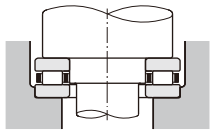


Fig. 8.2

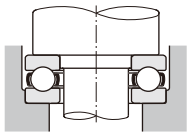


Fig. 8.3

8.3 Shaft and housing accuracy

Table 8.5 shows the required accuracies for shaft and housing fitting surface dimensions and configurations, as well as fitting surface roughness and abutment squareness for normal operating conditions.

Table 8.5 Shaft and housing accuracy

Concern		Shaft	Housing
Dimensional accuracy		IT6(IT5)	IT7(IT5)
Roundness (max.) Cylindricity		IT3	IT4
Abutment squareness		IT3	IT3
Fitting surface roughness Ra	Small size bearings	0.8	1.6
	Mid-large size bearings	1.6	3.2

Note: For precision bearings (P4, P5 accuracy), it is necessary to improve the circularity and cylindricity accuracies in this table to approximately 50 % of these values. For details, see the special catalog "**Precision Rolling Bearings (CAT. No. 2260/E)**".

MEMO

General Bearings

Bearing Data Table of Contents

NTN

NTN New Generation Bearings (ULTAGE™ series)

Introduction of ULTAGE™ series

"ULTAGE™" (a name created from the combination of "ultimate", signifying refinement, and "stage", signifying **NTN**'s intention that this series of products be employed in diverse applications) is the general name for **NTN**'s new generation of rolling bearings that are noted for their industry-leading performance.
NTN is developing and expanding the ULTAGE™ series of each bearing type. Please see the introductory article on the following pages. The corresponding dimensions are specified in the dimension tables of each bearing type.
For details, see the following **NTN** catalogs.

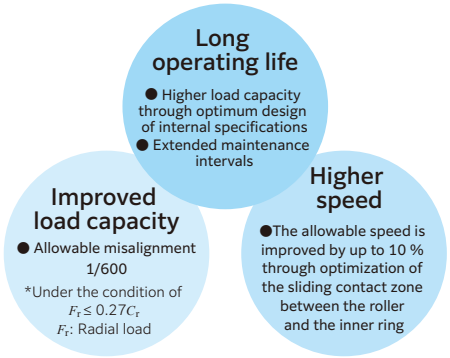
ULTAGE™ series large size tapered roller bearings [Metric] CAT.No.3035/E
ULTAGE™ series spherical roller bearings [Type EA, Type EM] ... CAT.No.3033/E

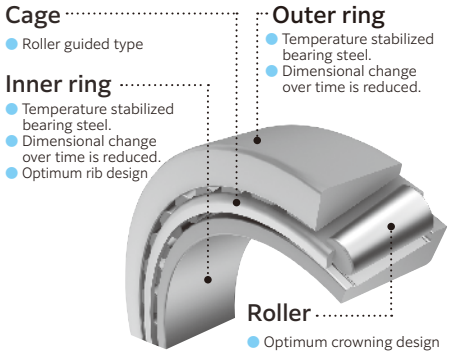
The following ULTAGE™ series bearings for special applications are also available.
For further details, please refer to the section of "C. Special Application Bearings".

ULTAGE™ series sealed four-row tapered roller bearings for rolling mill roll necks [CROU-LL type]
ULTAGE™ series sealed spherical roller bearings [WA type]
ULTAGE™ series sealed spherical roller bearings [EMLLX type]
ULTAGE™ series spherical roller bearings with high-strength cage [EMA type]

ULTAGE™ series large size tapered roller bearings [metric]

Large size tapered roller bearings (ULTAGE™ metric series with an outside diameter of ϕ270 mm or more) are the products developed to meet the demands of "long operating life", "improved load capability", and "higher speed" required for various industrial machinery.





Features

1. Long operating life

The optimization of internal specifications and industry leading load ratings have led to higher load capacities and longer operating lives.

(1) Rating life: 1.6 times longer (compared to conventional **NTN** products)

(2) Basic dynamic load rating: 16 % larger (compared to conventional **NTN** products)

2. Improved load capacity

Allowable misalignment (single row): 1/600

Optimization of the roller crowning has allowed a combination of heavy loads ($0.27C_r$) and allowable misalignment of 1/600.

Necessary minimum load: $0.04C_{0r}$

Fig. 1 shows the contact stress distribution of rollers considering an applied radial load of $F_r \leq 0.27C_r$. By optimizing the roller crowning, the edge stress is greatly reduced and the contact stress is made uniform compared with conventional **NTN** products.

[Evaluation conditions]

Bearing: 30328UUTG (ULTAGE™ product)
30328U (conventional **NTN** product)

Load: $0.27C_r$

Misalignment: 1/600

* The allowable misalignment differs depending on the loads and the bearing type. Please consult **NTN** Engineering.

3. Higher speed

The allowable speed is improved by up to 10 % (compared with the conventional **NTN** products) by optimizing the sliding contact zone between the roller and the inner ring, thus reducing the rotational torque and temperature rise (see **Fig. 2**, **Fig. 3**, and **Fig. 4**).

4. Dimensional change over time

Dimensional change of bearings over time has been reduced compared with conventional **NTN** products by applying special heat treatment to bearing steel.

● Reduction in dimensional change over time
Bearing steel ratio: 1/10
Carburizing (case hardened) steel ratio: 1/4

5. Interchangeability

The boundary dimensions conform to JIS B 1512-3 and ISO 355, and the installation dimensions are the same as that of the conventional **NTN** products.

In addition, the precision also conforms to JIS B 1514-1 and ISO 492.

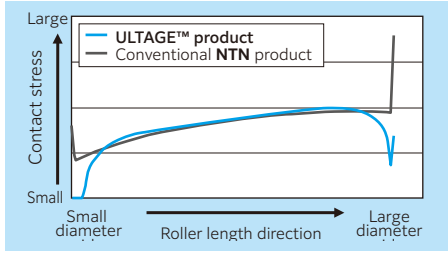


Fig. 1 Contact stress distribution of rollers

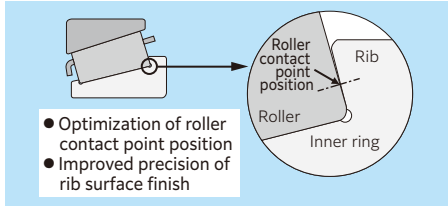


Fig. 2 Optimization of the sliding contact zone between the roller and inner ring

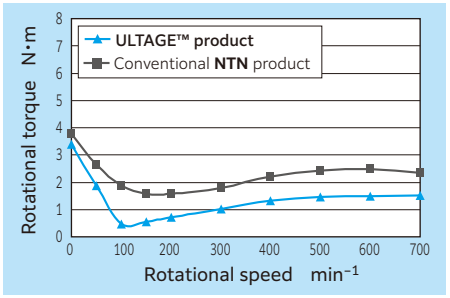


Fig. 3 Rotational torque test result

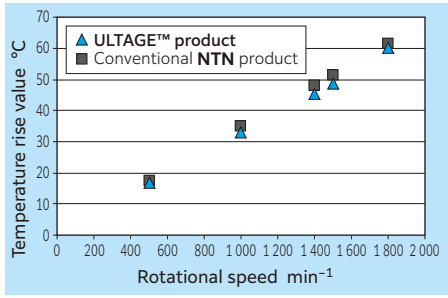
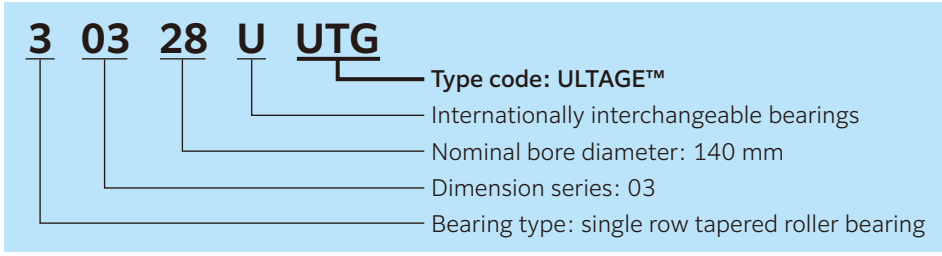


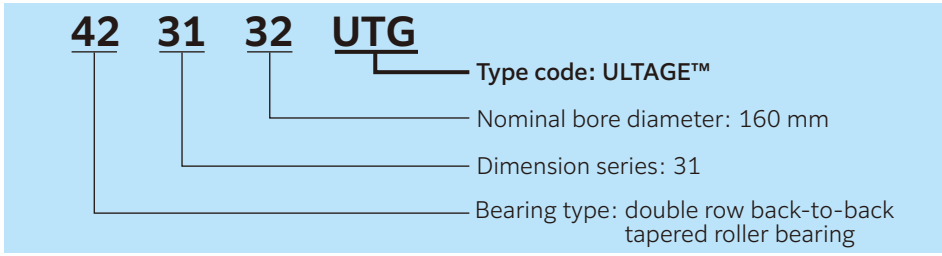
Fig. 4 Temperature rise test result

Bearing number

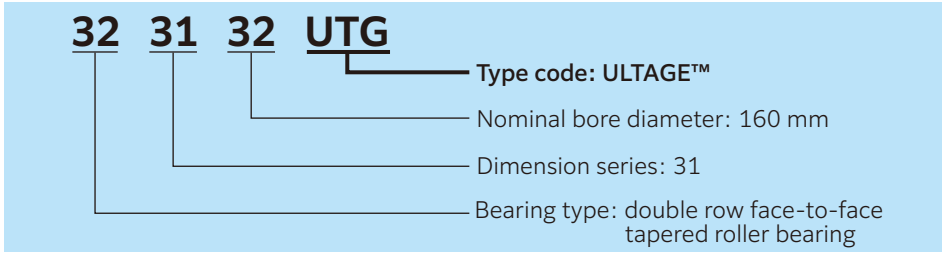
Single row tapered roller bearings



Double row back-to-back tapered roller bearings

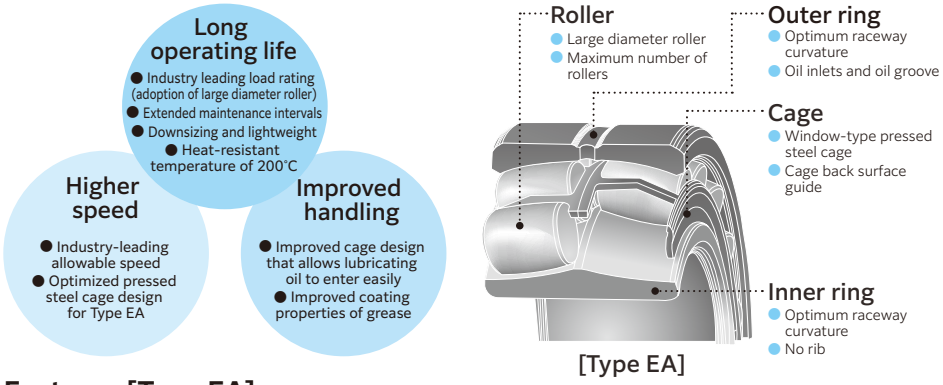


Double row face-to-face tapered roller bearings



ULTAGE™ series spherical roller bearings [Type EA, Type EM]

ULTAGE™ series spherical roller bearings are the products developed to meet the demands of "long operating life", "higher speed", and "Improved handling" that are required for various industrial machinery.



[Type EA]

Features [Type EA]

1. Long operating life

Increasing the roller diameter, maximizing the number of rollers, and industry-leading load ratings have led to higher load capacities and longer operating lives. Longer maintenance intervals can be achieved (see **Fig. 1**).

(1) Rating life: Up to 3.7 times longer (compared to conventional **NTN** products)
(2) Basic dynamic load rating: Up to 50 % higher (compared to conventional **NTN** products)
(3) Basic static load rating: Up to 35 % higher (compared to conventional **NTN** products)

2. Higher speed

Higher speed is realized through the adoption of a new pressed steel cage design.

[Allowable speed: Up to 20 % higher (compared to conventional **NTN** products)]

3. Improved handling

Adoption of the simple window-type new pressed steel cage improved the workability at the time of assembly, disassembly, and grease application.

(1) Improved application of grease to the roller surface
(2) Improved roller retention contributes to easier assembly/disassembly

4. Standard use of pressed steel cage

For the pressed steel cage, "window-type" with rigidity is adopted, and the roller pocket is provided with four tabs (projections) (see **Fig. 2** and **Fig. 3**).

(1) Cage back surface used for guidance.
(2) The four pocket tabs stabilize the position of rollers.
(3) The new pocket shape allows consistent supply of lubricating oil and grease to the internal bearing surfaces (see **Fig. 4**).
(4) Special surface treatment is applied to the entire surface to improve the abrasion resistance.

5. Reduced size and weight

High load capacity has allowed for downsizing and a lighter weight.

Comparison example

Bearing number	Load rating (kN)		Boundary dimension (mm)	Bearing volume (cm^3)	Mass (kg)
	C_r	C_{0r}			
22220B	350	415	ϕ100×ϕ180×46	810	4.95
22218EA	**384**	**398**	**ϕ90×ϕ160×40**	**550**	**3.34**

The volume weight and mass weight can be reduced by about 30 %.

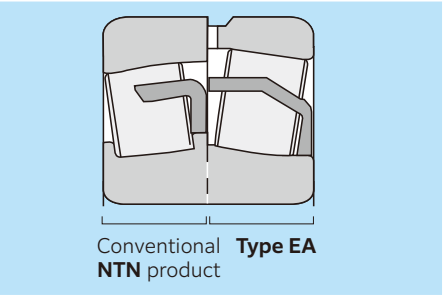


Fig. 1

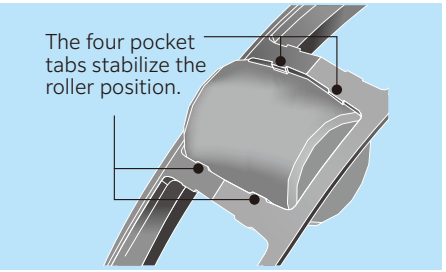


Fig. 2

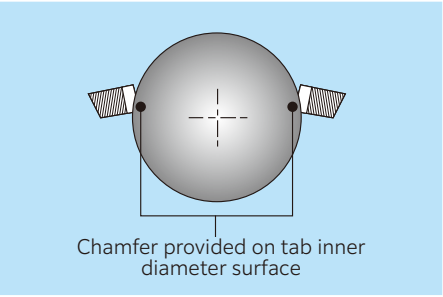


Fig. 3

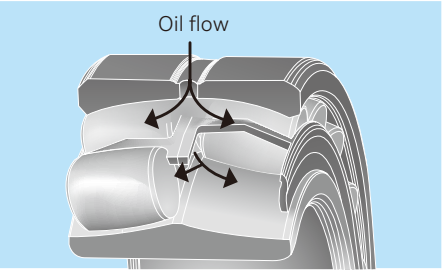


Fig. 4

Bearing number

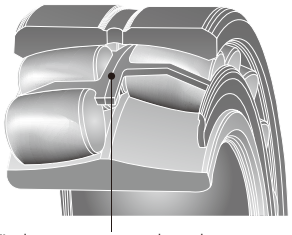
Spherical Roller Bearings

222 20 EA K D1 C3

- **Internal clearance code**
  No code: normal clearance
  C3: C3 clearance
- **Oil inlet and oil groove code**
  D1 : oil inlet and oil groove
  W33 : oil inlet and oil groove (Manufacturing in Europe)
- **External configuration code**
  No code : bore diameter cylindrical bore
  K : bore diameter tapered bore
- **Type code**
  EA : window-type pressed steel cage
  EM : one-piece high strength, machined brass cage
- **Bore diameter code**
- **Dimension series code**

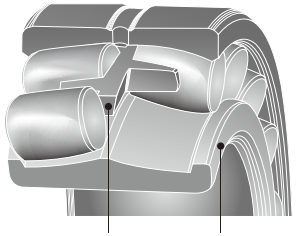
Type EM has a roller-guided one-piece machined cage and an inner ring with outboard ribs providing retention for the rollers. Type EM is particularly suitable for use in conditions subjected to severe vibrations and impacts. Internal specifications are the same as the type EA.

Type EA



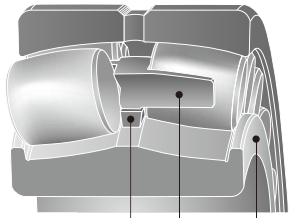
Window-type pressed steel cage

Type EM



One-piece machined cage Inner ring rib

Type EM (large size)



Guide ring One-piece machined cage Inner ring rib

[Allowable axial load]

$F_a/F_r \leq e$
F_a : Axial load
F_r : Radial load
e : Constant (see dimension table)

If this bearing type is used for a vertical shaft or under a large axial load, the load on the rollers of the row that is not subject to the axial load can become small. This small load on the rollers can result in skidding of the rollers, which can cause bearing damage. If the ratio of the radial load exceeds the factor e in the dimension table ($F_a/F_r > e$), consult **NTN** Engineering.

[Allowable misalignment]

- Normal load or more ····· 1/115
- Light load ····· 1/30

* Misalignment beyond the above limits may cause the roller to protrude from the outer ring, causing interference with the peripheral components.

Deep Groove Ball Bearings

1. Design features and characteristics

Deep groove ball bearings are very widely used. A deep groove is formed on the inner and outer ring of the bearing enabling the bearing to sustain radial and axial loads in either direction as well as the complex loads which result from the combination of these forces. Deep groove ball bearings are suitable for high speed applications.

The dimension table contains drawing numbers of various cage types and special shapes shown in **Fig. 1**.

Drawing 1 shows a pressed cage; **Drawing 2** through **Drawing 7** show machined cages. **Drawing 3** through **Drawing 6** show positions and shapes of notches in the inner ring; **Drawing 7** shows a bearing with a key groove in the inner ring.

While pressed cages are generally used, machined cages are used for larger sized bearings or bearings for high speed.

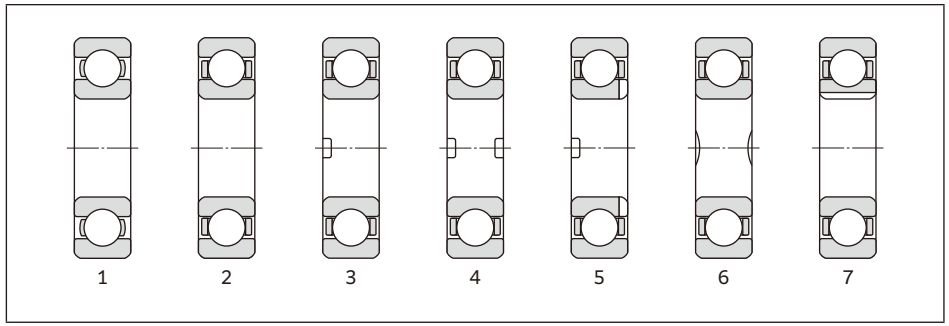


Fig. 1 Drawings of deep groove ball bearings

2. Dimensional and rotational accuracy

Refer to **Table 3.3** (pages A-18 and A-19).

3. Recommended fits

Refer to **Table 4.2** (pages A-33 and A-34).

4. Bearing internal clearance

Refer to **Table 5.2** (page A-40).

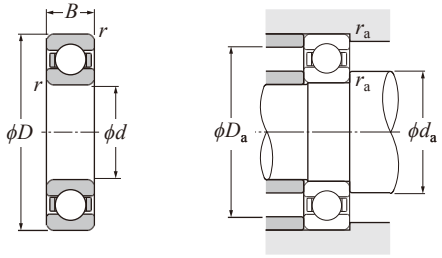
5. Allowable misalignment

1/1 500 to 1/300

6. Precautions

Slippage between the balls and raceways may occur when bearings are operated under small loads and may cause smearing. This is most apparent when a large deep groove ball bearing, in which the mass of the balls and cage is large, is used.

For additional details, please contact **NTN** Engineering.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

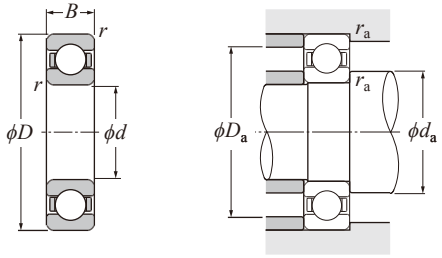
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 100-130 mm

Boundary dimensions				Basic load rating dynamic	Basic load rating static	Fatigue load limit	Factor	Bearing number	Drawing 2) No.	Installation-related dimensions			Mass
mm				kN		kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0			d_a Min.	D_a Max.	r_{as} Max.	(approx.)
100	125	13	1	21.7	21.2	1.33	16.0	**6820**	1	105	120	1	0.31
	140	20	1.1	45.5	39.5	2.44	16.4	**6920**	1	106.5	133.5	1	0.78
	150	16	1	39.0	36.5	2.18	16.4	**16020**	1	105	145	1	0.91
	150	24	1.5	66.5	54.0	3.50	15.9	**6020**	1	108	142	1.5	1.15
	180	34	2.1	135	93.0	6.15	14.4	**6220**	1	111	169	2	3.14
	215	47	3	192	141	8.75	13.2	**6320**	1	113	202	2.5	7
105	130	13	1	22.0	22.0	1.35	15.9	**6821**	1	110	125	1	0.33
	145	20	1.1	47.0	42.0	2.52	16.5	**6921**	1	111.5	138.5	1	0.81
	160	18	1	57.5	50.5	3.00	16.3	**16021**	1	110	155	1	1.2
	160	26	2	80.5	65.5	4.15	15.8	**6021**	1	114	151	2	1.59
	190	36	2.1	147	105	6.75	14.4	**6221**	1	116	179	2	3.7
	225	49	3	204	153	9.35	13.2	**6321**	1	118	212	2.5	8.05
110	140	16	1	27.5	28.2	1.68	16.0	**6822**	1	115	135	1	0.51
	150	20	1.1	48.5	44.5	2.60	16.6	**6922**	1	116.5	143.5	1	0.85
	170	19	1	63.5	56.5	3.25	16.3	**16022**	1	115	165	1	1.46
	170	28	2	91.0	73.0	4.55	15.6	**6022**	1	119	161	2	1.96
	200	38	2.1	160	117	7.35	14.3	**6222**	1	121	189	2	4.36
	240	50	3	227	179	10.5	13.1	**6322**	1	123	227	2.5	9.54
120	150	16	1	32.0	33.0	1.89	16.0	**6824**	1	125	145	1	0.55
	165	22	1.1	59.0	54.0	3.05	16.5	**6924**	1	126.5	158.5	1	1.15
	180	19	1	70.0	63.5	3.50	16.4	**16024**	1	125	175	1	1.56
	180	28	2	94.0	79.5	4.65	15.9	**6024**	1	129	171	2	2.07
	215	40	2.1	172	131	7.95	14.4	**6224**	1	131	204	2	5.15
	260	55	3	229	185	10.5	13.5	**6324**	1	133	247	2.5	12.4
130	165	18	1.1	41.0	41.0	2.25	16.1	**6826**	1	136.5	158.5	1	0.8
	180	24	1.5	72.0	67.5	3.65	16.5	**6926**	1	138	172	1.5	1.52

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

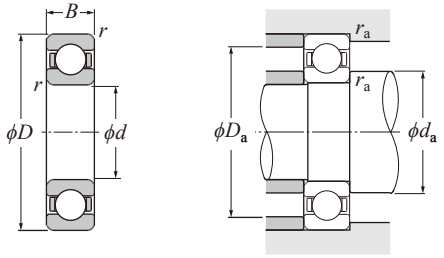
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 130-160 mm

Boundary dimensions				Basic load rating dynamic	Basic load rating static	Fatigue load limit	Factor	Bearing number	Drawing 2) No.	Installation-related dimensions			Mass
mm				kN		kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0			d_a Min.	D_a Max.	r_{as} Max.	(approx.)
130	200	22	1.1	88.5	79.5	4.25	16.2	**16026**	1	136.5	193.5	1	2.31
	200	33	2	118	101	5.70	15.8	**6026**	1	139	191	2	3.16
	230	40	3	185	146	8.55	14.5	**6226**	1	143	217	2.5	5.82
	280	58	4	254	214	11.7	13.6	**6326**	1	146	264	3	15.3
140	175	18	1.1	42.5	44.5	2.35	16.0	**6828**	1	146.5	168.5	1	0.85
	190	24	1.5	74.0	71.5	3.70	16.6	**6928**	1	148	182	1.5	1.62
	210	22	1.1	91.0	85.0	4.35	16.4	**16028**	1	146.5	203.5	1	2.45
	210	33	2	122	109	5.85	15.9	**6028**	1	149	201	2	3.35
	250	42	3	184	150	8.40	14.8	**6228**	1	153	237	2.5	7.57
	300	62	4	280	246	13.0	13.6	**6328**	1	156	284	3	18.5
150	190	20	1.1	53.0	55.0	2.80	16.1	**6830**	1	156.5	183.5	1	1.16
	210	28	2	94.0	90.5	4.55	16.5	**6930**	1	159	201	2	2.47
	225	24	1.1	107	101	5.00	16.4	**16030**	1	156.5	218.5	1	3.07
	225	35	2.1	139	126	6.55	15.9	**6030**	1	161	214	2	4.08
	230	35	2.5	133	118	6.10	16.0	**SC3002**	3	162	218	2	5.18
	270	45	3	195	168	9.05	15.1	**6230**	1	163	257	2.5	9.41
	320	65	4	305	284	14.5	13.9	**6330**	1	166	304	3	22
160	200	20	1.1	53.5	57.0	2.82	16.1	**6832**	1	166.5	193.5	1	1.23
	220	28	2	96.5	96.0	4.65	16.6	**6932**	1	169	211	2	2.61
	229.5	33	2.5	119	111	5.45	16.2	**SC3209**	2	172	218	2	4.35
	229.5	36	2.5	133	119	6.00	16.0	**SC3207**	2	172	218	2	4.75
	230	33	2.5	119	111	5.45	16.2	**SC3210**	2	172	218	2	4.39
	240	25	1.5	109	108	5.10	16.5	**16032**	1	168	232	1.5	3.64
	240	38	2.1	158	144	7.30	15.9	**6032**	1	171	229	2	5.05
	290	48	3	205	186	9.45	15.4	**6232**	1	173	277	2.5	11.7
	340	68	4	310	286	14.2	13.9	**6332**	1	176	324	3	26

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

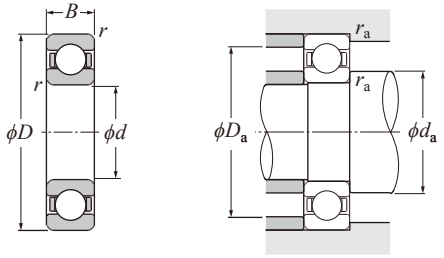
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 170-220 mm

Boundary dimensions				Basic load rating			Fatigue load limit	Factor	Bearing number	Drawing No. 2)	Installation-related dimensions			Mass
				dynamic	static									
mm				kN			kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0				d_a Min.	D_a Max.	r_{as} Max.	(approx.)
170	215	22	1.1	66.5	70.5	3.35	16.1	**6834**	1		176.5	208.5	1	1.63
	230	28	2	95.0	95.5	4.50	16.5	**6934**	1		179	221	2	2.74
	260	28	1.5	131	128	5.90	16.4	**16034**	1		178	252	1.5	4.93
	260	42	2.1	187	172	8.55	15.8	**6034**	1		181	249	2	6.76
	310	52	4	235	223	11.1	15.3	**6234**	1		186	294	3	14.5
	360	72	4	360	355	17.0	13.6	**6334**	1		186	344	3	30.7
180	225	22	1.1	67.0	73.0	3.40	16.1	**6836**	2		186.5	218.5	1	2.03
	250	33	2	122	119	5.45	16.5	**6936**	2		189	241	2	4.76
	280	31	2	129	134	5.85	16.5	**16036**	1		189	271	2	6.49
	280	46	2.1	210	199	9.70	15.6	**6036**	1		191	269	2	8.8
	320	52	4	252	241	11.9	15.1	**6236**	1		196	304	3	15.1
	380	75	4	390	405	19.0	13.9	**6336**	1		196	364	3	35.6
190	240	24	1.5	81.0	88.0	4.00	16.1	**6838**	2		198	232	1.5	2.62
	260	33	2	125	127	5.65	16.6	**6938**	2		199	251	2	4.98
	290	31	2	149	156	6.70	16.6	**16038**	1		199	281	2	6.77
	290	46	2.1	218	215	10.1	15.8	**6038**	1		201	279	2	9.18
	340	55	4	282	281	13.5	15.0	**6238**	1		206	324	3	18.2
	400	78	5	395	415	18.9	14.1	**6338**	1		210	380	4	41
195	270	35	2.5	145	147	6.45	16.5	**SC3904**	2		207	258	2	5.94
200	250	24	1.5	82.0	91.5	4.05	16.1	**6840**	2		208	242	1.5	2.73
	280	38	2.1	174	168	7.45	16.2	**6940**	2		211	269	2	7.1
	310	34	2	157	160	6.65	16.6	**16040**	1		209	301	2	8.68
	310	51	2.1	241	243	11.2	15.6	**6040**	1		211	299	2	11.9
	360	58	4	298	310	14.4	15.2	**6240**	1		216	344	3	21.6
	420	80	5	455	500	22.3	13.8	**6340**	1		220	400	4	46.3
220	270	24	1.5	84.5	98.0	4.15	16.0	**6844**	2		228	262	1.5	3

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

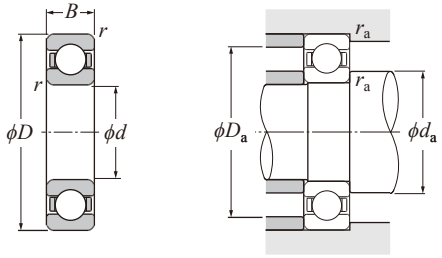
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 220-280 mm

Boundary dimensions				Basic load rating			Fatigue load limit	Factor	Bearing number	Drawing No. 2)	Installation-related dimensions			Mass
				dynamic	static									
mm				kN			kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0				d_a Min.	D_a Max.	r_{as} Max.	(approx.)
220	300	38	2.1	178	180	7.55	16.4	**6944**	2		231	289	2	7.69
	309.5	38	2.5	195	202	8.50	16.3	**SC4401**	2		232	298	2	8.77
	319.5	46	2.5	214	220	9.35	16.1	**SC4405**	2		232	308	2	12
	340	37	2.1	200	216	8.65	16.5	**16044**	1		231	329	2	11.3
	340	56	3	267	289	12.5	15.8	**6044**	1		233	327	2.5	15.7
	400	65	4	330	365	15.8	15.3	**6244**	1		236	384	3	30.2
	460	88	5	465	520	22.0	14.3	**6344**	1		240	440	4	60.8
230	329.5	40	2.5	212	227	9.25	16.3	**SC4605**	2		242	318	2	10.8
	339.5	45	3	248	266	11.2	16.0	**SC4609**	7		244	326	2.5	13.7
240	300	28	2	94.0	112	4.55	15.9	**6848**	2		249	291	2	4.6
	320	38	2.1	188	203	8.05	16.5	**6948**	2		251	309	2	8.28
	360	37	2.1	197	217	8.30	16.5	**16048**	1		251	349	2	12.1
	360	56	3	276	310	12.8	16.0	**6048**	1		253	347	2.5	16.8
	440	72	4	400	470	19.6	15.2	**6248**	2		258	422	3	51.7
	500	95	5	485	590	24.0	14.6	**6348**	2		262	478	4	93.6
250	349.5	46	2.5	237	262	10.4	16.2	**SC5003**	2		262	338	2	13.4
260	320	28	2	96.5	120	4.65	15.8	**6852**	2		269	311	2	5
	360	46	2.1	245	280	10.9	16.3	**6952**	2		271	349	2	13.9
	379.5	56	4	280	320	12.6	16.0	**SC5206**	7		278	362	3	20.8
	400	44	3	252	299	11.1	16.5	**16052**	1		273	387	2.5	18.5
	400	65	4	325	375	15.1	15.8	**6052**	1		276	384	3	25
	480	80	5	445	540	22.0	15.1	**6252**	2		282	458	4	65.7
	540	102	6	555	710	27.8	14.6	**6352**	2		288	512	5	116
280	350	33	2	151	177	6.65	16.1	**6856**	2		289	341	2	7.4
	380	46	2.1	252	299	11.1	16.5	**6956**	2		291	369	2	14.8
	420	44	3	257	315	11.3	16.5	**16056**	2		293	407	2.5	23

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

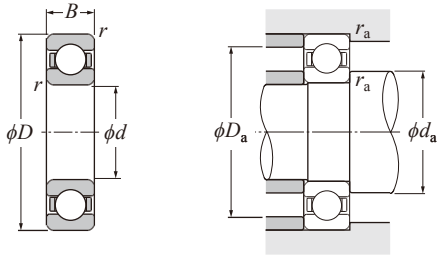
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 280-380 mm

Boundary dimensions				Basic load rating dynamic	Basic load rating static	Fatigue load limit	Factor	Bearing number	Drawing 2) No.	Installation-related dimensions			Mass
mm				kN		kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0			d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	420	65	4	360	420	16.9	15.5	**6056**	2	296	404	3	31
280	500	80	5	485	600	23.7	14.8	**6256**	2	302	478	4	70.9
	580	108	6	585	760	28.6	14.5	**6356**	2	308	552	5	142
	380	38	2.1	179	210	7.60	16.1	**6860**	2	311	369	2	10.5
	420	56	3	305	375	13.7	16.2	**6960**	2	313	407	2.5	23.5
300	460	50	4	325	410	14.5	16.3	**16060**	2	316	444	3	32.5
	460	74	4	395	480	18.4	15.6	**6060**	2	316	444	3	43.8
	540	85	5	515	670	25.6	15.1	**6260**	2	322	518	4	88.9
310	429.5	60	4	305	380	13.5	16.3	**SC6201**	2	328	412	3	25.8
	400	38	2.1	186	228	7.95	16.1	**6864**	2	331	389	2	10.9
	440	56	3	315	405	14.1	16.4	**6964**	2	333	427	2.5	24.8
	449.5	56	3	305	395	13.6	16.5	**SC6406**	2	334	436	2.5	27.6
320	480	50	4	335	440	14.9	16.4	**16064**	2	336	464	3	34.2
	480	74	4	410	530	19.3	15.7	**6064**	2	336	464	3	46.1
	580	92	5	590	805	29.8	15.0	**6264**	2	342	558	4	110
	420	38	2.1	189	236	8.05	16.0	**6868**	2	351	409	2	11.5
	460	56	3	325	430	14.4	16.5	**6968**	2	353	447	2.5	26.2
340	520	57	4	380	515	17.0	16.3	**16068**	2	356	504	3	47.1
	520	82	5	465	610	21.9	15.6	**6068**	2	360	500	4	61.8
	620	92	6	585	820	28.8	15.3	**6268**	2	368	592	5	129
	440	38	2.1	207	258	8.55	16.0	**6872**	2	371	429	2	12.3
	480	56	3	330	455	14.8	16.5	**6972**	2	373	467	2.5	27.5
360	540	57	4	390	550	17.6	16.4	**16072**	2	376	524	3	49.3
	540	82	5	485	670	23.0	15.7	**6072**	2	380	520	4	64.7
	650	95	6	615	905	30.5	15.4	**6272**	2	388	622	5	145
380	480	46	2.1	256	340	10.8	16.1	**6876**	2	391	469	2	19.7

1) Smallest allowable dimension for chamfer dimension *r*.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

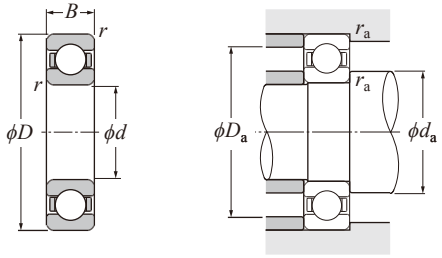
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 380-530 mm

Boundary dimensions				Basic load rating dynamic	Basic load rating static	Fatigue load limit	Factor	Bearing number	Drawing 2) No.	Installation-related dimensions			Mass
mm				kN		kN				mm			kg
d	D	B	$r_{s\,min}$ 1)	C_r	C_{0r}	C_u	f_0			d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	520	65	4	360	510	15.9	16.6	**6976**	2	396	504	3	39.8
380	560	57	4	400	590	18.1	16.5	**16076**	2	398	542	3	50.1
	560	82	5	505	725	24.1	15.9	**6076**	2	400	540	4	67.5
	500	46	2.1	251	340	10.6	16.0	**6880**	2	411	489	2	20.6
	540	65	4	370	535	16.4	16.5	**6980**	2	416	524	3	41.6
400	600	63	5	410	620	18.4	16.5	**16080**	2	422	578	4	65.8
	600	90	5	565	825	26.9	15.7	**6080**	2	420	580	4	87.6
	520	46	2.1	288	405	12.4	16.1	**6884**	2	431	509	2	21.6
420	560	65	4	380	560	16.8	16.4	**6984**	2	436	544	3	43.4
	620	90	5	590	895	28.3	15.8	**6084**	2	440	600	4	91.1
	540	46	2.1	292	420	12.6	16.0	**6888**	2	451	529	2	22.5
440	600	74	4	405	615	18.0	16.4	**6988**	2	456	584	3	60
	650	94	6	585	900	27.4	16.0	**6088**	2	468	622	5	104
450	629	80	4	485	770	22.1	16.5	**SC9001**	6	468	611	3	76
	580	56	3	350	515	15.1	16.2	**6892**	2	473	567	2.5	34.8
460	620	74	4	415	645	18.5	16.4	**6992**	2	476	604	3	62.2
	680	100	6	670	1 080	32.5	15.8	**6092**	2	488	652	5	122
	600	56	3	355	540	15.4	16.1	**6896**	2	493	587	2.5	36.2
480	650	78	5	480	770	21.5	16.5	**6996**	2	500	630	4	73
	700	100	6	670	1 090	32.0	15.9	**6096**	2	508	672	5	126
	620	56	3	360	560	15.7	16.1	**68/500**	2	513	607	2.5	37.5
500	670	78	5	490	805	22.2	16.5	**69/500**	2	520	650	4	75.5
	720	100	6	695	1 170	33.5	16.0	**60/500**	2	528	692	5	130
	650	56	3	365	580	15.9	16.0	**68/530**	2	543	637	2.5	39.5
530	710	82	5	505	845	22.5	16.4	**69/530**	2	552	688	4	89.1
	780	112	6	715	1 270	34.0	16.2	**60/530**	2	558	752	5	178

1) Smallest allowable dimension for chamfer dimension *r*.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

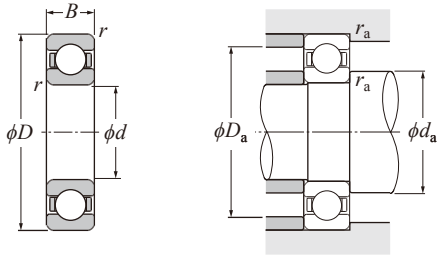
$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 560-850 mm

Boundary dimensions				Basic load rating			Fatigue load limit	Factor	Bearing number	Drawing No.[2]	Installation-related dimensions			Mass
				dynamic	static									
mm				kN			kN				mm			kg
d	D	B	$r_{s\,min}$[1]	C_r	C_{0r}	C_u	f_0				d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	680	56	3	370	600	16.1	16.0	**68/560**	2		573	667	2.5	41.5
560	750	85	5	580	1 020	26.5	16.5	**69/560**	2		582	728	4	103
	820	115	6	780	1 410	37.5	16.1	**60/560**	2		588	792	5	200
	730	60	3	415	705	18.2	16.0	**68/600**	2		613	717	2.5	51.7
600	800	90	5	655	1 200	30.0	16.5	**69/600**	2		622	778	4	122
	870	118	6	805	1 510	38.5	16.3	**60/600**	2		628	842	5	228
	780	69	4	465	820	20.5	16.0	**68/630**	2		648	762	3	71.6
630	850	100	6	755	1 450	35.5	16.5	**69/630**	2		658	822	5	158
	920	128	7.5	930	1 770	45.0	16.0	**60/630**	2		666	884	6	280
	820	69	4	470	850	20.7	15.9	**68/670**	2		688	802	3	75.1
670	900	103	6	775	1 530	36.5	16.5	**69/670**	2		698	872	5	181
	980	136	7.5	1 080	2 120	53.5	15.8	**60/670**	2		706	944	6	336
	870	74	4	485	910	21.5	15.9	**68/710**	2		728	852	3	91.1
710	950	106	6	790	1 600	37.0	16.4	**69/710**	2		738	922	5	205
	1 030	140	7.5	1 130	2 310	55.5	16.0	**60/710**	2		746	994	6	379
	920	78	5	535	1 040	24.0	15.9	**68/750**	2		772	898	4	107
750	1 000	112	6	805	1 670	37.5	16.3	**69/750**	2		778	972	5	238
	1 090	150	7.5	1 170	2 500	57.5	16.1	**60/750**	2		765	1 075	6	457
	980	82	5	540	1 070	23.9	15.8	**68/800**	2		822	958	4	127
800	1 060	115	6	885	1 900	41.5	16.4	**69/800**	2		828	1 032	5	270
	1 150	155	7.5	1 200	2 690	59.0	16.3	**60/800**	2		836	1 114	6	515
	1 030	82	5	555	1 140	24.7	15.7	**68/850**	2		872	1 008	4	135
850	1 120	118	6	995	2 240	47.5	16.4	**69/850**	2		878	1 092	5	305
	1 220	165	7.5	1 240	2 880	60.5	16.4	**60/850**	2		886	1 184	6	615

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.
Note: Inner rings of the four models (**69/750**, **69/800**, **68/850**, and **69/850**) may have lifting holes provided during manufacturing. Please consult **NTN** Engineering before using these lifting holes.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{0r} = 0.6F_r + 0.5F_a$
When,
$P_{0r} < F_r$ use $P_{0r} = F_r$.

d 900-1 250 mm

Boundary dimensions				Basic load rating			Fatigue load limit	Factor	Bearing number	Drawing No.[2]	Installation-related dimensions			Mass
				dynamic	static									
mm				kN			kN				mm			kg
d	D	B	$r_{s\,min}$[1]	C_r	C_{0r}	C_u	f_0				d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	1 090	85	5	675	1 450	30.5	15.9	**68/900**	2		922	1 068	4	156
900	1 180	122	6	1 020	2 340	48.0	16.3	**69/900**	2		928	1 152	5	346
	1 280	170	7.5	1 270	3 100	62.0	16.6	**60/900**	2		936	1 244	6	685
	1 150	90	5	700	1 550	32.0	15.8	**68/950**	2		972	1 128	4	184
950	1 250	132	7.5	1 030	2 430	48.5	16.2	**69/950**	2		986	1 214	6	424
	1 360	180	7.5	1 260	3 050	60.0	16.5	**60/950**	2		986	1 324	6	855
	1 220	100	6	785	1 790	35.5	15.9	**68/1000**	2		1 028	1 192	5	237
1 000	1 320	140	7.5	1 120	2 700	52.5	16.3	**69/1000**	2		1 036	1 284	6	506
	1 420	185	7.5	1 290	3 200	61.5	16.4	**60/1000**	2		1 036	1 384	6	945
	1 280	100	6	810	1 910	37.0	15.8	**68/1060**	2		1 088	1 252	5	250
1 060	1 400	150	7.5	1 330	3 400	64.0	16.4	**69/1060**	2		1 096	1 364	6	610
	1 500	195	9.5	1 320	3 350	62.5	16.3	**60/1060**	2		1 104	1 456	8	1 126
1 120	1 360	106	6	980	2 410	45.5	16.0	**68/1120**	2		1 148	1 332	5	307
	1 460	150	7.5	1 360	3 550	65.5	16.3	**69/1120**	2		1 156	1 424	6	640
1 180	1 420	106	6	1 020	2 580	47.5	15.9	**68/1180**	2		1 208	1 392	5	322
	1 540	160	7.5	1 380	3 700	66.5	16.2	**69/1180**	2		1 216	1 504	6	762
1 250	1 500	112	6	1 030	2 670	47.5	15.8	**68/1250**	2		1 278	1 472	5	376

1) Smallest allowable dimension for chamfer dimension r.
2) For details of Drawings, please refer to **Fig. 1** on page **B-11**.
Note: Inner rings of the bearings other than the four models (**60/900**, **60/950**, **60/1000**, and **60/1060**) may have lifting holes provided during manufacturing. Please consult **NTN** Engineering before using these lifting holes.

Angular Contact Ball Bearings

1. Design features and characteristics

1.1 Angular contact ball bearing

Angular contact ball bearings are non-separable bearings with a defined contact angle in the radial direction relative to the straight line that runs through the point where each ball makes contact with the inner and outer rings. Therefore, these bearings can support, in addition to radial loads, and axial loads in one direction. Since an axial load is generated from a radial force, these bearings are generally used in pairs. **Table 1** shows classification and characteristics of duplex angular contact ball bearings.

Table 1 Duplex angular contact ball bearings—duplex types and characteristics

Duplex type	Structure	Characteristics
Back-to-back arrangement (DB)		• Can accommodate radial loads and axial loads in either direction. • Has a large distance between the acting load centers of the bearings, and therefore a large momentary force load capacity. • Allowable misalignment is small.
Face-to-face arrangement (DF)		• Can accommodate radial loads and axial loads in either direction. • Has a smaller distance between the acting load centers of the bearings, and therefore a smaller momentary force load capacity. • Has larger allowable misalignment than back-to-back duplex type.

Note: 1. Duplex angular contact ball bearings are manufactured in a set to specified clearance and preload; therefore, they must be assembled side by side with identically numbered bearings and not be mixed with other arrangements.
2. To satisfy specified clearance and preload, tightening must be performed until the inner ring width surfaces or outer ring width surfaces come in contact with each other.
3. Other combinations are also available. Please consult **NTN** Engineering for details.

1.2 Drawings of single and duplex angular contact ball bearings

The dimension table of angular contact ball bearings and duplex angular contact ball bearings contains drawing numbers of various cage types and special profiles as shown in **Fig. 1**. **Drawing 1** through **Drawing 3** and **Drawing 6** show inner ring guide cages; **Drawing 2** and **Drawing 3** show bearings with oil inlets. **Drawing 4** and **Drawing 5** show rolling element guide cages; **Drawing 5** shows a bearing with oil inlet. Note that the inner ring width in **Drawing 6** is larger than that of the outer ring.

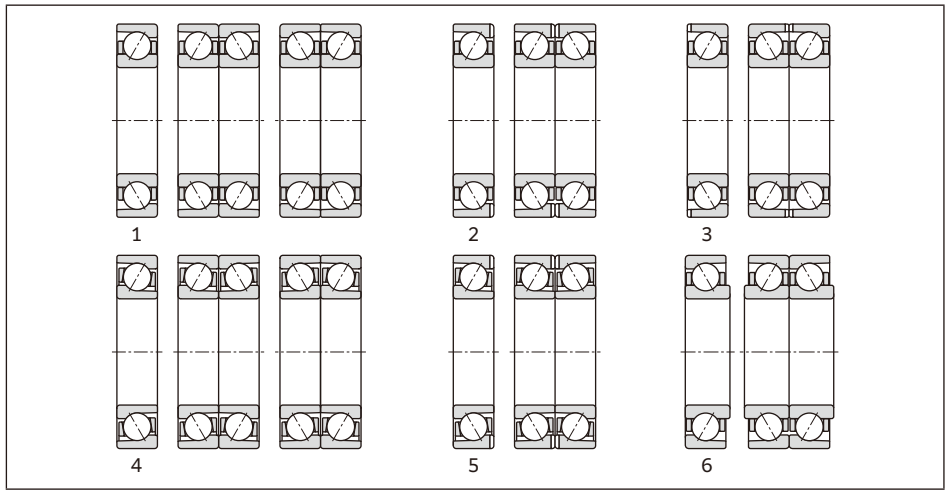


Fig. 1 Drawings of single and duplex angular contact ball bearings

1.3 Double row angular contact ball bearings

The double row angular contact ball bearings are structured by arranging two single row angular contact ball bearings back-to-back (DB) to unite their outer rings or face-to-face (DF) to unite their inner rings. These bearings support radial and axial loads in either direction: back-to-back duplexed bearings also support moment loads.

1.4 Drawings of double row angular contact ball bearings

The dimension table of double row angular contact bearings contains drawing numbers of various cage types and special shapes shown in **Fig. 2**. **Drawing 1** and **Drawing 2** show face-to-face arrangements; **Drawing 2** shows a bearing with oil inlet. **Drawing 3** through **Drawing 7** show back-to-back arrangements, representing different oil inlet locations and absence/presence of oil groove. Note that the inner ring width in **Drawing 3** is larger than that of the outer ring.

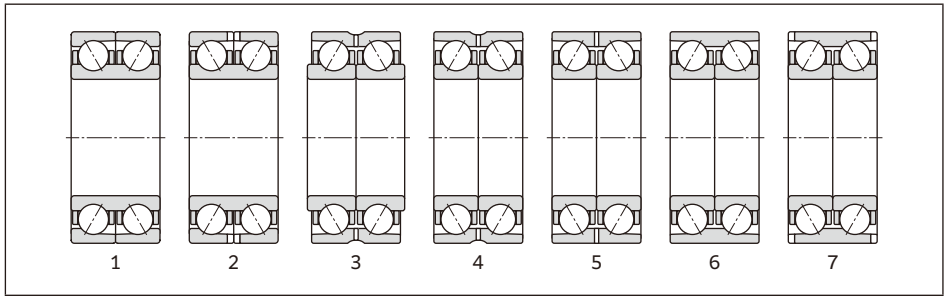


Fig. 2 Drawings of double row angular contact ball bearings

2. Dimensional and rotational accuracy

Refer to **Table 3.3** (pages A-18 and A-19) for accuracy of angular contact ball bearings.

3. Recommended fits

Refer to **Table 4.2** (pages A-33 and A-34) for recommended fits of angular contact ball bearings.

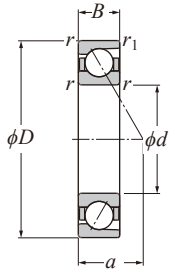
4. Bearing internal clearance

Refer to **Table 5.2** (page A-40) for bearing internal clearance of double row/duplex angular contact ball bearings.

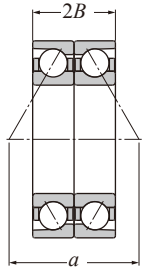
5. Precautions

If bearing load is light during operation, or if the ratio of axial to radial load for duplex bearings exceeds the value of e, slipping may develop between the balls and raceway, sometimes resulting in smearing. This is most apparent when a large angular contact ball bearing, in which the mass of balls and cage is large, is used.

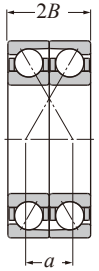
For additional details, please contact **NTN** Engineering.



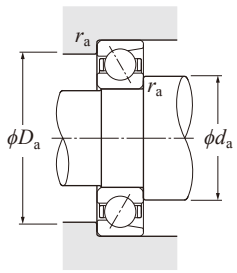
Single row

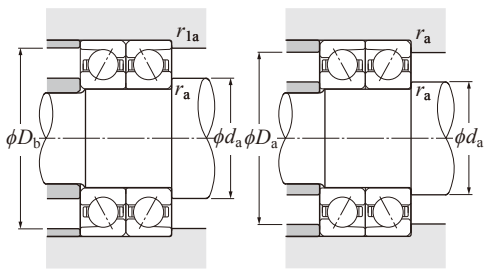


Back-to-back arrangement (DB)



Face-to-face arrangement (DF)





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	e	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
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

Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

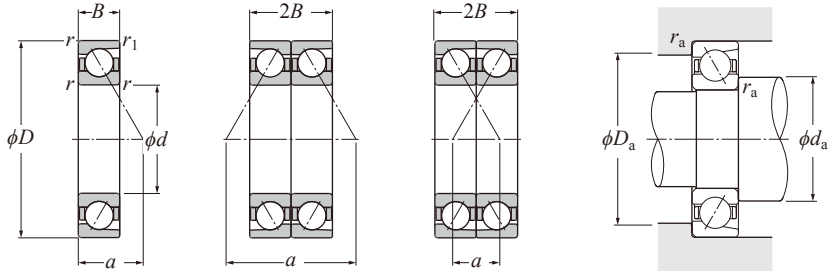
For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

d 100-120 mm

Boundary dimensions mm						Contact angle °	Basic load rating dynamic kN		Fatigue load limit kN	Bearing number	Drawing No.[2]	Load center mm	Mass Single row kg	Basic load rating (duplex) dynamic kN		Bearing number		Load center (duplex) mm		Installation-related dimensions mm				
d	D	B	C	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	α	C_r	C_{0r}	C_u			a	(approx.)	C_r	C_{0r}	Back-to-back arrangement	Face-to-face arrangement	DB	DF	d_a Min.	D_a Max.	D_b Max.	r_{as} Max.	r_{1as} Max.
100	125	13	—	1	0.6	30	23.4	25.2	1.58	**7820**	1	39	0.36	38.0	50.5	**DB**	**DF**	78	52	105.5	119.5	120.5	1	0.6
	140	20	—	1.1	0.6	30	53.0	52.5	3.20	**7920**	1	44.5	0.93	86.0	105	**DB**	**DF**	109	69	107	133	135.5	1	0.6
	150	24	—	1.5	1	30	75.5	70.5	4.35	**7020**	1	48	1.47	123	141	**DB**	**DF**	120	72	108.5	141.5	144.5	1.5	1
	150	24	—	1.5	1	40	67.5	63.5	3.80	**7020B**	1	64.5	1.49	110	127	**DB**	**DF**	129	81	108.5	141.5	144.5	1.5	1
	180	34	—	2.1	1.1	30	159	126	8.30	**7220**	1	57.5	3.2	259	251	**DB**	**DF**	149	81	112	168	173	2	1
	180	34	—	2.1	1.1	40	144	114	7.30	**7220B**	1	76	3.26	234	229	**DB**	**DF**	186	118	112	168	173	2	1
	215	47	—	3	1.1	30	230	193	12.0	**7320**	1	69	7.18	375	385	**DB**	**DF**	185	91	114	201	208	2.5	1
	215	47	—	3	1.1	40	211	178	11.1	**7320B**	1	89.5	7.32	340	355	**DB**	**DF**	226	132	114	201	208	2.5	1
105	130	13	—	1	0.6	30	24.0	26.5	1.62	**7821**	1	40.5	0.37	39.0	53.0	**DB**	**DF**	81	55	110.5	124.5	125.5	1	0.6
	145	20	—	1.1	0.6	30	54.0	54.5	3.25	**7921**	1	46	0.97	87.5	109	**DB**	**DF**	112	72	112	138	140.5	1	0.6
	160	26	—	2	1	30	88.5	81.5	4.95	**7021**	1	51.5	1.86	144	163	**DB**	**DF**	129	77	115	150	154.5	2	1
	160	26	—	2	1	40	79.5	73.5	4.30	**7021B**	1	68.6	1.88	129	147	**DB**	**DF**	137	85	115	150	154.5	2	1
	190	36	—	2.1	1.1	30	173	142	9.10	**7221**	1	60.5	3.79	282	283	**DB**	**DF**	157	85	117	178	183	2	1
	190	36	—	2.1	1.1	40	157	129	8.05	**7221B**	1	80	3.87	255	258	**DB**	**DF**	196	124	117	178	183	2	1
	225	49	—	3	1.1	30	244	210	12.8	**7321**	1	72	8.2	395	420	**DB**	**DF**	193	95	119	211	218	2.5	1
	225	49	—	3	1.1	40	224	194	11.8	**7321B**	1	93.5	8.36	365	385	**DB**	**DF**	236	138	119	211	218	2.5	1
110	140	16	—	1	0.6	30	34.5	38.0	2.25	**7822**	1	44	0.58	56.0	76.0	**DB**	**DF**	88	56	115.5	134.5	135.5	1	0.6
	150	20	—	1.1	0.6	30	54.5	56.0	3.25	**7922**	1	47.5	1.01	89.0	112	**DB**	**DF**	115	75	117	143	145.5	1	0.6
	170	28	—	2	1	30	102	93.0	5.50	**7022**	1	54.5	2.3	165	186	**DB**	**DF**	137	81	120	160	164.5	2	1
	170	28	—	2	1	40	91.0	83.5	4.80	**7022B**	1	72.8	2.34	148	167	**DB**	**DF**	145.5	89.5	120	160	164.5	2	1
	200	38	—	2.1	1.1	30	188	158	9.95	**7222**	1	64	4.45	305	315	**DB**	**DF**	166	90	122	188	193	2	1
	200	38	—	2.1	1.1	40	177	144	8.80	**7222B**	1	84	4.54	277	289	**DB**	**DF**	206	130	122	188	193	2	1
	240	50	—	3	1.1	30	273	246	14.5	**7322**	1	76	9.6	445	490	**DB**	**DF**	202	102	124	226	233	2.5	1
	240	50	—	3	1.1	40	250	226	13.3	**7322B**	1	99	9.8	405	455	**DB**	**DF**	248	148	124	226	233	2.5	1
120	150	16	—	1	0.6	30	35.0	40.0	2.27	**7824**	1	47	0.63	57.0	79.5	**DB**	**DF**	94	62	125.5	144.5	145.5	1	0.6
	165	22	—	1.1	0.6	30	67.5	69.5	3.90	**7924**	1	52	1.66	109	139	**DB**	**DF**	126	82	127	158	160.5	1	0.6

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.

Single and Duplex Angular Contact Ball Bearings NTN

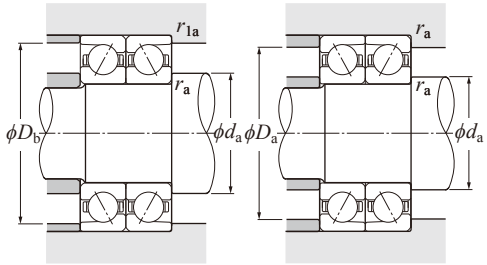


Single row | Back-to-back arrangement (DB) | Face-to-face arrangement (DF)

d 120-150 mm

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass
							dynamic	static					
mm						°	kN		kN			mm	Single row kg
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	α	C_r	C_{0r}	C_u			*a*	(approx.)
120	180	28	—	2	1	30	104	98.5	5.55	**7024**	1	57.5	2.47
	180	28	—	2	1	40	93.0	89.0	4.85	**7024B**	1	77	2.51
	215	40	—	2.1	1.1	30	202	177	10.7	**7224**	1	68.5	6.26
	215	40	—	2.1	1.1	40	183	162	9.40	**7224B**	1	90.5	6.26
	260	55	—	3	1.1	30	273	252	14.3	**7324**	1	82.5	14.7
	260	55	—	3	1.1	40	249	231	13.1	**7324B**	1	107	14.7
130	165	18	—	1.1	0.6	30	46.5	53.0	2.89	**7826**	1	51.5	0.91
	180	24	—	1.5	1	30	83.0	87.5	4.65	**7926**	1	56.5	1.82
	199.5	33	—	2.5	1	30	130	125	6.75	**SF2652**	1	64	3.74
	200	33	—	2	1	30	130	125	6.75	**7026**	1	64	3.73
	200	33	—	2	1	40	116	113	5.90	**7026B**	1	86	3.78
	205	24	—	2.5	1	30	83.5	90.0	4.60	**SF2608**	1	60.5	2.98
	230	40	—	3	1.1	30	217	198	11.5	**7226**	1	72	7.15
	230	40	—	3	1.1	40	196	180	10.0	**7226B**	1	95.5	7.15
	280	58	—	4	1.5	30	305	293	16.0	**7326**	1	88	17.6
	280	58	—	4	1.5	40	277	268	14.7	**7326B**	1	115	17.6
140	175	18	—	1.1	0.6	30	47.5	55.5	2.94	**7828**	1	54.5	0.97
	190	24	—	1.5	1	30	83.5	90.0	4.65	**7928**	1	59.5	1.94
	210	33	—	2	1	30	133	133	6.85	**7028**	1	67	3.96
	210	33	—	2	1	40	118	119	5.95	**7028B**	1	90	4.01
	250	42	—	3	1.1	30	225	215	11.7	**7228**	1	77.5	8.78
	250	42	—	3	1.1	40	203	195	10.1	**7228B**	1	103	8.78
	300	62	—	4	1.5	30	335	335	17.7	**7328**	1	94.5	21.5
	300	62	—	4	1.5	40	305	310	16.3	**7328B**	1	123	21.5
145	220	38	—	2.5	1.5	30	164	158	8.20	**SF2951**	1	71.7	5.15
150	190	20	—	1.1	0.6	30	60.5	70.5	3.60	**7830**	1	59	1.35

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

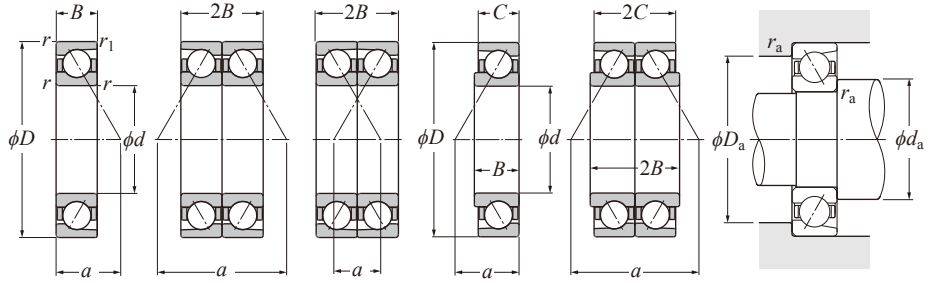
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

Basic load rating		Bearing number		Load center		Installation-related dimensions				
dynamic	static			(duplex)						
(duplex)				mm		mm				
kN				*a*						
C_r	C_{0r}	Back-to-back arrangement	Face-to-face arrangement	DB	DF	d_a Min.	D_a Max.	D_b Max.	r_{as} Max.	r_{1as} Max.
169	197	**DB**	**DF**	143	87	130	170	174.5	2	1
151	178	**DB**	**DF**	154	98	130	170	174.5	2	1
330	355	**DB**	**DF**	177	97	132	203	208	2	1
298	325	**DB**	**DF**	221	141	132	203	208	2	1
445	505	**DB**	**DF**	220	110	134	246	263	2.5	1
405	460	**DB**	**DF**	269	159	134	246	263	2.5	1
76	106	**DB**	**DF**	103	67	137	158	160.5	1	0.6
135	175	**DB**	**DF**	137	89	138.5	171.5	174.5	1.5	1
211	251	**DB**	**DF**	128.5	62.5	142	187.5	194	2	1
211	251	**DB**	**DF**	161	95	140	190	194.5	2	1
189	226	**DB**	**DF**	171.5	105.5	140	190	194.5	2	1
135	180	**DB**	**DF**	120.5	72.5	142	193	199.5	2	1
355	395	**DB**	**DF**	184	104	144	216	223	2.5	1
320	360	**DB**	**DF**	231	151	144	216	223	2.5	1
490	585	**DB**	**DF**	234	118	148	262	271.5	3	1.5
450	535	**DB**	**DF**	288	172	148	262	271.5	3	1.5
77.0	111	**DB**	**DF**	109	73	147	168	170.5	1	0.6
136	180	**DB**	**DF**	143	95	148.5	181.5	184.5	1.5	1
215	265	**DB**	**DF**	167	101	150	200	204.5	2	1
193	237	**DB**	**DF**	180	114	150	200	204.5	2	1
365	430	**DB**	**DF**	197	113	154	236	243	2.5	1
330	390	**DB**	**DF**	248	164	154	236	243	2.5	1
540	670	**DB**	**DF**	251	127	158	282	291.5	3	1.5
495	615	**DB**	**DF**	308	184	158	282	291.5	3	1.5
267	315	**DB**	**DF**	143.5	67.5	157	208	211.5	2	1.5
98.0	141	**DB**	**DF**	118	78	157	183	185.5	1	0.6

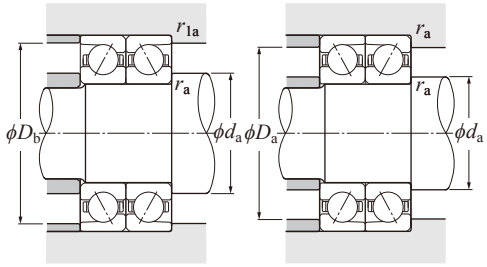


Single row | Back-to-back arrangement (DB) | Face-to-face arrangement (DF) | Single row | Back-to-back arrangement (DB)

d 150-170 mm

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing[2] No.	Load center	Mass
							dynamic	static					
mm						°	kN		kN			mm	Single row kg (approx.)
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	
150	210	28	—	2	1	30	108	117	5.80	**7930**	1	66	2.96
	225	35	—	2.1	1.1	30	152	154	7.65	**7030**	1	71.5	4.82
	225	35	—	2.1	1.1	40	136	138	6.70	**7030B**	1	96	4.88
	270	45	—	3	1.1	30	257	259	13.7	**7230**	1	83	11
	270	45	—	3	1.1	40	232	235	11.9	**7230B**	1	111	11
	320	65	—	4	1.5	30	365	380	19.5	**7330**	1	100	25.1
	320	65	—	4	1.5	40	335	350	17.9	**7330B**	1	131	25.1
160	200	20	—	1.1	0.6	30	61.5	74.0	3.65	**7832**	1	62	1.42
	215	28	25	2.5	1.1	40	84.0	93.0	4.50	**SF3208**	6	91	2.74
	220	28	—	2	1	30	109	121	5.80	**7932**	1	69	3.13
	229.5	33	—	2.5	1	40	122	128	6.10	**SF3209**	1	98.5	4.52
	229.5	33	—	2.5	1	40	122	128	6.10	**SF3214**	3	98.5	4.52
	230	33	—	2.5	1	30	137	147	7.00	**SF3210**	1	73	4.15
	240	38	—	2.1	1.1	30	172	176	8.55	**7032**	1	77	5.96
	240	38	—	2.1	1.1	40	154	158	7.45	**7032B**	1	103	5.98
	290	48	—	3	1.1	30	291	305	15.8	**7232**	1	89	13.7
	290	48	—	3	1.1	40	263	279	13.7	**7232B**	1	118	13.7
	340	68	—	4	1.5	30	385	420	20.9	**7332**	1	106	29.8
	340	68	—	4	1.5	40	350	385	19.1	**7332B**	1	139	29.8
170	215	22	—	1.1	0.6	30	75.5	90.5	4.35	**7834**	1	66.5	1.88
	230	28	—	2	1	30	113	129	6.05	**7934**	1	71.5	3.29
	260	42	—	2.1	1.1	30	206	214	10.2	**7034**	1	83	7.96
	260	42	—	2.1	1.1	40	184	193	8.85	**7034B**	1	111.5	8.02
	310	52	—	4	1.5	30	325	360	18.0	**7234**	1	95.5	17
	310	52	—	4	1.5	40	295	325	15.6	**7234B**	1	127	17
	360	72	—	4	1.5	30	430	485	23.3	**7334**	1	113	35.3

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

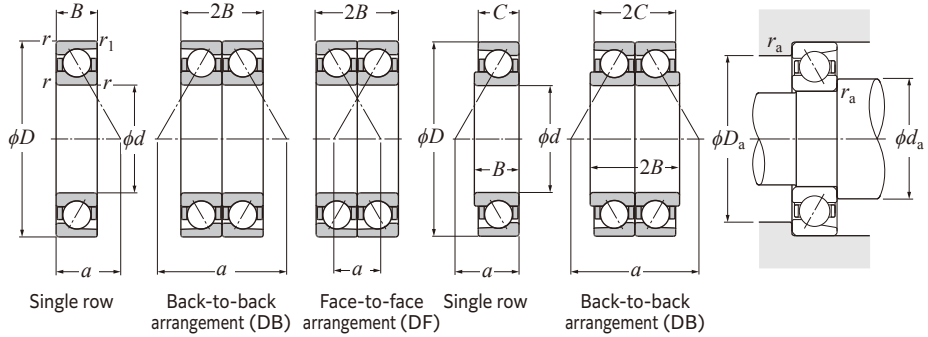
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

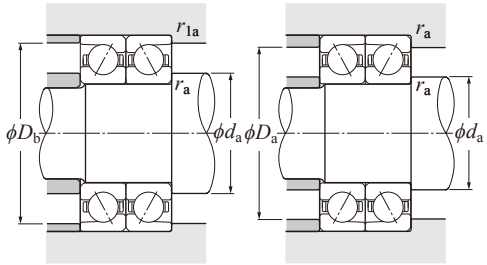
Basic load rating		Bearing number		Load center		Installation-related dimensions				
dynamic	static			(duplex)						
(duplex)				mm		mm				
kN		Back-to-back arrangement	Face-to-face arrangement	*a*		d_a	D_a	D_b	r_{as}	r_{1as}
C_r	C_{0r}			DB	DF	Min.	Max.	Max.	Max.	Max.
175	234	**DB**	**DF**	160	104	160	200	204.5	2	1
246	305	**DB**	**DF**	178	108	162	213	218	2	1
220	275	**DB**	**DF**	192.5	122.5	162	213	218	2	1
420	515	**DB**	**DF**	211	121	164	256	263	2.5	1
375	470	**DB**	**DF**	267	177	164	256	263	2.5	1
595	765	**DB**	**DF**	265	135	168	302	311.5	3	1.5
540	700	**DB**	**DF**	327	197	168	302	311.5	3	1.5
100	148	**DB**	**DF**	124	84	167	193	195.5	1	0.6
136	186	**DB**	—	182.5	132.5	172	203	208	2	1
177	241	**DB**	**DF**	166	110	170	210	214.5	2	1
199	256	**DB**	**DF**	196.5	130.5	172	217.5	224	2	1
199	256	—	**DF**	196.5	130.5	172	217.5	224	2	1
223	293	**DB**	**DF**	145.5	79.5	172	218	224.5	2	1
279	355	**DB**	**DF**	192	116	172	228	233	2	1
250	315	**DB**	**DF**	206	130	172	228	233	2	1
475	615	**DB**	**DF**	226	130	174	276	283	2.5	1
430	555	**DB**	**DF**	284	188	174	276	283	2.5	1
625	845	**DB**	**DF**	280	144	178	322	331.5	3	1.5
570	770	**DB**	**DF**	346	210	178	322	331.5	3	1.5
123	181	**DB**	**DF**	133	89	177	208	210.5	1	0.6
183	257	**DB**	**DF**	171	115	180	220	224.5	2	1
335	430	**DB**	**DF**	208	124	182	248	253	2	1
299	385	**DB**	**DF**	222.5	138.5	182	248	253	2	1
530	715	**DB**	**DF**	243	139	188	292	301.5	3	1.5
480	650	**DB**	**DF**	306	202	188	292	301.5	3	1.5
700	970	**DB**	**DF**	298	154	188	342	351.5	3	1.5



d 170-195 mm

Boundary dimensions						Contact angle	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass
mm						°	kN		kN			mm	kg
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	Single row (approx.)
170	360	72	—	4	1.5	40	395	445	21.3	**7334B**	1	147	35.3
180	225	22	—	1.1	0.6	30	77.5	95.0	4.45	**7836**	1	69.5	1.98
	250	33	—	2	1	30	145	163	7.40	**7936**	1	78.5	4.87
	259.5	33	—	2.5	1	40	153	166	7.40	**SF3618**	2	109	5.7
	259.5	33	—	2.5	1	30	198	211	9.65	**SF3629**	3	80	5.8
	259.5	33	—	2.5	1	30	198	211	9.65	**SF3639**	2	80	5.75
	259.5	33	—	2.5	1	30	171	190	8.50	**SF3641**	3	80	5.65
	280	46	—	2.1	1.1	30	242	266	12.3	**7036**	1	89.5	10.4
	280	46	—	2.1	1.1	40	217	240	10.7	**7036B**	1	119.5	10.5
	320	52	—	4	1.5	30	340	385	18.6	**7236**	1	98	17.7
	320	52	—	4	1.5	40	305	350	16.1	**7236B**	1	131	17.7
	380	75	—	4	1.5	30	455	535	24.9	**7336**	1	118	40.9
	380	75	—	4	1.5	40	415	490	22.8	**7336B**	1	155	40.9
190	240	24	—	1.5	1	30	94.0	116	5.25	**7838**	1	74	2.55
	255	33	29	2.5	1.5	40	119	138	6.15	**SF3806**	6	108	4.16
	259.5	33	—	2	1	30	147	169	6.00	**SF3816**	3	81.5	5.1
	260	33	—	2	1	30	147	169	7.45	**7938**	1	81.5	5.1
	269.5	33	—	2.5	1.5	30	146	168	7.35	**SF3802**	1	83	5.95
	269.5	33	—	2.5	2.5	40	148	166	7.25	**SF3807**	2	113	6.05
	290	46	—	2.1	1.1	30	248	280	12.6	**7038**	1	92.5	10.8
	290	46	—	2.1	1.1	40	220	253	11.0	**7038B**	1	124	10.9
	340	55	—	4	1.5	30	335	390	17.9	**7238**	1	104	21.3
	340	55	—	4	1.5	40	300	355	15.5	**7238B**	1	139	21.3
	400	78	—	5	2	30	475	585	26.6	**7338**	1	124	47
	400	78	—	5	2	40	430	535	24.0	**7338B**	1	163	47
195	270	35	—	2.5	1.5	30	170	196	8.55	**SF3901**	3	84.5	6.2

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row $F_a/F_r \le e$		Single row $F_a/F_r > e$		DB, DF $F_a/F_r \le e$		DB, DF $F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

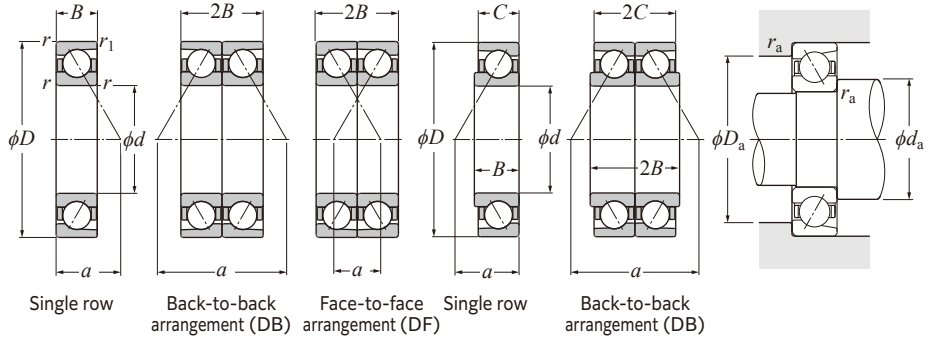
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

Basic load rating dynamic (duplex)	Basic load rating static (duplex)	Bearing number		Load center (duplex)		Installation-related dimensions				
kN				mm		mm				
C_r	C_{0r}	Back-to-back arrangement	Face-to-face arrangement	*a* DB	*a* DF	d_a Min.	D_a Max.	D_b Max.	r_{as} Max.	r_{1as} Max.
640	890	**DB**	**DF**	366	222	188	342	351.5	3	1.5
126	190	**DB**	**DF**	139	95	187	218	220.5	1	0.6
236	325	**DB**	**DF**	190	124	190	240	244.5	2	1
248	330	**DB**	—	217.5	151.5	192	247.5	254	2	1
320	420	—	**DF**	160	94	192	247.5	254	2	1
320	420	**DB**	**DF**	160	80	192	247.5	254	2	1
278	380	—	**DF**	160	94	192	247.5	254	2	1
395	530	**DB**	**DF**	225	133	192	268	273	2	1
355	480	**DB**	**DF**	239	147	192	268	273	2	1
550	770	**DB**	**DF**	248	144	198	302	311.5	3	1.5
495	700	**DB**	**DF**	314	210	198	302	311.5	3	1.5
735	1 070	**DB**	**DF**	311	161	198	362	371.5	3	1.5
670	975	**DB**	**DF**	385	235	198	362	371.5	3	1.5
153	232	**DB**	**DF**	148	100	198.5	231.5	234.5	1.5	1
194	276	**DB**	—	215.5	157.5	202	243	246.5	2	1.5
239	335	—	**DF**	163	97	200	249.5	254	2	1
239	335	**DB**	**DF**	196	130	200	250	254.5	2	1
238	335	**DB**	**DF**	166	83	202	257.5	261	2	1.5
241	330	**DB**	—	226	160	202	257.5	257.5	2	2
405	560	**DB**	**DF**	231	139	202	278	283	2	1
360	505	**DB**	**DF**	247.5	155.5	202	278	283	2	1
545	780	**DB**	**DF**	263	153	208	322	331.5	3	1.5
490	705	**DB**	**DF**	333	223	208	322	331.5	3	1.5
770	1 170	**DB**	**DF**	326	170	212	378	390	4	2
700	1 070	**DB**	**DF**	404	248	212	378	390	4	2
276	395	—	**DF**	169	99	207	258	261.5	2	1.5

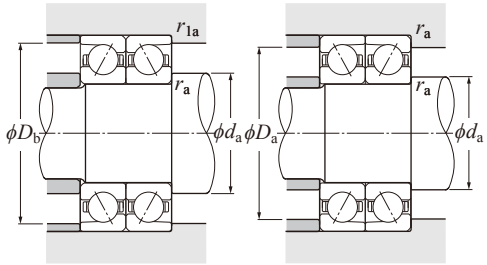


Single row | Back-to-back arrangement (DB) | Face-to-face arrangement (DF) | Single row | Back-to-back arrangement (DB)

d 200-240 mm

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass
	mm					°	dynamic kN	static kN				mm	Single row kg
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	(approx.)
200	250	24	—	1.5	1	30	96.5	122	5.40	**7840**	1	77	2.68
	279.5	38	—	2.5	1.5	40	183	202	8.65	**SF4006**	1	119.5	7.15
	280	38	—	2.1	1.1	30	205	231	9.90	**7940**	1	88.5	7.15
	289.5	38	—	2.5	1.5	40	209	238	7.85	**SF4017**	3	122	8.25
	310	51	—	2.1	1.1	30	279	325	14.3	**7040**	1	99	14
	310	51	—	2.1	1.1	40	250	293	12.4	**7040B**	1	132.5	14.1
	360	58	—	4	1.5	30	375	450	20.2	**7240**	1	110	25.3
	360	58	—	4	1.5	40	335	410	17.6	**7240B**	1	146	25.3
	420	80	—	5	2	30	500	610	27.0	**7340**	1	130	53.1
	420	80	—	5	2	40	455	555	24.7	**7340B**	1	170	53.1
203.2	330.2	88.9	—	3	1.5	30	243	285	11.8	**SF4104**	1	99	14.7
220	270	24	—	1.5	1	30	99.0	131	5.55	**7844**	1	82.5	2.91
	300	38	—	2.1	1.1	30	207	239	9.85	**7944**	1	94	7.74
	300	38	35	2.5	1.5	40	165	189	7.80	**SF4407**	6	126.5	7.25
	309.5	38	—	2.1	1.1	40	211	246	10.0	**SF4421**	2	130	8.9
	309.5	38	—	2.1	1.1	40	211	246	7.00	**SF4433**	3	130	8.9
	319.5	46	—	2.1	1.1	35	250	299	12.2	**SF4438**	3	117.5	12.2
	340	56	—	3	1.1	30	315	390	16.4	**7044**	1	109	18.2
	340	56	—	3	1.1	40	264	325	13.0	**7044B**	1	145.5	18.4
	400	65	—	4	1.5	30	380	485	20.0	**7244**	1	122	37.1
	400	65	—	4	1.5	40	345	440	17.4	**7244B**	1	162.5	37
	460	88	—	5	2	30	550	725	31.0	**7344**	1	142	72.4
230	329.5	40	—	2.5	1.5	40	171	202	8.10	**SF4614**	5	135.5	11
240	300	28	—	2	1	30	112	155	6.25	**7848**	1	92	4.49
	320	38	—	2.1	1.1	30	213	255	10.1	**7948**	1	100	8.34
	329.5	40	—	2.1	1.1	30	245	305	11.9	**SF4839**	3	102.5	10

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

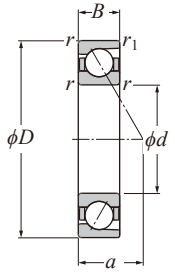
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

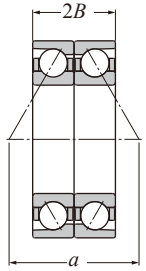
Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

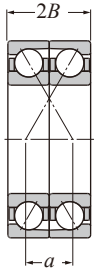
Basic load rating		Bearing number		Load center		Installation-related dimensions				
dynamic (duplex) kN	static (duplex) kN			(duplex) mm		mm				
		Back-to-back arrangement	Face-to-face arrangement	*a*		d_a	D_a	D_b	r_{as}	r_{1as}
C_r	C_{0r}			DB	DF	Min.	Max.	Max.	Max.	Max.
156	244	**DB**	**DF**	154	106	208.5	241.5	244.5	1.5	1
297	405	**DB**	**DF**	239	163	212	267.5	271	2	1.5
335	465	**DB**	**DF**	215	139	212	268	273	2	1
340	475	—	**DF**	243.5	167.5	212	277.5	281	2	1.5
455	650	**DB**	**DF**	249	147	212	298	303	2	1
405	585	**DB**	**DF**	265	163	212	298	303	2	1
605	900	**DB**	**DF**	278	162	218	342	351.5	3	1.5
545	815	**DB**	**DF**	350	234	218	342	351.5	3	1.5
810	1 220	**DB**	**DF**	340	180	222	398	410	4	2
740	1 110	**DB**	**DF**	420	260	222	398	410	4	2
395	570	**DB**	**DF**	198.5	109.5	217.2	316.2	321.7	2.5	1.5
161	261	**DB**	**DF**	165.5	117.5	228.5	261.5	264.5	1.5	1
335	475	**DB**	**DF**	226	150	232	288	293	2	1
269	380	**DB**	—	253	183	232	288	291.5	2	1.5
340	490	**DB**	—	260.5	184.5	232	297.5	302.5	2	1
340	490	—	**DF**	260.5	184.5	232	297.5	302.5	2	1
405	600	—	**DF**	235	143	232	307.5	312.5	2	1
515	780	**DB**	**DF**	217.5	105.5	234	326	333	2.5	1
430	650	**DB**	**DF**	291	179	234	326	333	2.5	1
620	975	**DB**	**DF**	244	114	238	382	391.5	3	1.5
560	880	**DB**	**DF**	325	195	238	382	391.5	3	1.5
895	1 450	**DB**	**DF**	284.5	108.5	242	438	450	4	2
278	405	**DB**	—	270.8	191	242	317.5	321	2	1.5
182	310	**DB**	**DF**	184	128	250	290	294.5	2	1
345	510	**DB**	**DF**	238	162	252	308	313	2	1
400	605	—	**DF**	204.5	124.5	252	317.5	322.5	2	1



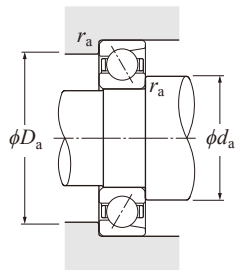
Single row



Back-to-back arrangement (DB)



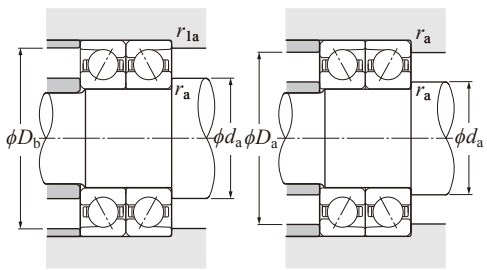
Face-to-face arrangement (DF)



d 240-280 mm

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass
							dynamic	static					
mm						°	kN		kN			mm	Single row kg (approx.)
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	
240	329.5	40	—	2.5	1.5	40	219	265	10.4	**SF4814**	1	139.5	10.1
	329.5	40	—	2.5	1.5	40	219	265	10.4	**SF4818**	2	139.5	10.1
	340	40	—	2.5	1.5	30	234	289	11.3	**SF4802**	1	160.5	11.5
	360	56	—	3	1.1	30	310	400	15.6	**7048**	1	114.5	19.5
	360	56	—	3	1.1	40	276	355	13.6	**7048B**	1	154	19.8
	440	72	—	4	1.5	30	465	630	24.9	**7248**	1	135.5	49.8
	500	95	—	5	2	30	570	795	32.0	**7348**	1	154.5	92.2
	500	95	—	5	2	40	515	725	27.8	**7348B**	1	202.5	93
250	340	38	—	2.5	1	40	187	222	8.60	**SF5005**	6	141.5	9.55
	349.5	46	—	3	1.5	30	258	325	12.4	**SF5004**	1	109.5	13.6
260	320	28	—	2	1	30	140	192	7.45	**7852**	1	97.5	4.83
	360	46	—	2.1	1.1	30	285	375	14.1	**7952**	1	112	14
	369.5	46	—	2.5	1.5	40	260	340	12.7	**SF5206**	3	155	16.1
	369.5	46	—	2.5	1.5	40	260	340	12.7	**SF5225**	2	155	15.7
	369.5	46	—	2.5	1.5	40	260	340	12.7	**SF5224**	1	155	15.7
	369.5	46	—	2.5	1.5	30	268	350	13.1	**SF5210**	4	114	15.7
	379.5	56	—	4	2	40	293	385	14.4	**SF5218**	1	162.5	19.1
	400	65	—	4	1.5	30	350	455	17.3	**7052**	1	128	28.7
	400	65	—	4	1.5	40	310	410	15.1	**7052B**	1	171	29
	480	80	—	5	2	30	530	750	29.0	**7252**	1	147	66
	480	80	—	5	2	40	475	680	25.1	**7252B**	1	195	66
	540	102	—	6	3	30	655	960	37.5	**7352**	1	166.5	115
	540	102	—	6	3	40	590	870	32.5	**7352B**	1	219	115
280	350	33	—	2	1	30	182	247	9.25	**7856**	1	107.5	7.17
	380	46	—	2.1	1.1	30	289	385	14.1	**7956**	1	118	14.8
	389.5	46	—	2.1	1.1	40	247	325	11.8	**SF5606**	1	163.5	16

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

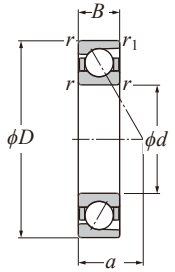
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

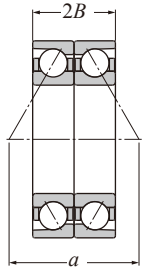
Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

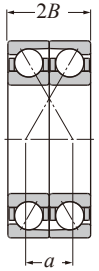
Basic load rating		Bearing number		Load center		Installation-related dimensions				
dynamic	static			(duplex)						
(duplex) kN				mm		mm				
C_r	C_{0r}	Back-to-back arrangement	Face-to-face arrangement	*a* DB	*a* DF	d_a Min.	D_a Max.	D_b Max.	r_{as} Max.	r_{1as} Max.
355	530	**DB**	**DF**	279	199	252	317.5	321	2	1.5
355	530	**DB**	—	279	199	252	317.5	321	2	1.5
380	575	**DB**	**DF**	207.5	127.5	252	328	331.5	2	1.5
500	795	**DB**	**DF**	229.5	117.5	254	346	353	2.5	1
450	710	**DB**	**DF**	308	196	254	346	353	2.5	1
750	1 260	**DB**	**DF**	271	127	258	422	431.5	3	1.5
930	1 590	**DB**	**DF**	309	119	262	478	490	4	2
840	1 450	**DB**	**DF**	405.5	216	262	478	490	4	2
305	445	**DB**	—	282.5	212.5	262	328	334.5	2	1
420	650	**DB**	**DF**	219	127	264	335.5	341	2.5	1.5
228	385	**DB**	**DF**	195.5	139.5	270	310	314.5	2	1
465	750	**DB**	**DF**	270	178	272	348	353	2	1
420	680	—	**DF**	310.5	218.5	272	357.5	361	2	1.5
420	680	**DB**	—	310.5	218.5	272	357.5	361	2	1.5
420	680	**DB**	**DF**	310.5	218.5	272	357.5	361	2	1.5
435	695	**DB**	**DF**	228	136	272	357.5	361	2	1.5
475	775	**DB**	**DF**	324.5	212.5	278	361.5	369.5	3	2
565	905	**DB**	**DF**	255.5	125.5	278	382	391.5	3	1.5
505	820	**DB**	**DF**	342	212	278	382	391.5	3	1.5
860	1 500	**DB**	**DF**	294	134	282	458	470	4	2
775	1 360	**DB**	**DF**	390.5	231	282	458	470	4	2
1 060	1 920	**DB**	**DF**	333	129	288	512	526	5	2.5
960	1 740	**DB**	**DF**	437.5	234	288	512	526	5	2.5
296	495	**DB**	**DF**	215	148	290	340	344.5	2	1
470	775	**DB**	**DF**	282	190	292	368	373	2	1
400	650	**DB**	**DF**	327	235	292	377.5	382.5	2	1



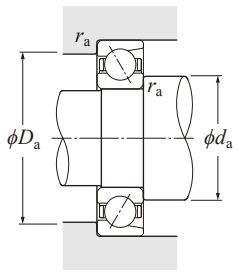
Single row



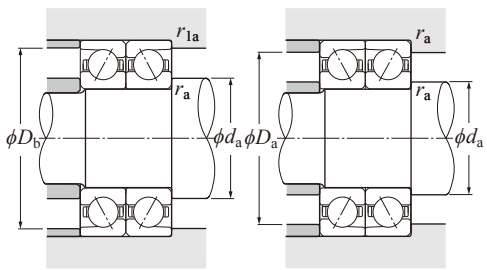
Back-to-back arrangement (DB)



Face-to-face arrangement (DF)



d 280-360 mm



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	e	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
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

Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

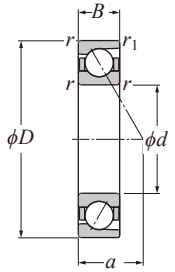
Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

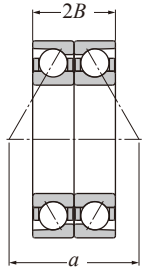
Boundary dimensions (mm)						Contact angle	Basic load rating dynamic (kN)	Basic load rating static (kN)	Fatigue load limit (kN)	Bearing number	Drawing No.[2]	Load center (mm)	Mass Single row (kg)	Basic load rating dynamic (duplex) (kN)	Basic load rating static (duplex) (kN)	Bearing number Back-to-back arrangement	Bearing number Face-to-face arrangement	Load center (duplex) a (mm) DB	Load center (duplex) a (mm) DF	Installation-related dimensions da Min. (mm)	Da Max. (mm)	Db Max. (mm)	ras Max. (mm)	r1as Max. (mm)
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	α	C_r	C_{0r}	C_u			*a*	(approx.)	C_r	C_{0r}									
280	389.5	46	—	2.5	1.5	30	277	370	13.5	**SF5608**	4	119.5	16	450	745	**DB**	**DF**	239.5	147.5	292	377.5	381	2	1.5
	420	65	—	4	1.5	30	435	595	22.7	**7056**	1	133.5	30.7	705	1 190	**DB**	**DF**	267	137	298	402	411.5	3	1.5
	420	65	—	4	1.5	40	390	540	19.7	**7056B**	1	179.5	30.9	630	1 080	**DB**	**DF**	359	229	298	402	411.5	3	1.5
	500	80	—	5	2	30	595	860	33.0	**7256**	1	152.5	69.7	965	1 720	**DB**	**DF**	305	145	258	478	490	4	2
	580	108	—	6	3	30	740	1 140	43.0	**7356**	1	178	140	1 200	2 270	**DB**	**DF**	356.5	140.5	308	552	566	5	2.5
	580	108	—	6	3	40	670	1 030	37.5	**7356B**	1	234.5	141	1 090	2 070	**DB**	**DF**	469	253	308	552	566	5	2.5
285	380	46	—	2.5	2	40	228	305	11.0	**SF5702**	1	162.5	14.7	370	605	**DB**	**DF**	325	233	297	368	370	2	2
290	419.5	60	—	5	2.5	40	325	455	16.1	**SF5803**	2	179	26.9	525	910	**DB**	—	357.5	237.5	312	397.5	407.5	4	2
300	380	38	—	2.1	1.1	30	214	290	10.4	**7860**	1	117	10.1	350	580	**DB**	**DF**	234.5	158.5	312	368	373	2	1
	420	56	—	3	1.1	30	360	520	18.2	**7960**	1	132	23.7	590	1 040	**DB**	**DF**	320	208	314	406	413	2.5	1
	460	74	—	4	1.5	30	490	715	26.0	**7060**	1	146.5	43.4	795	1 430	**DB**	**DF**	293.5	145.5	318	442	451.5	3	1.5
	460	74	—	4	1.5	40	440	645	22.6	**7060B**	1	196.5	43.7	710	1 290	**DB**	**DF**	393	245	318	442	451.5	3	1.5
	540	85	—	5	2	30	610	930	33.5	**7260**	1	164	87.2	995	1 860	**DB**	**DF**	327.5	157.5	322	518	530	4	2
310	429.5	60	—	4	2	40	330	470	16.3	**SF6203**	1	185.5	26.7	535	945	**DB**	—	370.5	250.5	328	411.5	419.5	3	2
320	400	38	—	2.1	1.1	30	218	305	10.6	**7864**	1	123	10.7	355	610	**DB**	**DF**	246	170	332	388	393	2	1
	440	56	—	3	1.1	30	365	540	18.3	**7964**	1	137.5	24.7	595	1 080	**DB**	**DF**	275.5	163.5	334	426	433	2.5	1
	480	74	—	4	1.5	30	500	760	26.4	**7064**	1	152.5	45.7	810	1 520	**DB**	**DF**	305	152.5	338	462	471.5	3	1.5
	580	92	—	5	2	30	700	1 120	39.5	**7264**	1	176	109	1 140	2 230	**DB**	**DF**	352	168	342	558	570	4	2
340	420	38	—	2.1	1.1	30	226	325	11.1	**7868**	1	128.5	11.3	365	650	**DB**	**DF**	257.5	181.5	352	408	413	2	1
	460	56	—	3	1.1	30	380	575	19.1	**7968**	1	143.5	26	620	1 150	**DB**	**DF**	287	175	354	446	453	2.5	1
	479.5	65	—	4	2	30	440	680	22.4	**SF6807**	1	151	36.7	715	1 360	—	**DF**	301.5	171.5	358	461.5	469.5	3	2
	520	82	—	5	2	30	575	905	31.0	**7068**	1	165	61.1	935	1 810	**DB**	**DF**	330.5	166.5	362	498	510	4	2
	620	92	—	5	2	30	720	1 200	40.0	**7268**	1	184.5	127	1 170	2 400	**DB**	**DF**	369	185	362	598	610	4	2
360	440	38	—	2.1	1.1	30	251	365	12.0	**7872**	1	134.5	11.9	405	725	**DB**	**DF**	269	193	372	428	433	2	1
	480	56	—	3	1.1	30	385	595	19.3	**7972**	1	149.5	27.3	625	1 190	**DB**	**DF**	298.5	186.5	374	466	473	2.5	1
	509.5	70	—	5	2	40	435	685	21.8	**SF7203**	1	217.5	45	705	1 370	**DB**	—	435	295	382	487.5	499.5	4	2

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.

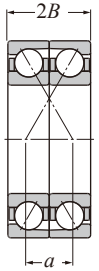
Single and Duplex Angular Contact Ball Bearings NTN



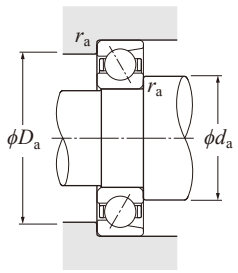
Single row



Back-to-back arrangement (DB)



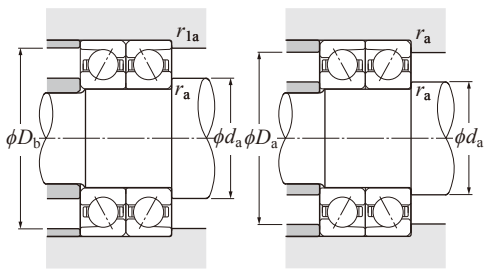
Face-to-face arrangement (DF)



d 360-500 mm

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass
							dynamic	static					
mm						°	kN		kN			mm	Single row kg
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	(approx.)
360	540	82	—	5	2	30	590	960	31.5	**7072**	1	171	63.4
	650	95	—	6	3	30	740	1 280	40.5	**7272**	1	193.5	143
	480	46	—	2.1	1.1	30	310	475	15.3	**7876**	1	147	19.5
	519.5	65	—	4	2	40	385	610	19.1	**SF7603**	1	221.5	41.3
380	520	65	—	4	1.5	30	430	700	21.9	**7976**	1	162.5	39.6
	540	164	—	4	2	40	490	810	25.1	**SF7601**	1	234	61
	560	82	—	5	2	30	605	1 010	32.0	**7076**	1	176.5	66.3
	500	46	—	2.1	1.1	30	320	500	15.7	**7880**	1	153	20.4
400	540	65	—	4	1.5	30	435	720	22.0	**7980**	1	168	41
	600	90	—	5	2	30	685	1 180	37.0	**7080**	1	189.5	86.1
	520	46	—	2.1	1.1	30	345	555	17.0	**7884**	1	158.5	21.1
420	560	65	—	4	1.5	30	450	765	22.9	**7984**	1	174	42.8
	620	90	—	5	2	30	700	1 250	37.5	**7084**	1	195	89.7
	540	46	—	2.1	1.1	30	345	565	17.0	**7888**	1	164.5	22
440	600	74	—	4	1.5	30	490	860	25.0	**7988**	1	187	59.3
	650	94	—	6	3	30	715	1 310	38.5	**7088**	1	204.5	103
	540	40	—	2.1	1.1	30	276	455	13.5	**SF9211**	1	164.5	15.8
460	580	56	—	3	1.1	30	420	725	21.1	**7892**	1	178	33.5
	620	74	—	4	1.5	30	500	885	25.3	**7992**	1	193	61.6
	680	100	—	6	3	30	800	1 510	43.5	**7092**	1	214.5	119
470	570	50	—	2.1	1.1	30	355	605	17.7	**SF9404**	1	175	25.7
	600	56	—	3	1.1	30	435	760	21.8	**7896**	1	184	34.9
480	650	78	—	5	2	30	590	1 090	30.5	**7996**	1	202	71.8
	700	100	—	6	3	30	795	1 520	42.5	**7096**	1	220.5	123
500	620	56	—	3	1.1	30	435	780	21.9	**78/500**	1	189.5	36.5
	670	78	—	5	2	30	595	1 120	31.0	**79/500**	1	208	74.9

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

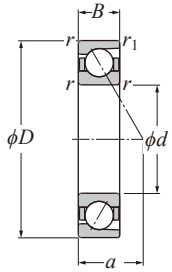
Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

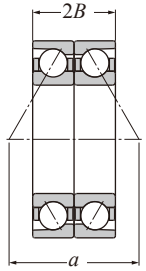
Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

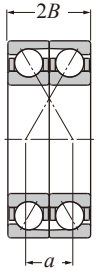
Basic load rating		Bearing number		Load center		Installation-related dimensions				
dynamic	static			(duplex)						
(duplex)				mm		mm				
kN		Back-to-back arrangement	Face-to-face arrangement	*a*		d_a	D_a	D_b	r_{as}	r_{1as}
C_r	C_{0r}			DB	DF	Min.	Max.	Max.	Max.	Max.
960	1 920	**DB**	**DF**	342	178	382	518	530	4	2
1 210	2 550	**DB**	**DF**	386.5	196.5	388	622	636	5	2.5
505	955	**DB**	**DF**	294.5	202.5	392	468	473	2	1
625	1 220	**DB**	—	442.5	312.5	398	501.5	509.5	3	2
700	1 400	**DB**	**DF**	325	195	398	502	511.5	3	1.5
790	1 620	—	**DF**	468	304	398	522	530	3	2
980	2 020	**DB**	**DF**	342	178	402	538	550	4	2
515	1 000	**DB**	**DF**	306	214	412	488	493	2	1
710	1 440	**DB**	**DF**	336.5	206.5	418	522	531.5	3	1.5
1 110	2 370	**DB**	**DF**	379	199	422	578	590	4	2
555	1 110	**DB**	**DF**	317.5	225.5	432	508	513	2	1
735	1 530	**DB**	**DF**	348	218	438	542	551.5	3	1.5
1 140	2 500	**DB**	**DF**	390.5	210.5	442	598	610	4	2
560	1 130	**DB**	**DF**	329	237	452	528	533	2	1
800	1 720	**DB**	**DF**	374.5	226.5	458	582	591.5	3	1.5
1 160	2 630	**DB**	**DF**	409	221	468	622	636	5	2.5
450	905	**DB**	—	328.5	248.5	472	528	533	2	1
685	1 450	**DB**	**DF**	356.5	244.5	474	566	573	2.5	1
810	1 770	**DB**	**DF**	386	238	478	602	611.5	3	1.5
1 300	3 000	**DB**	**DF**	429	229	488	652	666	5	2.5
575	1 210	**DB**	—	350	250	482	558	563	2	1
705	1 520	**DB**	**DF**	368	256	494	586	593	2.5	1
955	2 180	**DB**	**DF**	404.5	248.5	502	628	640	4	2
1 290	3 050	**DB**	**DF**	441	241	508	672	686	5	2.5
710	1 560	**DB**	**DF**	379.5	267.5	514	606	613	2.5	1
970	2 250	**DB**	**DF**	416	260	522	648	660	4	2



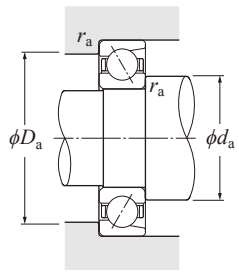
Single row



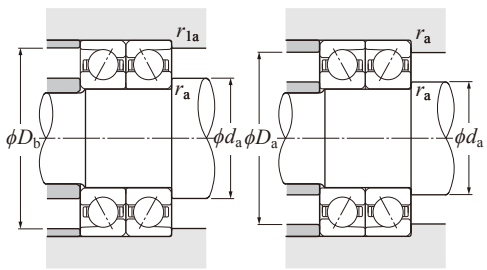
Back-to-back arrangement (DB)



Face-to-face arrangement (DF)



d 500-1 060 mm



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	*e*	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
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

Static equivalent radial load

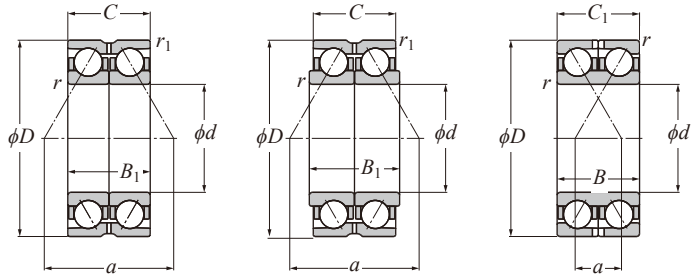
$P_{0r} = X_0F_r + Y_0F_a$

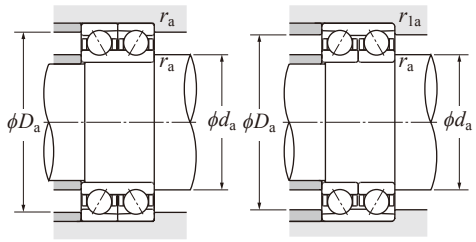
Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

Boundary dimensions						Contact angle	Basic load rating		Fatigue load limit	Bearing number	Drawing No.[2]	Load center	Mass	Basic load rating		Bearing number		Load center		Installation-related dimensions				
							dynamic	static						dynamic	static								
mm						°	kN		kN			mm	Single row kg	(duplex) kN				(duplex) mm		mm			
d	*D*	*B*	*C*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	*α*	C_r	C_{0r}	C_u			*a*	(approx.)	C_r	C_{0r}	Back-to-back arrangement	Face-to-face arrangement	*a* DB	*a* DF	d_a Min.	D_a Max.	D_b Max.	r_{as} Max.	r_{1as} Max.
500	720	100	—	6	3	30	815	1 600	43.5	**70/500**	1	226	129	1 320	3 200	**DB**	**DF**	452.5	252.5	528	692	706	5	2.5
560	700	100	—	5	2.5	30	740	1 450	39.0	**SF10013**	1	223	87.3	1 200	2 890	**DB**	**DF**	446.5	246.5	522	678	688	4	2
	750	85	—	5	2	30	690	1 380	36.0	**79/560**	1	231.5	105	1 120	2 760	**DB**	**DF**	463.5	293.5	582	728	740	4	2
630	780	69	—	4	1.5	30	555	1 140	28.4	**78/630A**	1	238	72.2	905	2 270	**DB**	**DF**	476	338	648	762	771.5	3	1.5
670	820	69	—	4	1.5	30	575	1 210	29.5	**78/670**	1	249.5	73.5	930	2 430	**DB**	**DF**	499	361	688	802	811.5	3	1.5
	820	69	—	4	1.5	40	510	1 070	25.9	**78/670B**	1	347	74.4	825	2 130	**DB**	**DF**	694	556	688	802	811.5	3	1.5
700	900	74	—	4	1.5	30	585	1 290	30.0	**SF14001**	1	268	117	955	2 580	**DB**	**DF**	536	388	718	882	891.5	3	1.5
1 000	1 420	130	—	7.5	4	30	1 590	4 650	88.5	**SF20001**	1	414.5	654	2 590	9 250	**DB**	**DF**	828.5	568.5	1 036	1 384	1 402	6	3
1 060	1 280	100	—	6	3	30	975	2 680	52.0	**78/1060**	1	387.5	255	1 580	5 350	**DB**	**DF**	775.5	575.5	1 088	1 252	1 266	5	2.5

1) Smallest allowable dimension for chamfer dimension *r* or r_1.
2) For details of Drawings, please refer to **Fig. 1** on page **B-21**.





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

Contact angle	e	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
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

Static equivalent radial load
$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

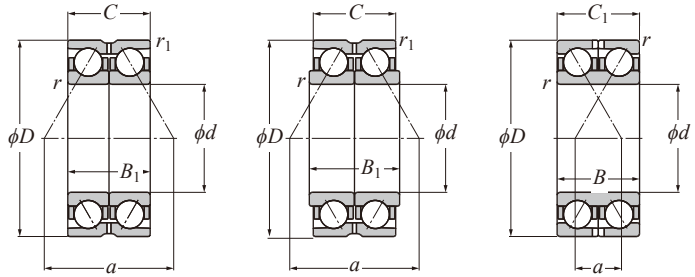
For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

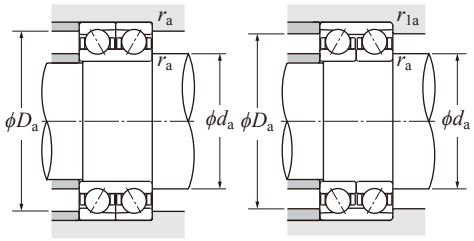
d 100-200 mm

Boundary dimensions mm						Contact angle °	Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number	Drawing 2) No.	Installation-related dimensions mm				Load center mm	Mass kg
d	D_1	B or B_1	C or C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	α	C_r	C_{0r}	C_u			d_a Min.	D_a Max.	r_{as} Max.	r_{1as} Max.	a	(approx.)
100	170	60.3	60.3	2.5	2.5	40	177	179	11.1	**DE2010**	4	158	112	2	2	143	5.64
120	190	66	66	2.5	1	30	207	236	13.4	**DE2409**	4	184.5	132	2	1	122	7.09
130	200	66	66	2.5	—	30	211	251	13.5	**DE2601**	2	188	142	2	—	64	7.54
140	210	66	66	2	—	40	225	266	10.4	**DE2812**	1	198	150	2	—	90	8
	210	66	66	1	—	40	198	248	12.5	**DE2806**	2	204.5	152	2	—	90	7.76
150	225	70	70	2.5	—	30	246	305	15.3	**DE3011**	2	213	162	2	—	71.5	9.74
	225	73	73	2.5	—	30	239	293	14.6	**DE3009**	1	213	162	2	—	72.5	9.69
	230	70	70	2	2	40	220	275	13.3	**DE3019**	4	221.5	158.5	2	2	194	9.74
160	215	56	50	2	1.1	40	136	186	9.00	**DE3207**	3	208	170	2	1	182	5.71
	240	76	76	2.5	—	30	279	355	17.1	**DE3201**	1	228	172	2	—	76.5	12
170	260	84	84	2.5	—	30	299	385	17.7	**DE3402**	1	248	182	2	—	111	16.1
175	280	92	92	2.5	—	40	355	480	21.5	**DE3502**	1	268	187	2	—	119	21.7
	280	92	92	2.5	—	40	395	530	24.8	**DE3501**	1	268	187	2	—	88.5	21.7
180	250	66	66	2.5	—	40	205	275	12.5	**DE3606**	1	238	192	2	—	106	9.83
	259.5	66	66	2.5	1	30	235	325	14.6	**DE3610**	4	254	192	2	1	160	10.4
	259.5	66	66	2.5	1	30	235	325	14.6	**DE3601**	6	254	192	2	1	160	10.4
	259.5	66	66	2.5	—	40	248	330	14.8	**DE3608**	2	247.5	192	2	—	109	10.7
	259.5	66	66	2	—	40	248	330	11.9	**DE3615**	1	249.5	190	2	—	109	10.7
	259.5	66	66	2.5	—	30	278	380	17.0	**DE3603**	1	247.5	192	2	—	80	10.7
	259.5	66	66	2.5	2.5	30	235	325	14.6	**DE3612**	4	247.5	192	2	2	160	10.4
	280	92	92	2.5	—	30	380	505	23.5	**DE3605**	1	268	192	2	—	89.5	20.9
190	269.5	66	66	2.5	1	30	238	335	14.7	**DE3807**	4	264	202	2	1	166	11.9
	269.5	66	66	2.5	1	30	238	335	14.7	**DE3801**	6	264	202	2	1	166	11.9
200	279.5	76	76	2.5	1.5	30	280	405	17.4	**DE4004**	6	271	212	2	1.5	177	14.3
	279.5	76	76	2.5	—	30	280	405	17.4	**DE4008**	2	267.5	212	2	—	88.5	14.3
	289.5	76	76	2.5	1.5	40	288	385	16.4	**DE4010**	7	281	212	2	1.5	244	16.5

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) For details of Drawings, please refer to **Fig. 2** on page **B-22**.

Double Row Angular Contact Ball Bearings NTN





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

Contact angle	e	Single row				DB, DF			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
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

Static equivalent radial load

$P_{0r} = X_0F_r + Y_0F_a$

Contact angle	Single row		DB, DF	
	X_0	Y_0	X_0	Y_0
30°	0.5	0.33	1	0.66
40°	0.5	0.26	1	0.52

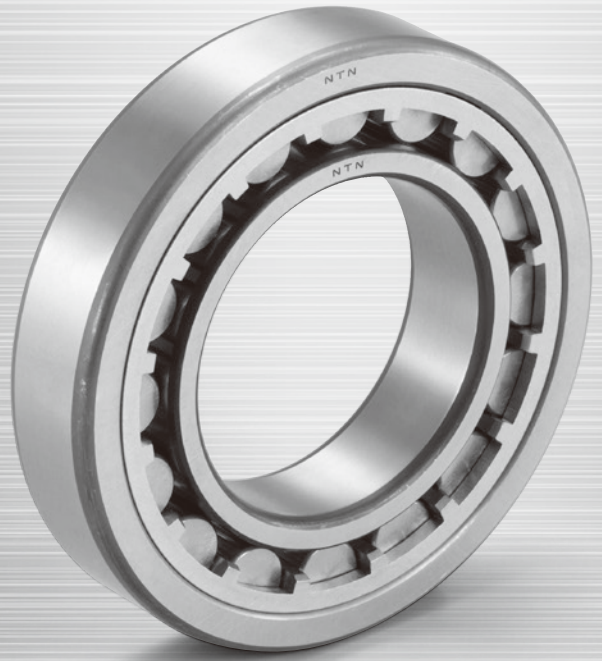
For single row,
when $P_{0r} < F_r$ use $P_{0r} = F_r$.

d 200-360 mm

Boundary dimensions mm						Contact angle °	Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number	Drawing 2) No.	Installation-related dimensions mm				Load center mm	Mass kg
d	D_1	B or B_1	C or C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	α	C_r	C_{0r}	C_u			d_a Min.	D_a Max.	r_{as} Max.	r_{1as} Max.	a	(approx.)
	289.5	76	76	2.5	2.1	30	299	420	17.8	**DE4019**	4	277.5	212	2	2	179	16.4
	289.5	76	76	2.5	1.5	30	299	420	17.8	**DE4009**	6	281	212	2	1.5	180	16.4
200	289.5	76	76	2.5	1.5	30	299	420	17.8	**DE4002**	6	281	212	2	1.5	179	16.4
	289.5	76	76	2.5	1.5	30	299	420	17.8	**DE4012**	4	281	212	2	1.5	179	16.4
	310	102	102	2.5	—	30	455	650	28.6	**DE4007**	1	298	212	2	—	99	28.3
	309.5	76	76	2.5	—	30	360	520	21.2	**DE4403**	1	297.5	232	2	—	95.5	17.8
	309.5	76	76	2.5	—	30	360	520	21.2	**DE4404**	1	297.5	232	2	—	95.5	17.8
220	309.5	76	76	2.1	1.1	30	360	520	21.2	**DE4408**	4	302.5	232	2	1	191	17.8
	319.5	92	92	2.5	—	30	415	625	19.6	**DE4409**	1	307.5	232	2	—	101	24.4
	319.5	92	92	2.5	—	40	370	550	22.2	**DE4406**	1	307.5	232	2	—	136	24.4
	329.5	80	80	2.5	1.5	30	390	585	23.2	**DE4602**	6	321	242	2	1.5	202	22
230	329.5	80	80	2.5	1.5	30	390	585	23.2	**DE4603**	4	321	242	2	1.5	202	22
	329.5	80	80	2.5	1.5	30	390	585	23.2	**DE4605**	5	321	242	2	1.5	202	22
240	359.5	112	112	3	1.5	40	485	770	29.9	**DE4803**	6	351	254	2.5	1.5	308	39.7
250	340	76	70	2	2	30	300	480	18.6	**DE5004**	3	328	262	2	2	208	18.4
	369.5	92	92	2.5	—	40	420	680	25.4	**DE5213**	1	357.5	272	2	—	155	31.3
260	369.5	92	92	2.5	—	30	475	775	29.1	**DE5211**	1	357.5	272	2	—	114	31.3
	369.5	92	92	2.5	2.5	30	435	695	26.1	**DE5212**	6	357.5	272	2	2	228	30.9
280	389.5	92	92	2.1	1.1	30	450	745	27.0	**DE5605**	4	382.5	292	2	1	239	33.4
300	429.5	112	112	3	—	30	590	1 040	36.5	**DE6001**	1	417.5	312	2.5	—	132	52.4
360	540	164	164	5	—	30	805	1 630	51.0	**DE7201**	1	518	382	4	—	171	131

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) For details of Drawings, please refer to **Fig. 2** on page **B-22**.

Cylindrical Roller Bearings



1. Types, design features, and characteristics

Cylindrical roller bearings can accommodate heavy radial loads due to the line contact formed between their rolling elements and raceways. These bearings are also suitable for high speed applications since the rollers are guided by either inner or outer ring ribs. Cylindrical roller bearings are separable, allowing them to be easily installed and disassembled even when interference fits are required.

Among the various types of cylindrical roller bearings other than the standard type, E type has a high load capacity while maintaining standard boundary dimensions. These bearings are classified by the number or roller rows into double row bearings, four row bearings, etc.

For extremely heavy load applications, the non-separable full complement SL-type bearing offers special advantages. For SL-type and four-row cylindrical roller bearings, see section "C. Special Application Bearings".

Table 1 shows the various types and characteristics of single row cylindrical roller bearings. **Table 2** shows the characteristics of non-standard type cylindrical roller bearings.

Table 1 Cylindrical roller bearing types and characteristics

Type code	Structure	Characteristics
NU type N type	 NU type  N type	• NU-type outer rings have two ribs. The outer ring, roller, and cage assembly can be separated from the inner ring. N-type inner rings have two ribs. The inner ring, roller, and cage assembly can be separated from the outer ring. • Unable to accommodate any axial loading. • This is widely used as the floating side bearing in a fixed-float arrangement.
NJ type NF type	 NJ type  NF type	• NJ type has two ribs on the outer ring, a single rib on the inner ring; NF type has a single rib on the outer ring, and two ribs on the inner ring. • Can receive single direction axial loads. • When there is no distinction between the fixed-side and floating-side bearing, these types can be used as a pair in close proximity.
NUP type NH type (NJ + HJ)	 NUP type  NH type	• NUP type has a collar ring attached to the ribless side of the inner ring; NH type is NJ type with an L-type collar ring attached. All of these collar rings are separable, and therefore it is necessary to fix the inner ring axially. • Can accommodate axial loads in either direction. • Widely used as the shaft's fixed-side bearing.

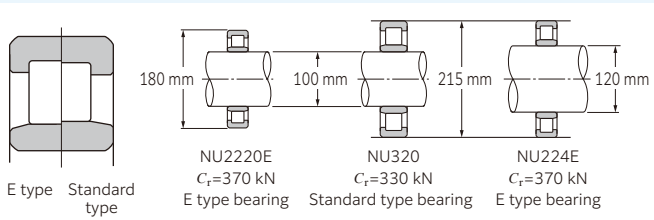
Remarks: Selection of bearing arrangement

In general, a shaft is supported by two bearings. A bearing that positions and fixes the shaft in the axial direction is called the "**fixed side bearing**" and a bearing that allows the axial movement is called the "**floating side bearing**". This allows expansion and contraction of the shaft due to temperature variation and absorbs errors in the bearing mounting clearance. Fixing two bearings without providing a floating side bearing applies an excessive load on bearings because of the expansion and contraction or the error, damaging the bearings at an early stage.

The **fixed side bearing** is able to support radial and axial loads. A bearing that can fix axial movement in both directions should therefore be selected. A **floating side bearing** that allows movement in the axial direction while supporting a radial load is desirable. Movement in the axial direction **occurs on the raceway surface** for bearings with separable inner and outer rings such as **cylindrical roller bearings**, and **occurs on the fitting surface** for those which are not separable, such as **deep groove ball bearings**.

When shaft expansion and contraction due to temperature fluctuations is slight, the same type of bearing may be used for both the fixed-side and floating-side bearing.

Table 2 Non-standard type cylindrical roller bearing characteristics

Designation	Characteristics
E-Type cylindrical roller bearing	• Boundary dimensions are the same as the standard type, but the diameter, length and number of the rollers have been increased, resulting in higher load capacity. • Identified by the addition of "E" to the end of the basic roller number. • Enables compact design due increased load rating. • Rollers' inscribed circle diameter differs from the standard-type rollers and therefore cannot be interchanged.  Note: In the dimension tables, both the standard type and E type are listed.
Double-row cylindrical roller bearing	• NN type and NNU type are available. • Widely used for applications requiring thin-walled bearings, such as the main shafts of machine tools, rolling machine rollers, and in printing equipment. • Internal radial clearance is adjusted for the spindle of machine tools by pressing the tapered bore of the inner ring on a tapered shaft. Remarks: For precision bearings for machine tools, see the special catalog"**Precision Rolling Bearings (CAT. No. 2260/E)**".

2. Dimensional and rotational accuracy

Refer to **Table 3.3** (pages A-18 and A-19).

3. Recommended fits

Refer to **Table 4.2** (pages A-33 and A-34).

4. Bearing internal clearance

Radial internal clearances of the cylindrical roller bearing are classified into the following two types; interchangeable radial internal clearances that allow changing the combination of inner and outer rings, and non-interchangeable radial internal clearances that do not allow changing the combination. Refer to the tables (pages) provided for each of interchangeable and non-interchangeable radial internal clearances.

Interchangeable radial internal clearance
····· **Table 5.5** (page A-41)
Non-interchangeable radial internal clearance
····· **Table 5.6** (pages A-42 and A-43)

5. Allowable misalignment

Edge loading due to misalignment under general load conditions should be avoided to prevent premature bearing failure. The maximum allowable misalignment based on bearing series can be found below. The values apply when the bearings are to be used as the floating side of NU and N types. For NJ, NUP, and NH types that are to be used for the fixed side, consult **NTN** Engineering. Depending on the magnitude of the axial load, the edge loading may exceed recommended limits, which could lead to a reduction in bearing life.

- Bearing series 0 or 1 ····· 1/1 000
- Bearing series 2 ····· 1/2 000
- Double-row cylindrical roller bearings[1)]
  ····· 1/2 000

Note: 1) Does not include high-precision bearings for machine tool main shaft applications.

6. Tolerance of inscribed circle diameter and circumscribed circle diameter of rollers of interchangeable cylindrical roller bearings

Table 3 Tolerance of inscribed circle diameter and circumscribed circle diameter of rollers of interchangeable cylindrical roller bearings

Unit: μm

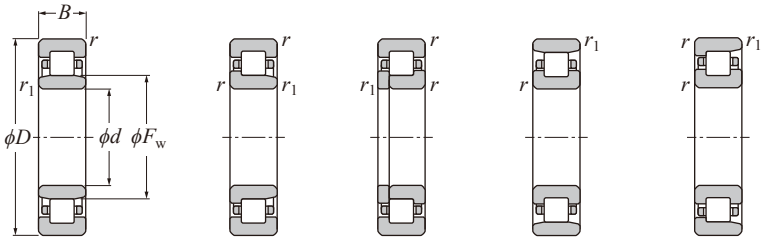
Nominal bearing bore diameter d mm		Dimensional tolerance of roller inscribed circle diameter Δ_{Fw}		Dimensional tolerance of roller circumscribed circle diameter Δ_{Ew}	
Over	Incl.	Upper	Lower	Upper	Lower
50	120	+ 20	0	0	−20
120	200	+ 25	0	0	−25
200	250	+ 30	0	0	−30
250	315	+ 35	0	0	−35
315	400	+ 40	0	0	−40
400	500	+ 45	0	0	−45
500	630	+ 70	0	0	−70
630	800	+ 80	0	0	−80
800	1 000	+ 90	0	0	−90
1 000	1 250	+ 105	0	0	−105
1 250	1 400	+ 125	0	0	−125

Note: Interchangeable cylindrical roller bearings are bearings having the same number in the group. The bearing function is not impaired even if an outer ring is combined with an inner ring with rollers or an inner ring is combined with an outer ring with rollers.

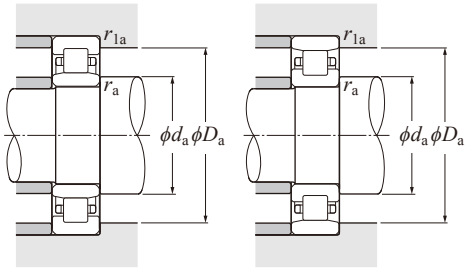
7. Precautions

Slippage between the rollers and raceways may occur when bearings are operated under small loads and may cause smearing. This is most apparent when a large cylindrical roller bearing, in which the mass of the rollers and cage is large, is used.

For additional details, please contact **NTN** Engineering.



NU type NJ type NUP type N type NF type



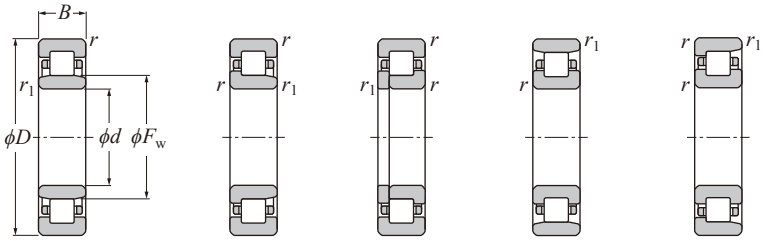
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

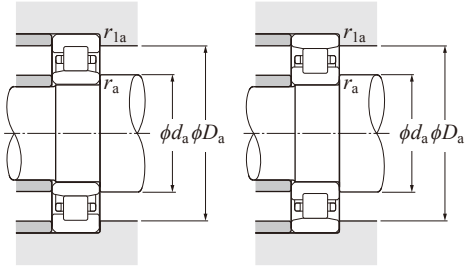
d 100-120 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
100	140	20	1.1	1	77.5	98.0	11.3	**NU1920**	110	105	133.5	1	1	1.01
	150	24	1.5	1.1	103	126	14.4	**NU1020**	113	106.5	142	1.5	1	1.45
	180	34	2.1	2.1	203	217	23.9	**NU220**	120	111	169	2	2	3.33
	180	34	2.1	2.1	277	305	33.5	**NU220E**	119	111	169	2	2	3.66
	180	46	2.1	2.1	286	340	37.5	**NU2220**	120	111	169	2	2	4.57
	180	46	2.1	2.1	370	445	49.0	**NU2220E**	119	111	169	2	2	5.01
	215	47	3	3	330	335	36.0	**NU320**	129.5	113	202	2.5	2.5	7.49
	215	47	3	3	420	425	45.0	**NU320E**	127.5	113	202	2.5	2.5	8.57
	215	73	3	3	455	505	54.0	**NU2320**	129.5	113	202	2.5	2.5	11.7
	215	73	3	3	630	715	76.0	**NU2320E**	127.5	113	202	2.5	2.5	12.8
105	160	26	2	1.1	117	142	16.0	**NU1021**	119.5	111.5	151	2	1	1.84
	190	36	2.1	2.1	223	241	26.1	**NU221**	126.8	116	179	2	2	3.95
	225	49	3	3	355	360	37.5	**NU321**	135	118	212	2.5	2.5	8.53
110	150	20	1.1	1	80.5	106	11.9	**NU1922**	120	115	143.5	1	1	1.09
	170	28	2	1.1	146	174	19.2	**NU1022**	125	116.5	161	2	1	2.33
	200	38	2.1	2.1	266	290	31.0	**NU222**	132.5	121	189	2	2	4.63
	200	38	2.1	2.1	325	365	39.0	**NU222E**	132.5	121	189	2	2	4.27
	200	53	2.1	2.1	350	415	44.0	**NU2222**	132.5	121	189	2	2	6.56
	200	53	2.1	2.1	425	515	55.0	**NU2222E**	132.5	121	189	2	2	7.4
	200	69.8	2.1	2.1	475	605	65.0	**NU3222A**	132.5	121	189	2	2	9.85
	240	50	3	3	395	400	41.5	**NU322**	143	123	227	2.5	2.5	10
	240	50	3	3	500	525	54.0	**NU322E**	143	123	227	2.5	2.5	11.1
	240	80	3	3	670	790	81.5	**NU2322**	143	123	227	2.5	2.5	17.1
	240	80	3	3	750	880	90.5	**NU2322E**	143	123	227	2.5	2.5	19.4
120	180	28	2	1.1	154	191	20.6	**NU1024**	135	126.5	171	2	1	2.44
	215	40	2.1	2.1	288	320	33.5	**NU224**	143.5	131	204	2	2	5.57
	215	40	2.1	2.1	370	420	44.0	**NU224E**	143.5	131	204	2	2	5.97
	215	58	2.1	2.1	385	460	48.0	**NU2224**	143.5	131	204	2	2	8.19

1) Smallest allowable dimension for chamfer dimension r or r_1.



NU type NJ type NUP type N type NF type



NU type N type

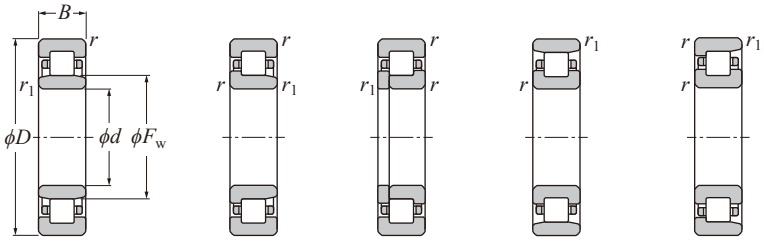
Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

d 120-150 mm

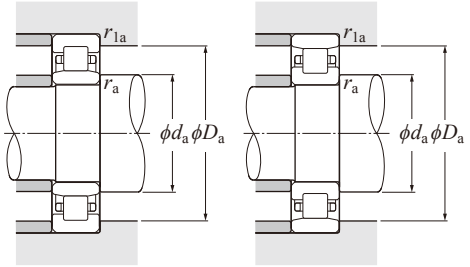
Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
120	215	58	2.1	2.1	500	620	64.5	**NU2224E**	143.5	131	204	2	2	9.18
	215	76	2.1	2.1	600	815	85.0	**NU3224**	143.5	131	204	2	2	12.2
	260	55	3	3	500	510	51.0	**NU324**	154	133	247	2.5	2.5	12.8
	260	55	3	3	585	610	61.0	**NU324E**	154	133	247	2.5	2.5	13.9
	260	86	3	3	785	920	92.5	**NU2324**	154	133	247	2.5	2.5	21.5
	260	86	3	3	880	1 030	103	**NU2324E**	154	133	247	2.5	2.5	26.1
130	200	33	2	1.1	191	238	24.9	**NU1026**	148	136.5	191	2	1	3.69
	230	40	3	3	300	340	35.0	**NU226**	156	143	217	2.5	2.5	6.3
	230	40	3	3	405	455	46.0	**NU226E**	153.5	143	217	2.5	2.5	6.9
	230	64	3	3	420	530	54.0	**NU2226**	156	143	217	2.5	2.5	10.2
	230	64	3	3	590	735	75.0	**NU2226E**	153.5	143	217	2.5	2.5	11.8
	280	58	4	4	620	665	65.5	**NU326**	167	146	264	3	3	17.4
	280	58	4	4	685	735	72.0	**NU326E**	167	146	264	3	3	19.4
	280	93	4	4	930	1 130	111	**NU2326**	167	146	264	3	3	26.9
	280	93	4	4	1 020	1 230	121	**NU2326E**	167	146	264	3	3	30.9
140	210	33	2	1.1	195	250	25.7	**NU1028**	158	146.5	201	2	1	4.05
	250	42	3	3	345	400	39.5	**NU228**	169	153	237	2.5	2.5	7.88
	250	42	3	3	435	515	51.0	**NU228E**	169	153	237	2.5	2.5	8.73
	250	68	3	3	495	635	63.5	**NU2228**	169	153	237	2.5	2.5	12.9
	250	68	3	3	635	835	83.0	**NU2228E**	169	153	237	2.5	2.5	15.8
	250	88	3	3	770	1 120	112	**NU3228**	169	153	237	2.5	2.5	19.1
	300	62	4	4	685	745	72.0	**NU328**	180	156	284	3	3	21.2
	300	62	4	4	735	795	76.5	**NU328E**	180	156	284	3	3	23.2
	300	102	4	4	1 020	1 250	120	**NU2328**	180	156	284	3	3	33.8
	300	102	4	4	1 130	1 380	133	**NU2328E**	180	156	284	3	3	38.7
150	225	35	2.1	1.5	224	294	29.6	**NU1030**	169.5	158	214	2	1.5	4.77
	270	45	3	3	380	435	42.5	**NU230**	182	163	257	2.5	2.5	9.92
	270	45	3	3	495	595	58.0	**NU230E**	182	163	257	2.5	2.5	11

1) Smallest allowable dimension for chamfer dimension r or r_1.

Cylindrical Roller Bearings NTN



NU type NJ type NUP type N type NF type



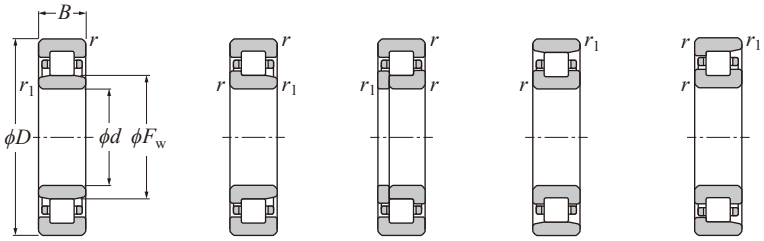
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

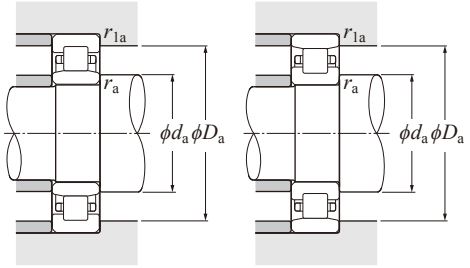
d 150-180 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
150	270	73	3	3	555	710	69.5	**NU2230**	182	163	257	2.5	2.5	16.3
	270	73	3	3	735	980	95.5	**NU2230E**	182	163	257	2.5	2.5	19.7
	270	96	3	3	885	1 300	127	**NU3230**	182	163	257	2.5	2.5	24.5
	320	65	4	4	735	805	76.0	**NU330**	193	166	304	3	3	25.3
	320	65	4	4	840	920	86.5	**NU330E**	193	166	304	3	3	28.4
	320	108	4	4	1 130	1 400	132	**NU2330**	193	166	304	3	3	40.6
	320	108	4	4	1 290	1 600	150	**NU2330E**	193	166	304	3	3	47.2
160	240	38	2.1	1.5	263	340	34.0	**NU1032**	180	168	229	2	1.5	5.9
	290	48	3	3	475	570	54.5	**NU232**	195	173	277	2.5	2.5	13.7
	290	48	3	3	555	665	63.5	**NU232E**	195	173	277	2.5	2.5	15.6
	290	80	3	3	700	940	90.0	**NU2232**	195	173	277	2.5	2.5	22
	290	80	3	3	895	1 190	114	**NU2232E**	193	173	277	2.5	2.5	25.1
	340	68	4	4	775	875	81.0	**NU332**	208	176	324	3	3	31.3
	340	68	4	4	950	1 050	97.5	**NU332E**	204	176	324	3	3	34
	340	114	4	4	1 190	1 520	141	**NU2332**	208	176	324	3	3	50.5
	340	114	4	4	1 460	1 820	168	**NU2332E**	204	176	324	3	3	56
170	260	42	2.1	2.1	310	400	38.5	**NU1034**	193	181	249	2	2	7.88
	310	52	4	4	530	635	59.5	**NU234**	208	186	294	3	3	17
	310	52	4	4	670	800	75.0	**NU234E**	207	186	294	3	3	19.6
	310	86	4	4	795	1 080	101	**NU2234**	208	186	294	3	3	27.2
	310	86	4	4	1 070	1 410	132	**NU2234E**	205	186	294	3	3	31
	310	110	4	4	1 130	1 690	159	**NU3234**	208	186	294	3	3	37.4
	360	72	4	4	885	1 010	92.0	**NU334**	220	186	344	3	3	37
	360	120	4	4	1 360	1 750	159	**NU2334**	220	186	344	3	3	59.5
180	250	33	2	1.1	239	335	32.5	**NU1936**	197	186.5	241	2	1	5.21
	280	46	2.1	2.1	380	485	46.5	**NU1036**	205	191	269	2	2	10.3
	280	74	2.1	2.1	675	1 030	97.5	**NU3036**	205	191	269	2	2	17.8
	320	52	4	4	550	675	62.5	**NU236**	218	196	304	3	3	17.7

1) Smallest allowable dimension for chamfer dimension r or r_1.



NU type NJ type NUP type N type NF type



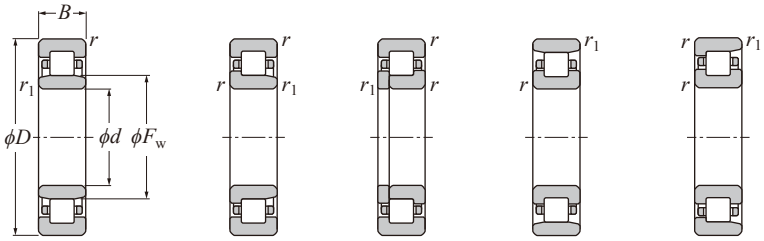
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

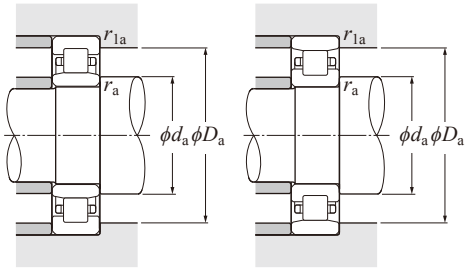
d 180-220 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
	320	52	4	4	695	850	78.5	**NU236E**	217	196	304	3	3	20.4
	320	86	4	4	825	1 140	106	**NU2236**	218	196	304	3	3	28.4
180	320	86	4	4	1 120	1 510	139	**NU2236E**	215	196	304	3	3	31.9
	380	75	4	4	1 000	1 150	103	**NU336**	232	196	364	3	3	44.2
	380	126	4	4	1 530	1 990	179	**NU2336**	232	196	364	3	3	69.5
	290	46	2.1	2.1	390	510	48.0	**NU1038**	215	201	279	2	2	10.7
	340	55	4	4	615	770	70.0	**NU238**	231	206	324	3	3	21.3
	340	55	4	4	770	955	86.5	**NU238E**	230	206	324	3	3	24.2
190	340	92	4	4	920	1 290	117	**NU2238**	231	206	324	3	3	34.4
	340	92	4	4	1 220	1 670	152	**NU2238E**	228	206	324	3	3	39.5
	400	78	5	5	1 080	1 260	111	**NU338**	245	210	380	4	4	49.4
	400	132	5	5	1 680	2 220	196	**NU2338**	245	210	380	4	4	80.5
	310	51	2.1	2.1	430	580	53.5	**NU1040**	229	211	299	2	2	13.9
	340	112	3	3	1 260	1 820	165	**NU3140A**	235	213	327	2.5	2.5	42.8
	360	58	4	4	690	865	77.5	**NU240**	244	216	344	3	3	25.3
	360	58	4	4	850	1 060	95.0	**NU240E**	243	216	344	3	3	28.1
200	360	98	4	4	1 020	1 440	129	**NU2240**	244	216	344	3	3	41.3
	360	98	4	4	1 350	1 870	167	**NU2240E**	241	216	344	3	3	47.8
	420	80	5	5	1 080	1 270	111	**NU340**	260	220	400	4	4	55.8
	420	138	5	5	1 680	2 240	195	**NU2340**	260	220	400	4	4	92.6
	420	165	5	5	2 070	2 930	255	**NU3340**	260	220	400	4	4	118
	300	48	2.1	1.5	430	705	64.5	**NU2944**	240	231	289	2	1.5	10.5
	340	56	3	3	555	750	67.0	**NU1044**	250	233	327	2.5	2.5	18.2
	340	90	3	3	950	1 490	134	**NU3044**	250	233	327	2.5	2.5	31.7
220	370	120	4	4	1 310	2 090	184	**NU3144**	262	236	354	3	3	55.7
	400	65	4	4	845	1 080	94.0	**NU244**	270	236	384	3	3	37.7
	400	108	4	4	1 260	1 810	157	**NU2244**	270	236	384	3	3	59
	400	144	4	4	1 710	2 680	233	**NU3244**	270	236	384	3	3	84.2

1) Smallest allowable dimension for chamfer dimension r or r_1.



NU type NJ type NUP type N type NF type



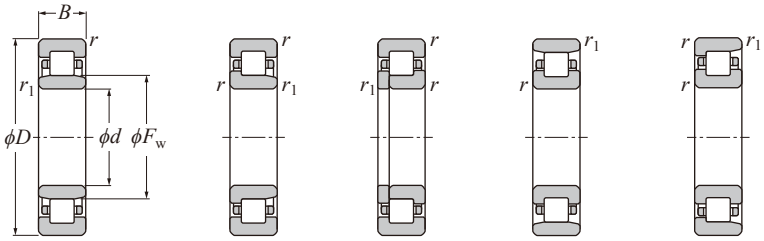
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

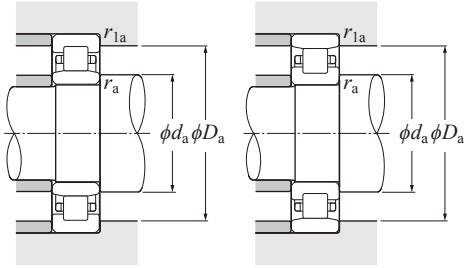
d 220-300 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
220	460	88	5	5	1 320	1 570	133	**NU344**	284	240	440	4	4	73.4
	460	145	5	5	1 970	2 620	222	**NU2344**	284	240	440	4	4	116
240	360	56	3	3	585	820	72.0	**NU1048**	270	253	347	2.5	2.5	19.6
	440	72	4	4	1 040	1 340	113	**NU248**	295	256	424	3	3	50.2
	440	120	4	4	1 590	2 320	196	**NU2248**	295	256	424	3	3	80
	500	95	5	5	1 590	1 950	160	**NU348**	310	260	480	4	4	93.4
	500	155	5	5	2 330	3 200	262	**NU2348**	310	260	480	4	4	147
260	360	60	2.1	2.1	605	985	85.5	**NU2952**	285	271	349	2	2	19.5
	400	65	4	4	715	1 000	85.0	**NU1052**	296	276	384	3	3	29.1
	440	144	4	4	2 010	3 150	264	**NU3152**	305	276	424	3	3	95.1
	480	80	5	5	1 270	1 660	137	**NU252**	320	280	460	4	4	66.9
	480	130	5	5	1 980	2 930	241	**NU2252**	320	280	460	4	4	104
	540	102	6	6	1 790	2 230	180	**NU352**	336	284	516	5	5	117
	540	165	6	6	2 600	3 600	289	**NU2352**	336	284	516	5	5	182
	540	206	6	6	3 250	4 800	385	**NU3352**	336	284	516	5	5	242
280	380	46	2.1	2.1	460	710	60.5	**NU1956**	305	291	369	2	2	15.9
	420	65	4	4	730	1 050	88.0	**NU1056**	316	296	404	3	3	30.9
	500	80	5	5	1 320	1 760	143	**NU256**	340	300	480	4	4	70.8
	500	130	5	5	2 050	3 100	252	**NU2256**	340	300	480	4	4	109
	580	175	6	6	3 000	4 250	335	**NU2356**	362	304	556	5	5	222
300	420	72	3	3	865	1 440	120	**NU2960**	330	313	407	2.5	2.5	32.6
	460	74	4	4	950	1 340	109	**NU1060**	340	316	444	3	3	43.6
	460	118	4	4	1 780	3 000	246	**NU3060**	340	316	444	3	3	75.2
	540	85	5	5	1 560	2 070	164	**NU260**	364	320	520	4	4	88.2
	540	140	5	5	2 420	3 650	290	**NU2260**	364	320	520	4	4	138
	620	185	7.5	7.5	3 600	5 150	395	**NU2360**	385	332	588	6	6	316

1) Smallest allowable dimension for chamfer dimension r or r_1.



NU type NJ type NUP type N type NF type



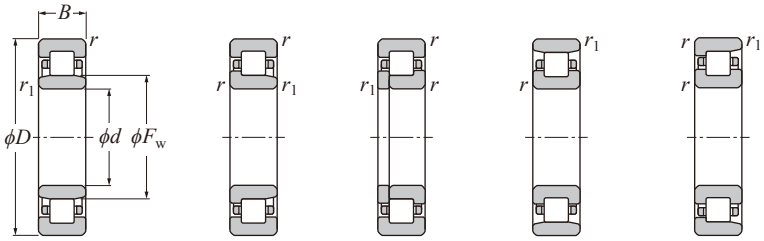
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

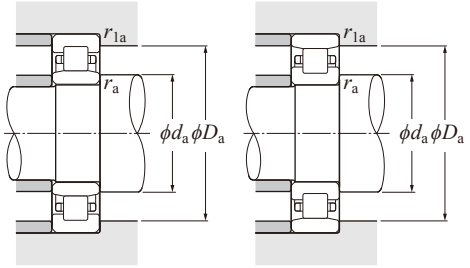
d 320-530 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
320	480	74	4	4	970	1 410	113	**NU1064**	360	336	464	3	3	46
	540	176	5	5	2 800	4 550	355	**NU3164**	376	340	520	4	4	175
	580	92	5	5	1 780	2 390	186	**NU264**	390	340	560	4	4	111
340	460	72	3	3	920	1 610	130	**NU2968**	370	353	447	2.5	2.5	36.2
	520	82	5	5	1 160	1 670	132	**NU1068**	385	360	500	4	4	61.8
	520	133	5	5	2 260	3 900	310	**NU3068**	385	360	500	4	4	108
	710	212	7.5	7.5	4 700	6 600	490	**NU2368**	435	372	678	6	6	477
360	440	60	2.1	2.1	510	1 090	88.0	**NU3872**	382	371	429	2	2	20.1
	480	72	3	3	955	1 720	137	**NU2972**	390	373	467	2.5	2.5	38
	540	82	5	5	1 190	1 750	136	**NU1072**	405	380	520	4	4	64.7
	650	232	6	6	4 600	7 600	570	**NU3272**	435	384	626	5	5	356
	750	224	7.5	7.5	5 000	7 000	510	**NU2372**	460	392	718	6	6	562
380	560	82	5	5	1 220	1 840	141	**NU1076**	425	400	540	4	4	67.5
	680	175	6	6	3 700	5 800	430	**NU2276**	460	404	656	5	5	326
400	500	75	2.1	2.1	965	2 250	174	**NU3880**	430	411	489	2	2	35.4
	600	90	5	5	1 460	2 190	164	**NU1080**	450	420	580	4	4	87.6
	600	148	5	5	2 800	5 050	380	**NU3080**	450	420	580	4	4	155
420	560	65	4	4	885	1 510	114	**NU1984**	456	436	544	3	3	46.7
	560	82	4	4	1 320	2 530	192	**NU2984**	456	436	544	3	3	59
	620	90	5	5	1 500	2 290	170	**NU1084**	470	440	600	4	4	91
440	600	95	4	4	1 640	3 000	225	**NU2988**	480	456	584	3	3	82.8
	650	94	6	6	1 590	2 430	178	**NU1088**	493	464	626	5	5	105
460	580	72	3	3	1 100	2 230	166	**NU2892**	490	473	567	2.5	2.5	47.1
480	650	78	5	5	1 260	2 150	156	**NU1996**	523	500	630	4	4	78.5
	650	100	5	5	1 820	3 450	250	**NU2996**	523	560	630	4	4	101
500	720	100	6	6	1 790	2 870	203	**NU10/500**	556	524	696	5	5	130
530	710	82	5	5	1 440	2 480	175	**NU19/530**	576	550	690	4	4	95.9
	710	106	5	5	2 080	4 000	282	**NU29/530**	576	550	690	4	4	124

1) Smallest allowable dimension for chamfer dimension r or r_1.



NU type NJ type NUP type N type NF type



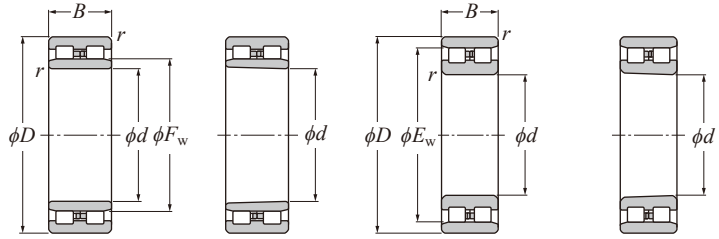
NU type N type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

d 560-1 250 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Dimension mm	Installation-related dimensions mm				Mass kg
d	*D*	*B*	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u	**NU** type	F_w	d_a Min.	D_a Max.	r_{as} Max.	r_{las} Max.	**NU** type (approx.)
560	750	85	5	5	1 630	2 840	197	**NU19/560**	607	580	730	4	4	111
	750	112	5	5	2 230	4 250	296	**NU29/560**	607	580	730	4	4	146
	820	115	6	6	2 430	3 900	268	**NU10/560**	626	584	796	5	5	216
600	800	90	5	5	1 790	3 200	217	**NU19/600**	650	620	780	4	4	132
	800	118	5	5	2 510	4 950	335	**NU29/600**	650	620	780	4	4	173
630	780	88	4	4	1 690	3 650	246	**NU28/630**	667	646	764	3	3	97.5
	850	128	6	6	3 000	5 850	390	**NU29/630**	684	654	826	5	5	218
	920	128	7.5	7.5	2 840	4 650	310	**NU10/630**	705	662	888	6	6	302
670	820	112	4	4	2 230	5 500	365	**NU38/670**	709	686	804	3	3	136
	900	136	6	6	3 250	6 600	435	**NU29/670**	729	694	876	5	5	257
710	950	140	6	6	3 700	7 500	485	**NU29/710**	770	734	926	5	5	292
750	1 000	145	6	6	3 950	8 400	535	**NU29/750**	815	774	976	5	5	332
800	1 150	155	7.5	7.5	4 500	7 800	480	**NU10/800**	887	832	1 118	6	6	554
850	1 030	106	5	5	2 650	6 350	395	**NU28/850**	895	870	1 010	4	4	188
	1 120	118	6	6	3 250	6 150	375	**NU19/850**	917	874	1 096	5	5	329
	1 120	155	6	6	4 450	9 250	570	**NU29/850**	917	874	1 096	5	5	432
1 060	1 400	195	7.5	7.5	6 750	14 500	835	**NU29/1060**	1 145	1 092	1 368	6	6	855
1 180	1 540	206	7.5	7.5	7 650	17 000	945	**NU29/1180**	1 270	1 212	1 508	6	6	1 060
1 250	1 630	170	7.5	7.5	6 150	12 500	685	**NU19/1250**	1 345	1 282	1 598	6	6	975

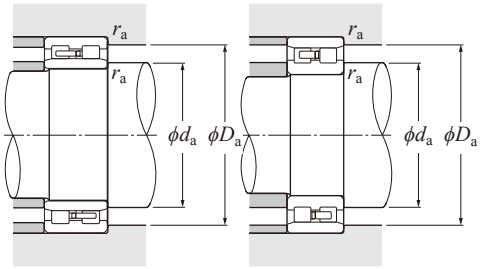
1) Smallest allowable dimension for chamfer dimension r or r_1.



NNU type
Cylindrical bore Tapered bore

NN type
Cylindrical bore Tapered bore

Double Row Cylindrical Roller Bearings NTN



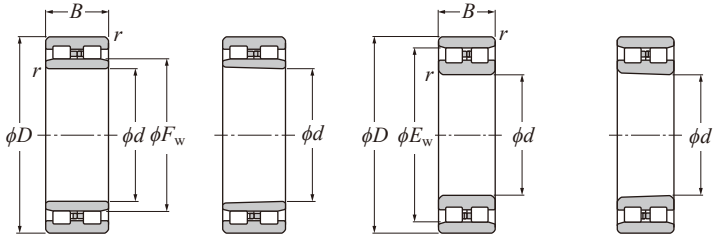
NNU type NN type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

d 100-220 mm

Boundary dimensions mm				Basic load rating kN		Fatigue load limit kN	Bearing number [2] NNU type		Bearing number [2] NN type		Dimension mm		Installation-related dimensions mm			Mass (approx.) kg			
				dynamic	static		NNU type		NN type							NNU type		NN type	
d	D	B	r_{smin} [1]	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore	F_w	E_w	d_a Min.	D_a Max.	r_{as} Max.	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore
100	140	40	1.1	145	260	30.0	**NNU4920**	—	—	—	113	—	106.5	133.5	1	1.83	—	—	—
105	160	41	2	220	320	36.0	—	—	**NN3021**	—	—	146	114	151	2	—	—	2.89	—
110	170	45	2	254	375	41.5	—	—	**NN3022**	—	—	155	119	161	2	—	—	3.69	—
120	165	45	1.1	203	360	39.5	**NNU4924**	**NNU4924K**	—	—	134.5	—	126.5	158.5	1	2.75	2.63	—	—
	180	46	2	258	390	42.5	—	—	**NN3024**	—	—	165	129	171	2	—	—	3.98	—
130	180	50	1.5	244	440	47.0	**NNU4926**	—	—	—	146	—	138	172	1.5	3.69	—	—	—
	200	52	2	315	475	50.0	**NNU3026**	—	**NN3026**	—	150	182	139	191	2	6.15	—	5.92	—
140	190	50	1.5	251	470	49.0	**NNU4928**	—	—	—	156	—	148	182	1.5	3.94	—	—	—
	210	53	2	330	515	53.0	**NNU3028**	—	**NN3028**	—	160	192	149	201	2	6.64	—	6.44	—
150	210	60	2	380	690	70.5	**NNU4930**	**NNU4930K**	—	—	168.5	—	159	201	2	6.18	5.9	—	—
	225	56	2.1	370	585	59.0	**NNU3030**	—	**NN3030**	—	172	206	161	214	2	8.06	—	7.81	—
160	220	60	2	395	740	74.0	**NNU4932**	—	—	—	178.5	—	169	211	2	6.53	—	—	—
	240	60	2.1	415	660	65.5	—	—	**NN3032**	**NN3032K**	—	219	171	229	2	—	—	8.92	8.59
170	230	60	2	400	765	75.5	**NNU4934**	—	—	—	188.5	—	179	221	2	6.87	—	—	—
	260	67	2.1	490	775	75.0	**NNU3034**	—	**NN3034**	—	196	236	181	249	2	13.3	—	12.6	—
	280	88	2.1	705	1 050	100	**NNU3134**	—	**NN3134**	—	201	253	181	269	2	22.3	—	21.5	—
180	250	69	2	510	965	93.0	**NNU4936**	—	—	—	202	—	189	241	2	9.9	—	—	—
	280	74	2.1	630	995	94.5	—	—	**NN3036**	—	—	255	191	269	2	—	—	16.6	—
190	260	69	2	525	1 030	98.0	**NNU4938**	**NNU4938K**	—	—	212	—	199	251	2	10.4	9.94	—	—
	290	75	2.1	640	1 040	97.0	—	—	**NN3038**	**NN3038K**	—	265	201	279	2	—	—	18	17.4
200	280	80	2.1	615	1 180	110	**NNU4940**	**NNU4940K**	**NN4940**	**NN4940K**	225	261	211	269	2	14.7	14	14	13.3
	310	82	2.1	725	1 170	107	**NNU3040**	—	**NN3040**	**NN3040K**	232	282	211	299	2	23.5	—	21.6	20.8
220	300	60	2.1	520	975	89.0	—	—	—	**NN3944K**	—	281	231	289	2	—	—	—	12.3
	300	80	2.1	650	1 300	118	**NNU4944**	**NNU4944K**	—	**NN4944K**	245	281	231	289	2	15.9	15.2	—	14.5
	340	90	3	905	1 480	132	**NNU3044**	—	**NN3044**	**NN3044K**	254	310	233	327	2.5	31	—	29.3	28.2
	370	120	4	1 200	1 890	166	**NNU3144**	—	**NN3144**	—	263.5	331.5	236	354	3	54.4	—	52.4	—

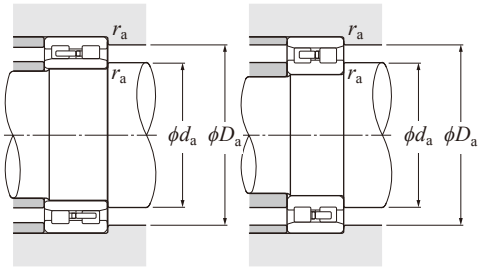
1) Smallest allowable dimension for chamfer dimension r.
2) "**K**" indicates bearings having a tapered bore with a taper ratio of 1:12.



NNU type
Cylindrical bore Tapered bore

NN type
Cylindrical bore Tapered bore

Double Row Cylindrical Roller Bearings NTN



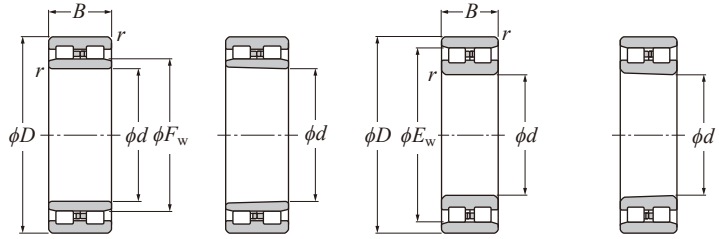
NNU type NN type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

d 240-420 mm

Boundary dimensions mm				Basic load rating kN		Fatigue load limit kN	Bearing number [2]				Dimension mm		Installation-related dimensions mm			Mass (approx.) kg			
				dynamic	static		NNU type		NN type							NNU type		NN type	
d	D	B	r_{smin} [1]	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore	F_w	E_w	d_a Min.	D_a Max.	r_{as} Max.	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore
	320	60	2.1	545	1 060	95.0	—	—	—	NN3948K	—	301	251	309	2	—	—	—	12.9
240	320	80	2.1	680	1 410	126	NNU4948	NNU4948K	NN4948	NN4948K	265	301	251	309	2	17.2	16.4	16.4	15.6
	360	92	3	945	1 600	140	—	—	NN3048	NN3048K	—	330	253	347	2.5	—	—	32.8	31.6
	360	75	2.1	730	1 390	120	—	—	—	NN3952K	—	336	271	349	2	—	—	—	22.9
260	360	100	2.1	1 000	2 070	179	NNU4952	NNU4952K	NN4952	NN4952K	292	336	271	349	2	29.6	28.3	28.3	27
	400	104	4	1 180	1 990	170	—	—	NN3052	NN3052K	—	364	276	384	3	—	—	47.4	45.8
	400	140	4	1 660	3 100	263	NNU4052	—	—	—	298	—	276	384	3	66.2	—	—	—
	380	75	2.1	770	1 510	128	—	—	—	NN3956K	—	356	291	369	2	—	—	—	24
280	380	100	2.1	1 030	2 200	187	NNU4956	—	NN4956	NN4956K	312	356	291	369	2	31.6	—	30.2	28.8
	420	106	4	1 200	2 080	174	—	—	NN3056	NN3056K	—	384	296	404	3	—	—	51.1	49.3
	420	90	3	1 050	2 050	170	—	—	—	NN3960K	—	391	313	407	2.5	—	—	—	37.8
300	420	118	3	1 330	2 800	231	NNU4960	NNU4960K	NN4960	NN4960K	339	391	313	407	2.5	48.6	46.4	46.4	44.2
	460	118	4	1 470	2 560	209	—	—	NN3060	NN3060K	—	418	316	444	3	—	—	70.8	68.6
	440	90	3	1 080	2 180	177	—	—	—	NN3964K	—	411	333	427	2.5	—	—	—	40
320	440	118	3	1 370	2 970	242	NNU4964	NNU4964K	—	NN4964K	359	411	333	427	2.5	51.4	49.1	—	46.7
	480	121	4	1 500	2 670	214	—	—	—	NN3064K	—	438	336	464	3	—	—	—	73.5
340	460	118	3	1 410	3 150	252	NNU4968	—	—	NN4968K	379	431	353	447	2.5	54.2	—	—	51.6
	520	133	5	1 800	3 200	251	—	—	NN3068	NN3068K	—	473	360	500	4	—	—	102	98.5
	480	90	3	1 140	2 430	192	—	—	NN3972	—	—	451	373	467	2.5	—	—	45	—
360	480	118	3	1 430	3 250	255	—	NNU4972K	—	—	398	—	373	467	2.5	—	54.4	—	—
	540	134	5	1 830	3 300	258	NNU3072	—	NN3072	NN3072K	413	493	380	520	4	111	—	107	103
	540	180	5	2 740	5 550	430	NNU4072	—	—	—	415	—	380	520	4	136	—	—	—
	500	100	2.1	1 190	2 950	228	NNU4880	—	—	—	430.5	—	411	489	2	46.1	—	—	—
400	540	140	4	1 870	4 300	325	NNU4980	NNU4980K	—	—	445	—	416	524	3	88.2	84.1	—	—
	600	148	5	2 260	4 150	310	—	—	NN3080	NN3080K	—	547	420	580	4	—	—	146	141
420	560	140	4	1 930	4 500	340	NNU4984	NNU4984K	—	—	465	—	436	544	3	92	87.7	—	—

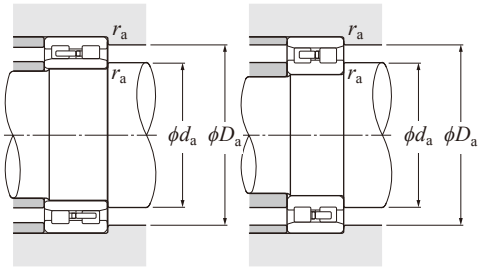
1) Smallest allowable dimension for chamfer dimension r.
2) "**K**" indicates bearings having a tapered bore with a taper ratio of 1:12.



NNU type
Cylindrical bore Tapered bore

NN type
Cylindrical bore Tapered bore

Double Row Cylindrical Roller Bearings NTN



NNU type NN type

Dynamic equivalent radial load
$P_r = F_r$
Static equivalent radial load
$P_{0r} = F_r$

d 440-800 mm

Boundary dimensions mm				Basic load rating kN		Fatigue load limit kN	Bearing number [2]				Dimension mm		Installation-related dimensions mm			Mass (approx.) kg			
				dynamic	static		NNU type		NN type							NNU type		NN type	
d	D	B	r_{smin} [1]	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore	F_w	E_w	d_a Min.	D_a Max.	r_{as} Max.	Cylindrical bore	Tapered bore	Cylindrical bore	Tapered bore
440	600	160	4	2 380	5 550	410	**NNU4988**	—	—	—	492	—	456	584	3	127	—	—	—
	650	157	6	2 680	5 100	370	**NNU3088**	—	—	—	500	—	464	626	5	184	—	—	—
	650	212	6	3 600	7 750	565	**NNU4088**	—	—	—	505	—	464	626	5	248	—	—	—
460	620	160	4	2 460	5 850	430	—	**NNU4992K**	—	—	512	—	476	604	3	—	126	—	—
	680	163	6	2 830	5 350	385	—	—	—	**NN3092K**	—	622	484	656	5	—	—	—	195
500	670	170	5	2 670	6 400	455	—	**NNU49/500K**	—	—	556	—	520	650	4	—	155	—	—
	720	167	6	2 940	5 750	410	—	—	**NN30/500**	—	—	664	524	696	5	—	—	221	—
530	710	180	5	3 050	7 150	500	**NNU49/530**	—	—	—	588	—	550	690	4	206	—	—	—
560	750	190	5	3 500	8 450	585	**NNU49/560**	**NNU49/560K**	—	—	618	—	580	730	4	242	230	—	—
800	980	136	5	2 700	6 700	425	**NNU38/800**	—	—	—	852	—	820	960	4	223	—	—	—

1) Smallest allowable dimension for chamfer dimension r.
2) "**K**" indicates bearings having a tapered bore with a taper ratio of 1:12.

Tapered Roller Bearings

1. Types, design features, and characteristics

Tapered roller bearings are designed so the tapered vertex of the raceway surfaces of the inner and outer rings and rollers converge at one point on the centerline of the bearing (see **Fig. 1**).

The tapered rollers are guided by the combined force of the inner and outer raceway surfaces which keep the rollers pressed up against the large rib on the inner ring. Tapered roller bearings are available not only in metric series, but also inch series; both of which are widely used.

A single row tapered roller bearing can be disassembled into parts: the inner ring, rollers, and cage (collectively known as the "CONE") and the outer ring (known as the "CUP"). These are the bearing's "subunits". Subunits with standardized dimensions of the nominal cup small inside diameter and bearing contact angle in accordance with ISO and ABMA as shown in **Fig. 2** are compatible between subunits.

Typical supplementary codes used in bearing numbers of tapered roller bearings are shown in **Table 1**.

Double row and four row bearings are available in addition to single row bearings. Models and characteristics are shown in **Table 2**. For four-row tapered roller bearings, see chapter "C Special Application Bearings".

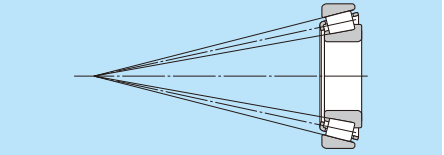


Fig. 1

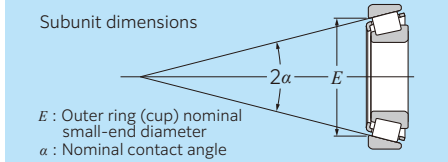


Fig. 2

Table 1 Supplementary codes

Supplementary prefix code		Supplementary suffix code	
4T-	Internationally interchangeable 4T bearings	X	Bearings having the same assembly width and inner ring width (excluding double row tapered roller bearings)
T-	Internationally interchangeable inch series bearings	U	Internationally interchangeable bearings
E-	Bearings using carburizing (case hardened) steel	XU	Internationally interchangeable bearings having the same assembly width and inner ring width (excluding double row tapered roller bearings)

Bearing number examples

4T- **T4CB100**

T-E- **HH926744/HH926710**

32020 **XU**

Supplementary prefix code

Supplementary suffix code

Table 2 Structure and characteristics of double row tapered roller bearings

Type	Structure	Nominal number	Characteristics
Double row back-to-back arrangement		413XXX 423XXX 430XXX 432XXX CRI	• These bearings are designed with one double row outer ring and two pairs of inner rings with rollers. These bearings are manufactured so that the internal clearance values are fixed. Due to this, only parts with identical manufacturing numbers can be used, and they must be assembled according to their code numbers. • These bearings support radial and axial loads. Since the cone pressure apex is wide, bearings are suitable where moment loads are applied. • These bearings have the same function as the back-to-back duplex arrangement of single row bearings.
Double row face-to-face arrangement		3230XX 3231XX CRD	• These bearings are designed with one double row inner ring with rollers and two pairs of outer rings and an outer ring spacer. • These bearings accept the radial and axial loads. Since the cone pressure apex is short, bearings are not suitable when the moment is applied. • As are the double row back-to-back arrangement, these bearings are manufactured so that the internal clearance values are fixed. Due to this, only parts with identical manufacturing numbers can be used, and they must be assembled according to their code numbers.
Double row steep slope face-to-face arrangement		CRD	• This bearing model has a larger and steeper contact angle than the double row with vertex of contact angles inside the bearing. These bearings are used when the axial load is large or only axials are applied. • Models without an outer ring spacer and with a key groove or notch on the inner ring (refer to the drawings in the dimension table) are also available. Consult **NTN** Engineering about this bearing's fit. • These bearings may be pressurized by using a spring between the housing shoulder and outer ring end.

2. Dimensional and rotational accuracy

Metric series bearings
····· Refer to **Table 3.4** (page A-20).
Inch series bearings
····· Refer to **Table 3.5** (page A-22).

3. Recommended fits

Metric series bearings
····· Refer to **Table 4.2** (page A-33).
Inch series bearings
····· Refer to **Table 4.5** (page A-36).
Refer to **Table 4.6** (page A-37).

4. Bearing internal clearance

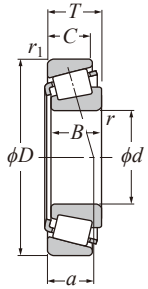
Metric series bearings (double row, duplex)
····· Refer to **Table 5.7** (page A-42).
Inch series bearings (double row, duplex)
····· Refer to **Table 5.8** (page A-44).

5. Precautions

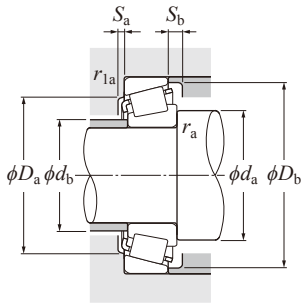
If bearing load is light during operation, or if the ratio of axial to radial load for duplex and double row bearings exceeds the value of e, slipping may develop between the rollers and raceway surface, sometimes resulting in smearing. This is most apparent when a large tapered roller bearing is used due to its large-mass rollers and cage. For additional details, please contact **NTN** Engineering.

In tapered roller bearings, the cage may protrude beyond the inner and/or outer ring side faces. Care should be taken when designing the housing and shaft to ensure contact with the cage does not occur.

Metric series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 100-110 mm

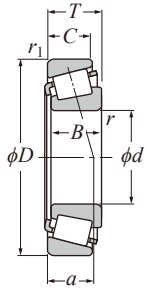
Boundary dimensions							Basic load rating		Fatigue load limit	Bearing number [2]	Installation-related dimensions										Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN		mm										mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u		d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.			a	e	Y_2	Y_0	(approx.)
100	140	25	25	20	1.5	1.5	134	206	23.8	**32920XU**	108.5	109	131.5	127.5	135.5	4	5	1.5	1.5		24.5	0.33	1.82	1.00	1.12
	145	24	22.5	17.5	3	3	119	153	—	**4T-T4CB100**	114	108.5	131	130	140.5	4	6.5	2.5	2.5		30	0.47	1.27	0.70	1.14
	150	32	32	24	2	1.5	188	281	32.0	**32020XU**	110	109.5	141.5	130.5	145	6	8	2	1.5		32.5	0.46	1.31	0.72	1.91
	150	39	39	32.5	2	1.5	248	390	44.5	**33020U**	110	108.5	141.5	132.5	144.5	7	6.5	2	1.5		29.5	0.29	2.09	1.15	2.4
	180	37	34	29	3	2.5	286	335	37.0	**30220U**	114	115.5	168	154.5	169.5	5	8	2.5	2		36	0.42	1.43	0.79	3.76
	180	49	46	39	3	2.5	365	465	51.0	**32220U**	114	113.5	168	151	172	5	10	2.5	2		41.5	0.42	1.43	0.79	5.11
	180	63	63	48	3	2.5	465	650	71.5	**33220U**	114	113	168	147	173	10	15	2.5	2		45.5	0.40	1.48	0.82	6.76
	215	51.5	47	39	4	3	455	500	53.0	**30320U**	118	126	201	181.5	199.5	5	12.5	3	2.5		41.5	0.35	1.74	0.96	8.3
	215	56.5	51	35	4	3	395	435	46.0	**31320XU**	118	122.5	201	165.5	203	7	21.5	3	2.5		69	0.83	0.73	0.40	8.7
	215	77.5	73	60	4	3	635	770	82.0	**32320U**	118	122.5	201	174.5	201.5	5	17.5	3	2.5		53	0.35	1.74	0.96	12.8
105	145	25	25	20	1.5	1.5	139	219	25.0	**32921XA**	113.5	113.5	136.5	131.5	140.5	5	5	1.5	1.5		25	0.34	1.76	0.97	1.2
	160	35	35	26	2.5	2	223	335	37.5	**32021XU**	117	115.5	150	138.5	153.5	6	9	2	2		34.5	0.44	1.35	0.74	2.44
	160	43	43	34	2.5	2	272	420	47.0	**33021U**	117	116	150	141.5	153.5	7	9	2	2		31	0.28	2.12	1.17	3
	190	39	36	30	3	2.5	320	380	41.0	**30221U**	119	121.5	178	163	178.5	6	9	2.5	2		38	0.42	1.43	0.79	4.45
	190	53	50	43	3	2.5	420	540	59.0	**32221U**	119	119	178	158.5	181.5	6	10	2.5	2		44	0.42	1.43	0.79	6.23
	225	53.5	49	41	4	3	485	535	56.0	**30321U**	123	132	211	190	208.5	6	12.5	3	2.5		43.5	0.35	1.74	0.96	9.37
	225	58	53	36	4	3	420	470	49.0	**31321XU**	123	128.5	211	173.5	213.5	7	22	3	2.5		71.5	0.83	0.73	0.40	9.65
	225	81.5	77	63	4	3	680	825	87.0	**32321U**	123	129	211	182.5	210.5	6	18.5	3	2.5		55	0.35	1.74	0.96	14.7
110	150	25	25	20	1.5	1.5	141	226	25.5	**32922XA**	118.5	118.5	141.5	136.5	146	5	5	1.5	1.5		26.5	0.36	1.69	0.93	1.24
	170	38	38	29	2.5	2	261	390	43.0	**32022XU**	122	122	160	147.5	164	7	9	2	2		36.5	0.43	1.39	0.77	3.07
	170	47	47	37	2.5	2	320	500	55.5	**33022U**	122	121	160	148	162	7	10	2	2		33.5	0.29	2.09	1.15	3.84
	180	56	56	43	2.5	2.5	400	610	66.5	**33122UE1**	122	121.5	170	150.5	174	9	13	2	2.5		44	0.42	1.43	0.79	5.52
	200	41	38	32	3	2.5	360	435	46.5	**30222U**	124	128	188	170.5	188.5	6	9	2.5	2		40	0.42	1.43	0.79	5.19
	200	56	53	46	3	2.5	465	605	65.0	**32222U**	124	125.5	188	167	192	6	10	2.5	2		47	0.42	1.43	0.79	7.44

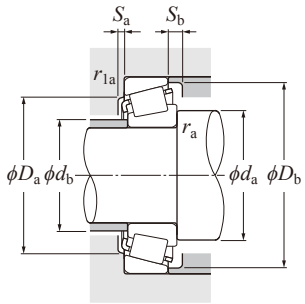
1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Note: Bearings **32921XA** and **32922XA** do not incorporate the subunit dimensions.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

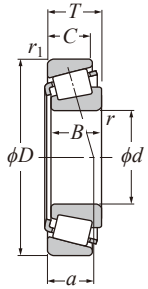
d 110-140 mm

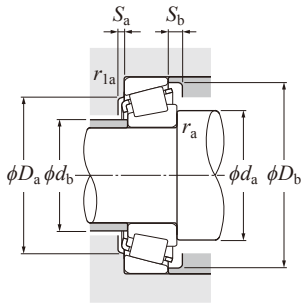
Boundary dimensions							Basic load rating		Fatigue load limit		Installation-related dimensions									Load center	Constant	Axial load factors			Mass
mm							dynamic kN	static kN	kN		mm									mm					kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u	Bearing number [2]	d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_2	Y_0	(approx.)
	240	54.5	50	42	4	3	530	590	60.0	**30322U**	128	141	226	203	222	6	12.5	3	2.5	45.5	0.35	1.74	0.96	11.1
110	240	63	57	38	4	3	480	535	55.0	**31322XU**	128	137	226	184	225.5	7	25	3	2.5	76	0.83	0.73	0.40	11.9
	240	84.5	80	65	4	3	785	970	99.5	**32322U**	128	136.5	226	195	224	6	19.5	3	2.5	57.5	0.35	1.74	0.96	17.6
	165	29	29	23	1.5	1.5	180	294	32.0	**32924XU**	128.5	129.5	156.5	150	160	6	6	1.5	1.5	29.5	0.35	1.72	0.95	1.76
	170	27	25	19.5	3	2	171	235	—	**4T-T4CB120**	134	128.5	156	153	159.5	7	7.5	2.5	2.5	35	0.47	1.27	0.70	1.69
	180	38	38	29	2.5	2	272	420	45.5	**32024XU**	132	131	170	156	174.5	7	9	2	2	39	0.46	1.31	0.72	3.29
	180	48	48	38	2.5	2.5	325	520	56.5	**33024U**	132	130	170	157	172	6	10	2	2.5	36	0.31	1.97	1.08	4.14
120	200	62	62	48	2.5	2.5	510	760	80.5	**33124U**	132	132.5	190	168	193	9	14	2	2.5	48	0.40	1.51	0.83	7.67
	215	43.5	40	34	3	2.5	385	470	49.0	**30224U**	134	139.5	203	184.5	203	6	9.5	2.5	2	44	0.44	1.38	0.76	6.32
	215	61.5	58	50	3	2.5	510	680	71.5	**32224U**	134	135.5	203	178	206	6	11.5	2.5	2	51.5	0.44	1.38	0.76	9.08
	260	59.5	55	46	4	3	620	695	69.5	**30324U**	138	153	246	218	239	6	13.5	3	2.5	49	0.35	1.74	0.96	14.1
	260	68	62	42	4	3	570	655	66.0	**31324XU**	138	147	246	200	245	9	26	3	2.5	82.5	0.83	0.73	0.40	15.2
	260	90.5	86	69	4	3	905	1 130	114	**32324U**	138	146.5	246	210	240.5	6	21.5	3	2.5	61.5	0.35	1.74	0.96	22.1
	180	32	32	25	2	1.5	215	350	37.5	**32926XU**	140	140.5	171.5	163	174	6	7	2	1.5	31.5	0.34	1.77	0.97	2.41
	200	45	45	34	2.5	2	350	545	57.0	**32026XU**	142	144	190	173.5	193.5	8	11	2	2	43.5	0.43	1.38	0.76	5
	200	55	55	43	2.5	2.5	415	660	69.5	**33026U**	142	143	190	173.5	193	8	12	2	2.5	42.5	0.34	1.76	0.97	6.09
	230	43.75	40	34	4	3	415	505	51.5	**30226U**	148	151	216	199.5	218	7	9.5	3	2.5	45.5	0.44	1.38	0.76	7.05
130	230	67.75	64	54	4	3	585	815	83.5	**32226U**	148	147	216	190	220.5	7	13.5	3	2.5	57	0.44	1.38	0.76	11.3
	280	63.75	58	49	5	4	720	830	81.0	**30326U**	152	165.5	262	235	257.5	8	14.5	4	3	53.5	0.35	1.74	0.96	17.4
	280	63.75	58	49	5	4	830	830	81.0	* **30326UUTG**	152	165.5	262	235	257.5	8	14.5	4	3	53.5	0.35	1.74	0.96	17.4
	280	72	66	44	5	4	670	780	77.0	**31326XU**	152	154	262	214.5	263	9	28	4	3	87.5	0.83	0.73	0.40	19
	280	98.75	93	78	4	4	990	1 240	122	**32326**	148	159	262	230	264	2.4	20	3	3	67.5	0.35	1.73	0.95	27.4
	280	98.75	93	78	4	4	1 140	1 240	122	* **32326UTG**	148	159	262	230	264	2.4	20	3	3	67.5	0.35	1.73	0.95	27.4
140	190	32	32	25	2	1.5	221	375	39.0	**32928XU**	150	150	181.5	172.5	184	6	6	2	1.5	34	0.36	1.67	0.92	2.5

1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

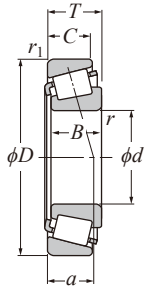
d 140-160 mm

Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_a Min.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
140	195	29	27	21	3	3	208	299	—		4T-T4CB140	154	149	181	176	190	5	8	2.5	2.5	40.5	0.50	1.19	0.66	2.35
	210	45	45	34	2.5	2	365	580	60.0		32028XU	152	153	200	182.5	203	8	11	2	2	46	0.46	1.31	0.72	5.32
	210	56	56	44	2.5	2	435	715	74.0		33028U	152	152	200	182.5	203	7	12	2	2	45.5	0.36	1.67	0.92	6.59
	250	45.75	42	36	4	3	465	570	57.0		30228U	158	163	236	214	235	7	9.5	3	2.5	48.5	0.44	1.38	0.76	8.73
	250	71.75	68	58	4	3	675	920	92.0		32228U	158	158.5	236	207	239.5	9	13.5	3	2.5	61	0.44	1.38	0.76	14.2
	300	67.75	62	53	5	4	820	950	91.5		30328U	162	175.5	282	252	275.5	9	14.5	4	3	56.5	0.35	1.74	0.96	21.1
	300	67.75	62	53	5	4	945	950	91.5	*	30328UUTG	162	175.5	282	252	275.5	9	14.5	4	3	56.5	0.35	1.74	0.96	21.1
	300	77	70	47	5	4	760	905	87.0		31328XU	162	162.5	282	232	282.5	9	30	4	3	94	0.83	0.73	0.40	22.9
	300	107.75	102	85	4	4	1 090	1 370	132		32328	158	168.5	282	244	281	1.5	20	3	3	74.5	0.35	1.73	0.95	33.5
	300	107.75	102	85	4	4	1 270	1 370	132	*	32328UTG	158	168.5	282	244	281	1.5	20	3	3	74.5	0.35	1.73	0.95	33.5
150	210	38	38	30	2.5	2	297	490	50.0		32930XU	162	162	200	189.5	202	7	8	2	2	36.5	0.33	1.83	1.01	3.93
	225	48	48	36	3	2.5	410	655	66.0		32030XU	164	164	213	195	217.5	8	12	2.5	2	49.5	0.46	1.31	0.72	6.45
	270	49	45	38	4	3	500	605	59.0		30230U	168	175	256	230	251.5	7	11	3	2.5	51.5	0.44	1.38	0.76	11
	270	77	73	60	4	3	775	1 070	105		32230U	168	169	256	222	256	8	17	3	2.5	64.5	0.44	1.38	0.76	18
	320	72	65	55	5	4	915	1 070	101		30330U	172	188.5	302	270	294	8	17	4	3	61	0.35	1.74	0.96	25.4
	320	72	65	55	5	4	1 060	1 070	101	*	30330UUTG	172	188.5	302	270	294	8	17	4	3	61	0.35	1.74	0.96	25.4
	320	82	75	50	5	4	860	1 030	97.5		31330XU	172	173.5	302	248	302	9	32	4	3	100	0.83	0.73	0.40	27.7
	320	114	108	90	4	4	1 290	1 750	166		32330	168	182.5	302	254	298	4.3	24	3	3	80	0.37	1.60	0.88	42.1
	320	114	108	90	4	4	1 490	1 750	166	*	32330UTG	168	182.5	302	254	298	4.3	24	3	3	80	0.37	1.60	0.88	42.1
160	220	38	38	30	2.5	2	305	520	52.5		32932XU	172	172	210	199	213	7	8	2	2	38.5	0.35	1.73	0.95	4.14
	240	51	51	38	3	2.5	485	790	78.5		32032XU	174	174.5	228	208	231.5	8	13	2.5	2	52.5	0.46	1.31	0.72	7.86
	290	52	48	40	4	3	585	720	68.5		30232U	178	188.5	276	248	271	8	12	3	2.5	55.5	0.44	1.38	0.76	13.4
	290	52	48	40	4	3	675	720	68.5	*	30232UUTG	178	188.5	276	248	271	8	12	3	2.5	55.5	0.44	1.38	0.76	13.4
	290	84	80	67	4	3	985	1 420	136		32232U	178	181	276	238	277	10	17	3	2.5	70	0.44	1.38	0.76	23.9

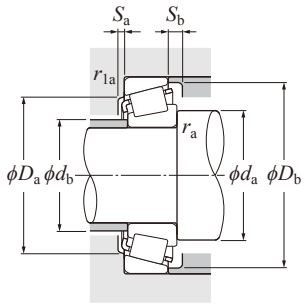
1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

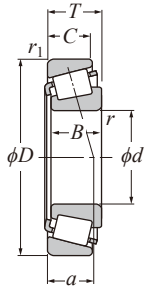
d 160-180 mm

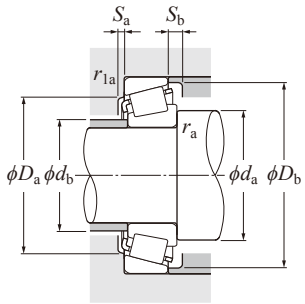
Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
160	290	84	80	67	4	3	1 140	1 420	136	*	**32232UUTG**	178	181	276	238	277	10	17	3	2.5	70	0.44	1.38	0.76	23.9
	340	75	68	58	5	4	1 010	1 200	110		**30332U**	182	200.5	322	286.5	312.5	10	17	4	3	64	0.35	1.74	0.96	29.8
	340	75	68	58	5	4	1 170	1 200	110	*	**30332UUTG**	182	200.5	322	286.5	312.5	10	17	4	3	64	0.35	1.74	0.96	29.8
	340	121	114	95	4	4	1 370	1 840	170		**32332**	178	196.5	322	272	318.5	2.3	26	3	3	85	0.37	1.60	0.88	48.9
	340	121	114	95	4	4	1 580	1 840	170	*	**32332UTG**	178	196.5	322	272	318.5	2.3	26	3	3	85	0.37	1.60	0.88	48.9
170	230	38	38	30	2.5	2	315	560	55.0		**32934XU**	182	181	220	208	223.5	7	8	2	2	42.5	0.38	1.57	0.86	4.4
	260	57	57	43	3	2.5	555	895	86.5		**32034XU**	184	187	248	224.5	250	10	14	2.5	2	56	0.44	1.35	0.74	10.6
	310	57	52	43	5	4	675	845	79.5		**30234U**	192	202	292	265.5	290.5	8	14	4	3	60.5	0.44	1.38	0.76	16.9
	310	57	52	43	5	4	780	845	79.5	*	**30234UUTG**	192	202	292	265.5	290.5	8	14	4	3	60.5	0.44	1.38	0.76	16.9
	310	91	86	71	5	4	1 110	1 600	150		**32234U**	192	194	292	255	297	10	20	4	3	75	0.44	1.38	0.76	29.2
	310	91	86	71	5	4	1 280	1 600	150	*	**32234UUTG**	192	194	292	255	297	10	20	4	3	75	0.44	1.38	0.76	29.2
	360	80	72	62	5	4	1 120	1 320	120		**30334U**	192	212.5	342	305	332.5	10	18	4	3	68	0.35	1.74	0.96	35.2
	360	80	72	62	5	4	1 290	1 320	120	*	**30334UUTG**	192	212.5	342	305	332.5	10	18	4	3	68	0.35	1.74	0.96	35.2
	360	127	120	100	4	4	1 450	1 940	177		**32334**	188	208	342	287	336	1.5	27	3	3	89.5	0.37	1.60	0.88	56.5
	360	127	120	100	4	4	1 680	1 940	177	*	**32334UTG**	188	208	342	287	336	1.5	27	3	3	89.5	0.37	1.60	0.88	56.5
180	250	45	45	34	2.5	2	390	700	68.0		**32936XU**	192	192	240	219.5	241.5	8	11	2	2	54	0.48	1.25	0.69	6.55
	280	64	64	48	3	2.5	715	1 170	111		**32036XUE1**	194	199	268	243	269	10	16	2.5	2	59.5	0.42	1.42	0.78	14.5
	280	64	64	48	3	2.5	825	1 170	111	*	**32036XUUTG**	194	199	268	243	269	10	16	2.5	2	59.5	0.42	1.42	0.78	14.5
	320	57	52	43	5	4	695	890	82.5		**30236U**	202	210.5	302	274	299.5	9	14	4	3	63	0.45	1.33	0.73	17.8
	320	57	52	43	5	4	805	890	82.5	*	**30236UUTG**	202	210.5	302	274	299.5	9	14	4	3	63	0.45	1.33	0.73	17.8
	320	91	86	71	5	4	1 140	1 690	157		**32236U**	202	202	302	263	305.5	10	20	4	3	77.5	0.45	1.33	0.73	60.4
	320	91	86	71	5	4	1 320	1 690	157	*	**32236UUTG**	202	202	302	263	305.5	10	20	4	3	77.5	0.45	1.33	0.73	60.4
	380	83	75	64	4	4	1 010	1 190	107		**30336**	198	227.5	362	314	345	1.5	19	3	3	72.5	0.37	1.60	0.88	38.9
	380	83	75	64	4	4	1 170	1 190	107	*	**30336UTG**	198	227.5	362	314	345	1.5	19	3	3	72.5	0.37	1.60	0.88	38.9

1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

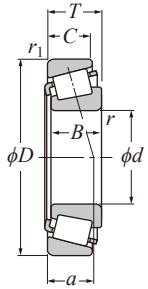
d 180-200 mm

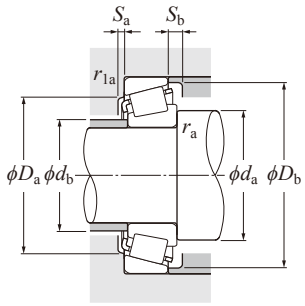
Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
180	380	134	126	106	4	4	1 600	2 150	192		32336	198	219	362	305	357	2.4	28	3	3	95	0.37	1.60	0.88	67.7
	380	134	126	106	4	4	1 850	2 150	192	*	32336UTG	198	219	362	305	357	2.4	28	3	3	95	0.37	1.60	0.88	67.7
190	260	45	45	34	2.5	2	390	710	68.0		32938XU	202	201.5	250	230	251	8	11	2	2	55	0.48	1.26	0.69	6.82
	290	64	64	48	3	2.5	730	1 210	113		32038XUE1	204	206.5	278	252	281	10	16	2.5	2	62.5	0.44	1.36	0.75	15
	290	64	64	48	3	2.5	840	1 210	113	*	32038XUUTG	204	206.5	278	252	281	10	16	2.5	2	62.5	0.44	1.36	0.75	15
	340	60	55	46	5	4	795	1 000	91.5		30238U	212	223	322	293	320.5	9	14	4	3	64	0.44	1.38	0.76	21.5
	340	60	55	46	5	4	920	1 000	91.5	*	30238UUTG	212	223	322	293	320.5	9	14	4	3	64	0.44	1.38	0.76	21.5
	340	97	92	75	5	4	1 280	1 850	169		32238U	212	214	322	283	325.5	11	22	4	3	82	0.44	1.38	0.76	36.1
	340	97	92	75	5	4	1 480	1 850	169	*	32238UUTG	212	214	322	283	325.5	11	22	4	3	82	0.44	1.38	0.76	36.1
	400	86	78	65	5	5	1 040	1 200	106		30338	212	241	378	335	366.5	2.3	21	4	4	74.5	0.37	1.60	0.88	43.6
	400	86	78	65	5	5	1 200	1 200	106	*	30338UTG	212	241	378	335	366.5	2.3	21	4	4	74.5	0.37	1.60	0.88	43.6
	400	140	132	109	5	5	1 760	2 390	211		32338	212	233	378	320	373.5	1.5	31	4	4	100	0.37	1.60	0.88	77
	400	140	132	109	5	5	2 040	2 390	211	*	32338UTG	212	233	378	320	373.5	1.5	31	4	4	100	0.37	1.60	0.88	77
200	280	51	51	39	3	2.5	535	895	84.0		32940XUE1	214	213.5	268	251.5	272	9	12	2.5	2	53.5	0.39	1.52	0.84	9.28
	280	51	51	39	3	2.5	620	895	84.0	*	32940XUUTG	214	213.5	268	251.5	272	9	12	2.5	2	53.5	0.39	1.52	0.84	9.28
	310	70	70	53	3	2.5	885	1 470	135		32040XUE1	214	218.5	298	269	298.5	11	17	2.5	2	66.5	0.43	1.39	0.77	19.2
	310	70	70	53	3	2.5	1 030	1 470	135	*	32040XUUTG	214	218.5	298	269	298.5	11	17	2.5	2	66.5	0.43	1.39	0.77	19.2
	360	64	58	48	5	4	870	1 110	99.0		30240U	222	235	342	311	338	10	16	4	3	70	0.44	1.38	0.76	25.2
	360	64	58	48	5	4	1 010	1 110	99.0	*	30240UUTG	222	235	342	311	338	10	16	4	3	70	0.44	1.38	0.76	25.2
	360	104	98	82	5	4	1 460	2 130	191		32240U	222	224.5	342	299	342.5	11	22	4	3	85	0.41	1.48	0.81	43.8
	360	104	98	82	5	4	1 690	2 130	191	*	32240UUTG	222	224.5	342	299	342.5	11	22	4	3	85	0.41	1.48	0.81	43.8
	420	89	80	67	5	5	1 160	1 370	119		30340	222	251	398	350	382.5	5.3	22	4	4	77	0.37	1.60	0.88	51.5
	420	89	80	67	5	5	1 340	1 370	119	*	30340UTG	222	251	398	350	382.5	5.3	22	4	4	77	0.37	1.60	0.88	51.5
	420	146	138	115	5	5	1 940	2 650	230		32340	222	242	398	335	391.5	3.2	31	4	4	105	0.37	1.60	0.88	89.6

1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

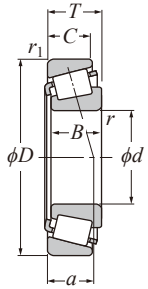
d 200-240 mm

Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
200	420	146	138	115	5	5	2 240	2 650	230	*	**32340UTG**	222	242	398	391.5	3.2	31	4	4	105	0.37	1.60	0.88	89.6
	300	51	51	39	3	2.5	530	950	87.0		**32944XUE1**	234	233.5	288	291	10	12	2.5	2	59.5	0.43	1.41	0.78	9.98
	300	51	51	39	3	2.5	615	950	87.0	*	**32944XUUTG**	234	233.5	288	291	10	12	2.5	2	59.5	0.43	1.41	0.78	9.98
	340	76	76	57	4	3	1 020	1 690	152		**32044XU**	238	239.5	326	326	12	19	3	2.5	72.5	0.43	1.39	0.77	24.9
	340	76	76	57	4	3	1 180	1 690	152	*	**32044XUUTG**	238	239.5	326	326	12	19	3	2.5	72.5	0.43	1.39	0.77	24.9
	400	72	65	54	4	4	905	1 220	106		**30244**	238	262.5	382	368	3.4	18	3	3	82	0.49	1.23	0.68	34.8
220	400	72	65	54	4	4	1 050	1 220	106	*	**30244UTG**	238	262.5	382	368	3.4	18	3	3	82	0.49	1.23	0.68	34.8
	400	114	108	90	4	4	1 540	2 410	209		**32244**	238	249	382	380.5	4.4	24	3	3	102	0.49	1.23	0.68	59.8
	400	114	108	90	4	4	1 780	2 410	209	*	**32244UTG**	238	249	382	380.5	4.4	24	3	3	102	0.49	1.23	0.68	59.8
	460	97	88	73	5	5	1 400	1 690	142		**30344**	242	270	438	418.5	4.2	24	4	4	86.5	0.37	1.60	0.88	66.6
	460	97	88	73	5	5	1 620	1 690	142	*	**30344UTG**	242	270	438	418.5	4.2	24	4	4	86.5	0.37	1.60	0.88	66.6
	460	154	145	122	5	5	2 240	3 050	259		**32344**	242	262.5	438	431	1.5	32	4	4	112	0.37	1.60	0.88	110
	460	154	145	122	5	5	2 590	3 050	259	*	**32344UTG**	242	262.5	438	431	1.5	32	4	4	112	0.37	1.60	0.88	110
	320	51	51	39	3	2.5	540	1 000	90.0		**32948XUE1**	254	252.5	308	312.5	10	12	2.5	2	65.5	0.46	1.31	0.72	10.9
	320	51	51	39	3	2.5	625	1 000	90.0	*	**32948XUUTG**	254	252.5	308	312.5	10	12	2.5	2	65.5	0.46	1.31	0.72	10.9
	360	76	76	57	4	3	1 030	1 760	154		**32048XU**	258	258.5	346	347	12	19	3	2.5	78	0.46	1.31	0.72	26.5
	360	76	76	57	4	3	1 190	1 760	154	*	**32048XUUTG**	258	258.5	346	347	12	19	3	2.5	78	0.46	1.31	0.72	26.5
	440	79	72	60	4	4	1 080	1 480	125		**30248**	258	284.5	422	406	3.9	19	3	3	91	0.49	1.23	0.68	47.7
240	440	79	72	60	4	4	1 250	1 480	125	*	**30248UTG**	258	284.5	422	406	3.9	19	3	3	91	0.49	1.23	0.68	47.7
	440	127	120	100	4	4	1 890	2 750	232		**32248**	258	270.5	422	421.5	4.1	27	3	3	107	0.43	1.39	0.77	78.9
	440	127	120	100	4	4	2 180	2 750	232	*	**32248UTG**	258	270.5	422	421.5	4.1	27	3	3	107	0.43	1.39	0.77	78.9
	500	105	95	80	5	5	1 650	2 000	165		**30348**	262	294.5	478	456	8.1	25	4	4	94	0.37	1.60	0.88	88.3
	500	105	95	80	5	5	1 900	2 000	165	*	**30348UTG**	262	294.5	478	456	8.1	25	4	4	94	0.37	1.60	0.88	88.3
	500	165	155	132	5	5	2 590	3 600	297		**32348**	262	339	478	467	1.5	33	4	4	120.5	0.37	1.60	0.88	141.9

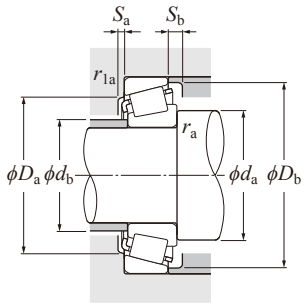
1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

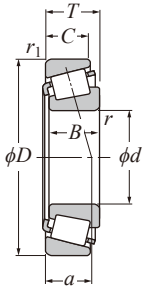
d 260-300 mm

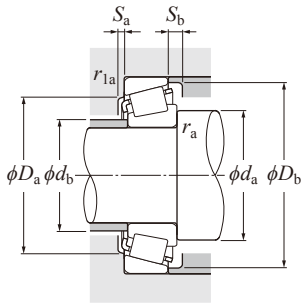
Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
260	360	63.5	63.5	48	3	2.5	785	1 430	124		32952XUE1	274	278	348	348.5	11	15	2.5	2	69.5	0.41	1.48	0.81	18.7
	360	63.5	63.5	48	3	2.5	905	1 430	124	*	32952XUUTG	274	278	348	348.5	11	15	2.5	2	69.5	0.41	1.48	0.81	18.7
	400	87	87	65	5	4	1 340	2 270	193		32052XU	282	283.5	382	383	14	22	4	3	85.5	0.43	1.38	0.76	39
	400	87	87	65	5	4	1 540	2 270	193	*	32052XUUTG	282	283.5	382	383	14	22	4	3	85.5	0.43	1.38	0.76	39
	480	89	80	67	5	5	1 300	1 810	149		30252	282	307	458	438.5	4.2	22	4	4	99.5	0.49	1.23	0.68	63.4
	480	89	80	67	5	5	1 500	1 810	149	*	30252UTG	282	307	458	438.5	4.2	22	4	4	99.5	0.49	1.23	0.68	63.4
	480	137	130	106	5	5	2 090	3 350	275		32252	282	297	458	453	2.9	31	4	4	121.5	0.49	1.23	0.68	100
	480	137	130	106	5	5	2 410	3 350	275	*	32252UTG	282	297	458	453	2.9	31	4	4	121.5	0.49	1.23	0.68	100
280	380	63.5	63.5	48	3	2.5	805	1 520	129		32956XUE1	294	297	368	369.5	11	15	2.5	2	75	0.43	1.39	0.76	19.9
	380	63.5	63.5	48	3	2.5	930	1 520	129	*	32956XUUTG	294	297	368	369.5	11	15	2.5	2	75	0.43	1.39	0.76	19.9
	420	87	87	65	5	4	1 350	2 350	197		32056XU	302	301	402	403	14	22	4	3	90.5	0.46	1.31	0.72	40.5
	420	87	87	65	5	4	1 570	2 350	197	*	32056XUUTG	302	301	402	403	14	22	4	3	90.5	0.46	1.31	0.72	40.5
	500	89	80	67	5	5	1 370	1 910	155		30256	302	324.5	478	464.5	5.9	22	4	4	102	0.49	1.23	0.68	66.6
	500	89	80	67	5	5	1 590	1 910	155	*	30256UTG	302	324.5	478	464.5	5.9	22	4	4	102	0.49	1.23	0.68	66.6
	500	137	130	106	5	5	2 190	3 500	283		32256	302	312	478	473	6.4	31	4	4	123.5	0.49	1.23	0.68	110
	500	137	130	106	5	5	2 530	3 500	283	*	32256UTG	302	312	478	473	6.4	31	4	4	123.5	0.49	1.23	0.68	110
	580	187	175	145	6	6	3 600	5 250	415		32356	308	334.5	552	540.5	3.4	42	5	5	137.5	0.37	1.60	0.88	222
300	420	76	76	57	4	3	1 040	2 090	173		32960XUE1	318	322	406	406.5	13	19	3	2.5	80	0.39	1.52	0.84	31.4
	420	76	76	57	4	3	1 290	2 090	173	*	32960XUUTG	318	322	406	406.5	13	19	3	2.5	80	0.39	1.52	0.84	31.4
	460	100	100	74	5	4	1 660	2 830	232		32060XU	322	324.5	442	441.5	15	26	4	3	98	0.43	1.38	0.76	57.2
	460	100	100	74	5	4	1 920	2 830	232	*	32060XUUTG	322	324.5	442	441.5	15	26	4	3	98	0.43	1.38	0.76	57.2
	540	96	85	71	5	5	1 580	2 220	176		30260	322	349.5	518	498	4.9	25	4	4	111	0.49	1.23	0.68	83.5
	540	96	85	71	5	5	1 820	2 220	176	*	30260UTG	322	349.5	518	498	4.9	25	4	4	111	0.49	1.23	0.68	83.5
	540	149	140	115	5	5	2 550	4 100	325		32260	322	339	518	511.5	2.6	34	4	4	135.5	0.49	1.23	0.68	140

1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

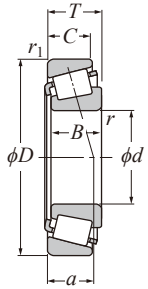
d 300-400 mm

Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions									Load center	Constant	Axial load factors		Mass
							dynamic	static																	
mm							kN		kN			mm									mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
300	540	149	140	115	5	5	2 950	4 100	325	*	**32260UTG**	322	339	518	438	511.5	2.6	34	4	4	135.5	0.49	1.23	0.68	140
320	440	76	76	57	4	3	1 130	2 150	176		**32964XUE1**	338	341	426	395.5	427	13	19	3	2.5	85	0.42	1.44	0.79	32.8
	440	76	76	57	4	3	1 300	2 150	176	*	**32964XUUTG**	338	341	426	395.5	427	13	19	3	2.5	85	0.42	1.44	0.79	32.8
	480	100	100	74	5	4	1 680	2 940	237		**32064XU**	342	344.5	462	418.5	463	15	26	4	3	104	0.46	1.31	0.72	60.2
	480	100	100	74	5	4	1 940	2 940	237	*	**32064XUUTG**	342	344.5	462	418.5	463	15	26	4	3	104	0.46	1.31	0.72	60.2
	580	104	92	75	5	5	1 850	2 580	201		**30264**	342	372	558	485	531.5	4.7	29	4	4	118.5	0.47	1.27	0.70	100
	580	104	92	75	5	5	2 130	2 580	201	*	**30264UTG**	342	372	558	485	531.5	4.7	29	4	4	118.5	0.47	1.27	0.70	100
	580	159	150	125	5	5	2 910	4 650	360		**32264**	342	363	558	473	551	3.9	34	4	4	142	0.47	1.27	0.70	170
	580	159	150	125	5	5	3 350	4 650	360	*	**32264UTG**	342	363	558	473	551	3.9	34	4	4	142	0.47	1.27	0.70	170
340	460	76	76	57	4	3	1 160	2 270	183		**32968XUE1**	358	360	446	414	447.5	13	19	3	2.5	90.5	0.44	1.37	0.75	34.5
	460	76	76	57	4	3	1 340	2 270	183	*	**32968XUUTG**	358	360	446	414	447.5	13	19	3	2.5	90.5	0.44	1.37	0.75	34.5
	520	112	106	90	5	5	1 830	3 150	249		**32068**	362	368.5	498	452	496	3.5	22	4	4	103.5	0.37	1.60	0.88	78.5
	520	112	106	90	5	5	2 120	3 150	249	*	**32068UTG**	362	368.5	498	452	496	3.5	22	4	4	103.5	0.37	1.60	0.88	78.5
360	480	76	76	57	4	3	1 160	2 330	185		**32972XUE1**	378	379.5	466	431.5	467.5	13	19	3	2.5	96.5	0.46	1.31	0.72	36.3
	480	76	76	57	4	3	1 350	2 330	185	*	**32972XUUTG**	378	379.5	466	431.5	467.5	13	19	3	2.5	96.5	0.46	1.31	0.72	36.3
	540	112	106	90	5	5	1 930	3 300	258		**32072**	382	388	518	476	520	5.5	22	4	4	106	0.37	1.60	0.88	83
	540	112	106	90	5	5	2 230	3 300	258	*	**32072UTG**	382	388	518	476	520	5.5	22	4	4	106	0.37	1.60	0.88	83
380	520	87	82	72	4	4	1 260	2 500	194		**32976**	398	404.5	502	464.5	503	4	15	3	3	101	0.40	1.49	0.82	51.3
	520	87	82	72	4	4	1 460	2 500	194	*	**32976UTG**	398	404.5	502	464.5	503	4	15	3	3	101	0.40	1.49	0.82	51.3
	560	112	106	90	5	5	2 130	3 800	292		**32076**	402	406.5	538	495	539	6.5	22	4	4	109.5	0.37	1.60	0.88	89.1
	560	112	106	90	5	5	2 460	3 800	292	*	**32076UTG**	402	406.5	538	495	539	6.5	22	4	4	109.5	0.37	1.60	0.88	89.1
400	540	87	82	71	4	4	1 330	2 710	207		**32980**	418	422.5	522	482	521.5	4	16	3	3	106	0.42	1.43	0.79	54
	540	87	82	71	4	4	1 530	2 710	207	*	**32980UTG**	418	422.5	522	482	521.5	4	16	3	3	106	0.42	1.43	0.79	54
	600	125	118	100	5	5	2 420	4 250	320		**32080**	422	428.5	578	526	575	5	25	4	4	119	0.37	1.60	0.88	110

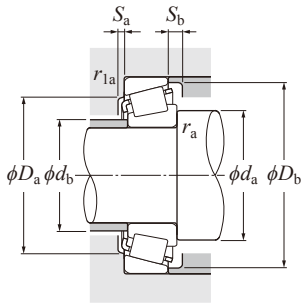
1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.

Metric series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

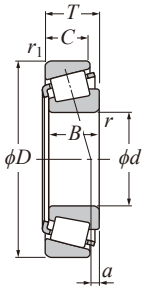
d 400-750 mm

Boundary dimensions							Basic load rating		Fatigue load limit		Bearing number [2]	Installation-related dimensions										Load center	Constant	Axial load factors			Mass
							dynamic	static																		
mm							kN		kN			mm										mm				kg
d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_u			d_a Min.	d_b Max.	D_a Max.	D_a Min.	D_b Min.	S_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
400	600	125	118	100	5	5	2 790	4 250	320		**32080UTG**	422	428.5	578	526	575	5	25	4	4	119	0.37	1.60	0.88	110
420	560	87	82	71	4	4	1 360	2 840	215		**32984**	438	442	542	501.5	543	3.5	16	3	3	111.5	0.44	1.37	0.76	56.2
	560	87	82	71	4	4	1 570	2 840	215	*	**32984UTG**	438	442	542	501.5	543	3.5	16	3	3	111.5	0.44	1.37	0.76	56.2
	620	125	118	100	6	5	2 530	4 550	340		**32084**	448	449.5	598	549	598	6.5	25	4	4	120	0.37	1.60	0.88	120
	620	125	118	100	6	5	2 920	4 550	340		**32084UTG**	448	449.5	598	549	598	6.5	25	4	4	120	0.37	1.60	0.88	120
440	600	100	95	82	4	4	1 780	3 450	258		**32988**	458	465.5	582	543	580.5	3.5	18	3	3	106	0.35	1.70	0.93	76
	600	100	95	82	4	4	2 060	3 450	258	*	**32988UTG**	458	465.5	582	543	580.5	3.5	18	3	3	106	0.35	1.70	0.93	76
	650	130	122	104	6	6	2 810	5 000	365		**32088**	468	469.5	622	576.5	627.5	5	26	5	5	127	0.37	1.60	0.88	140
	650	130	122	104	6	6	3 250	5 000	365	*	**32088UTG**	468	469.5	622	576.5	627.5	5	26	5	5	127	0.37	1.60	0.88	140
500	640	87.36	82	72	4	4	1 540	3 300	239		**CR-10010**	518	523.5	622	584.5	627.5	3.5	15	3	3	125	0.45	1.34	0.74	64.3
	750	150	140	120	7.5	7.5	3 450	6 950	485		**CR-10024**	536	566.5	714	658.5	722.5	1.5	30	6	6	154	0.41	1.48	0.81	224
530	670	100	95	82	5	5	1 700	3 800	271		**CR-10601**	552	552	648	616.5	653	1.5	18	4	4	111	0.33	1.80	0.99	76.2
570	695	57	52	50	3	2.5	960	2 080	146		**CR-11402**	584	598.5	683	652.5	675.5	5	7	2.5	2	102.5	0.36	1.67	0.92	41.7
600	870	118	111	93	6	6	3 200	5 700	380		**CR-12006**	628	656	842	782.5	828	1.5	25	5	5	147	0.37	1.60	0.88	208
720	880	80	75	60	5	5	1 440	3 450	225		**CR-14403**	742	757	858	818	853.5	5.5	20	4	4	158.5	0.46	1.31	0.72	94
740	900	80	75	65	5	5	1 520	3 700	240		**CR-14803**	762	775.5	878	839	877.5	5	15	4	4	159	0.46	1.31	0.72	96
750	1 000	110	107	80	6	6	2 910	5 800	370		**CR-15002**	778	801.5	972	915	954	7	30	5	5	155	0.37	1.60	0.88	210

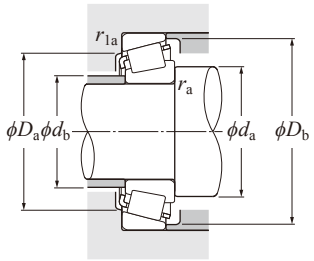
1) Smallest allowable dimension for chamfer dimension r or r_1.

2) Bearing numbers marked "*" designate **ULTAGE™ series**.
Note: **CR-10024** has a hollow roller and pin-type cage.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 114.300-174.625 mm

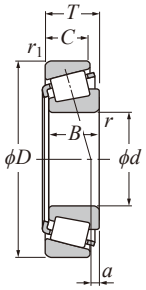
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
114.300	273.050	82.550	82.550	53.975	840	975	**T-E-HH926744/HH926710**	164	147	230	253	6.4	6.4	6.6	0.63	0.95	0.52	22.2
	279.400	82.550	82.550	53.975	840	975	**T-E-HH926744/HH926716**	164	147	233	253	6.4	6.4	6.6	0.63	0.95	0.52	23.5
120.650	273.050	82.550	82.550	53.975	840	975	**T-E-HH926749/HH926710**	168	147	230	253	6.4	6.4	6.6	0.63	0.95	0.52	21.7
127.000	295.275	82.550	87.312	57.150	975	1 190	**T-E-HH231637/HH231615**	174	150	258	264	13.5	6.4	26.7	0.32	1.88	1.04	27.1
	304.800	88.900	82.550	57.150	910	1 120	**T-E-HH932132/HH932110**	182	172	260	288	6.4	6.4	−1.9	0.73	0.82	0.45	32.8
139.700	288.925	82.550	87.312	57.150	975	1 190	**T-E-HH231649/HH231610**	177	161	255	264	9.7	6.4	26.7	0.32	1.88	1.04	24.4
	295.275	82.550	87.312	57.150	975	1 190	**T-E-HH231649/HH231615**	177	161	258	264	9.7	6.4	26.7	0.32	1.88	1.04	25.8
	307.975	88.900	93.662	66.675	1 120	1 390	**T-E-HH234031/HH234010**	180	168	276.1	285.5	9.7	6.8	26.7	0.33	1.84	1.01	30.9
146.050	304.800	88.900	82.550	57.150	910	1 120	**T-E-HH932145/HH932110**	195	174	260	288	6.4	6.4	−1.9	0.73	0.82	0.45	30.6
	311.150	88.900	82.550	57.150	910	1 120	**T-E-HH932145/HH932115**	195	174	262	288	6.4	6.4	−1.9	0.73	0.82	0.45	32.2
150.698	323.850	77.788	76.200	53.975	790	985	**E-EE560592/561279**	208	176	281.9	290	17.5	4.83	9	0.46	1.29	0.71	27.5
152.400	307.975	88.900	93.662	61.912	975	1 310	**T-E-EE450601/451212**	189	177	269	275	9.7	6.8	28.2	0.33	1.84	1.01	29.4
	307.975	88.900	93.662	66.675	1 120	1 390	**T-E-HH234048/HH234010**	191	179	276	285	9.7	6.8	26.4	0.33	1.84	1.01	29.4
155.575	330.200	85.725	79.375	53.975	970	1 260	**T-E-H936340/H936310**	209	193	282	311	6.4	6.4	−16.9	0.81	0.74	0.41	34.9
	342.900	85.725	79.375	53.975	970	1 260	**T-E-H936340/H936316**	209	193	287	311	6.4	6.4	−16.9	0.81	0.74	0.41	38.4
158.750	304.800	66.675	69.106	42.862	600	780	**E-EE280626/281200**	192	180	279	282	6.4	3.3	12.5	0.36	1.67	0.92	20.8
160.325	288.925	63.500	63.500	47.625	750	1 070	**T-E-HM237532/HM237510**	192	181	266	271	7	3.3	11.6	0.32	1.88	1.04	16
161.925	374.650	87.312	79.375	60.325	940	1 140	**E-EE117063/117148**	207	197	322	341	6.4	3.3	−11.5	0.71	0.85	0.47	47.9
165.100	288.925	63.500	63.500	47.625	610	950	**T-E-94649/94113**	197	186	259	272	7	3.3	0.9	0.47	1.28	0.70	17.1
	288.925	63.500	63.500	47.625	750	1 070	**T-E-HM237535/HM237510**	195	184	266	271	7	3.3	11.6	0.32	1.88	1.04	15.6
	311.150	82.550	82.550	63.500	900	1 330	**T-E-EE219065/219122**	196	185	275	282	6.4	6.4	15.3	0.38	1.59	0.87	27.1
	311.150	82.550	82.550	65.088	1 030	1 480	**T-E-H238140/H238110**	198	188	280	289	6.4	6.4	18.8	0.33	1.81	1.00	27.5
	336.550	92.075	95.250	69.850	1 180	1 510	**T-E-HH437549/HH437510**	196	196	297	308	3.3	6.4	21.4	0.37	1.62	0.89	36.6
168.275	330.200	85.725	79.375	53.975	970	1 260	**T-E-H936349/H936310**	218	193	282	311.4	6.4	6.4	−16.9	0.81	0.74	0.41	33.2
174.625	288.925	63.500	63.500	47.625	610	950	**T-E-94687/94113**	204	193	259	272	7	3.3	0.9	0.47	1.28	0.70	14.7
	288.925	63.500	63.500	47.625	750	1 070	**T-E-HM237542/HM237510**	202	191	266	271	7	3.3	11.6	0.32	1.88	1.04	14.7

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

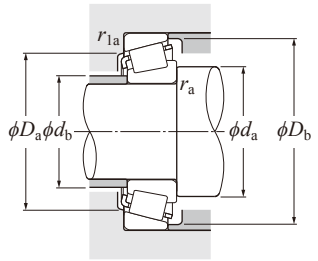
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 174.625-196.850 mm

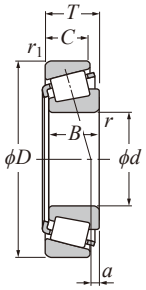
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
	298.450	82.550	82.550	63.500	900	1 330	**T-E-EE219068/219117**	204	193	269	282	6.4	6.4	15.3	0.38	1.59	0.87	21.1
174.625	311.150	82.550	82.550	63.500	900	1 330	**T-E-EE219068/219122**	204	193	275	282	6.4	6.4	15.3	0.38	1.59	0.87	23.9
	311.150	82.550	82.550	65.088	1 030	1 480	**T-E-H238148/H238110**	205	195	280	289	6.4	6.4	18.8	0.33	1.81	1.00	23.9
	288.925	63.500	63.500	47.625	610	950	**T-E-94700/94113**	207	195	259	272	7	3.3	0.9	0.47	1.28	0.70	15.4
177.800	288.925	63.500	63.500	47.625	750	1 070	**T-E-HM237545/HM237510**	205	194	266	271.3	7	3.3	11.6	0.32	1.88	1.04	15.2
	319.964	88.900	85.725	65.088	1 030	1 400	**T-E-H239640/H239610**	202	198	293	301	3.5	4.8	22.3	0.32	1.88	1.04	27.9
	428.625	106.362	95.250	61.912	1 320	1 610	**E-EE350701/351687**	230	221	365	383	6.4	6.4	−13.9	0.76	0.79	0.43	66.2
180.000	250.000	47.000	45.000	37.000	410	710	**T-E-JM736149/JM736110**	196	190.5	232	242.6	3	2.5	−9	0.48	1.25	0.69	6.74
	234.500	34.000	33.000	28.000	265	485	**T-E-LM236749/LM236710**	195	191	224	229	2	2	−5	0.33	1.79	0.99	3.42
184.150	235.229	34.000	33.000	28.000	265	485	**T-E-LM236749/LM236710A**	195	191	224	229	2	2	−5	0.33	1.79	0.99	3.44
	266.700	47.625	46.833	38.100	395	745	**T-E-67883/67820**	204	198	246	259	3.5	3.3	−10.2	0.48	1.26	0.69	8.8
	266.700	47.625	46.833	38.100	395	745	**T-E-67884/67820**	206	201	246	259	3.5	3.3	−10.2	0.48	1.26	0.69	8.42
187.325	319.964	88.900	85.725	65.088	1 030	1 400	**T-E-H239649/H239610**	214	205	293	301	5.5	4.8	22.3	0.32	1.88	1.04	26.1
	320.675	88.900	85.725	65.088	1 030	1 400	**T-E-H239649/H239612**	214	205	293	301	5.5	4.8	22.3	0.32	1.88	1.04	28.9
190.000	260.000	46.000	44.000	36.500	405	720	**T-E-JM738249/JM738210**	206	200	242	252	3	2.5	−10.9	0.48	1.26	0.69	6.84
	266.700	47.625	46.833	38.100	395	745	**T-E-67885/67820**	209	203	246	259	3.5	3.3	−10.2	0.48	1.26	0.69	8.12
	282.575	50.800	47.625	36.512	405	615	**T-E-87750/87111**	209	203	261	267	3.5	3.3	−3.8	0.42	1.44	0.79	10.6
	317.500	63.500	63.500	46.038	685	1 160	**T-E-93750/93125**	218	212	286	300	4.3	3.3	−7.9	0.52	1.15	0.63	19.8
190.500	327.025	90.488	92.075	63.500	985	1 380	**T-E-470075/470128**	220	210	294	306.5	6.4	6.4	21.8	0.52	1.15	0.90	28.3
	336.550	98.425	95.250	73.025	1 140	1 830	**T-E-HH840249/HH840210**	234	216	290	318	6.4	6.4	5.4	0.58	1.04	0.57	36.4
	355.600	79.375	77.788	53.975	990	1 250	**E-EE607075/607140**	225	213	311	327	6.4	6.4	−3	0.55	1.10	0.60	30.5
	365.049	92.075	88.897	63.500	1 080	1 600	**T-E-EE420751/421437**	227	218	329	334	6.4	3.3	−15.4	0.40	1.49	0.82	40.3
	428.625	106.362	95.250	61.912	1 320	1 610	**E-EE350750/351687**	240	237	365	383	6.4	6.4	−13.9	0.76	0.79	0.43	75.3
	241.300	23.812	23.017	17.462	177	330	**T-E-LL639249/LL639210**	205	203	236	232	1.57	1.57	−17.3	0.42	1.44	0.79	2.07
196.850	254.000	28.575	27.783	21.433	200	360	**T-E-L540049/L540010**	207	205	243	247	1.57	1.57	−14.2	0.40	1.51	0.83	3.32
	254.000	28.575	27.783	21.433	299	635	**T-E-LM739749/LM739710**	213	206	239	251	3.5	3.3	−11.3	0.45	1.34	0.83	5.33

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

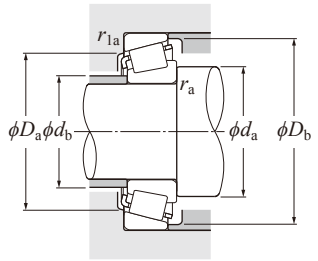
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 196.850-228.460 mm

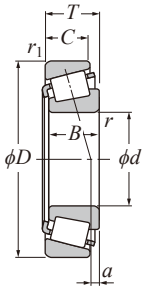
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
196.850	317.500	63.500	63.500	46.038	685	1 160	**T-E-93775/93125**	223	216	286	300	7.9	3.3	−7.9	0.52	1.15	0.63	18.8
	317.500	63.500	63.500	46.038	685	1 160	**T-E-93787/93125**	225	219	286	300	4.3	3.3	−7.9	0.52	1.15	0.63	18.3
200.025	384.175	112.712	112.712	90.488	1 620	2 730	**T-E-H247535/H247510**	241	231	346	362.5	6.4	6.4	28.1	0.33	1.80	0.99	60.7
	393.700	111.125	111.125	84.138	1 490	2 020	**E-HH144642/HH144614**	235	226	352	356.6	6.4	6.4	35.1	0.30	2.01	1.11	55.9
203.200	261.142	28.575	27.783	21.433	200	365	**T-E-LL641149/LL641110**	214	212	249	254	1.5	1.5	−15.7	0.41	1.47	0.81	3.48
	276.225	42.862	42.862	34.133	380	690	**E-LM241149/LM241110**	220	214.1	260	267	3.5	3.3	−2.1	0.32	1.88	1.04	7.03
	282.575	46.038	46.038	36.512	400	785	**T-E-67983/67920**	222	216	260	275	3.5	3.3	−15.9	0.51	1.18	0.65	8.76
	292.100	57.945	57.945	46.038	590	1 030	**T-E-M241547/M241510**	221	217	272	279	3.5	3.3	4.7	0.33	1.80	0.99	12.1
	317.500	63.500	63.500	46.038	685	1 160	**T-E-93800/93125**	227	222	286	300	4.3	3.3	−7.9	0.52	1.15	0.63	17.8
	365.049	92.075	88.897	63.500	1 080	1 600	**T-E-EE420801/421437**	230.1	227.1	329	334.4	3.3	3.3	15.4	0.40	1.49	0.82	37.6
	406.400	92.075	85.725	57.150	1 070	1 480	**E-EE114080/114160**	246	237	349	373.7	6.4	6.4	−27.9	0.80	0.75	0.41	49.4
	482.600	117.475	95.250	73.025	1 460	1 860	☆**T-E-EE380080/380190G2**	280	274	402	428.5	6.4	6.4	−34.3	0.87	0.69	0.38	108
206.375	282.575	46.038	46.038	36.512	400	785	**T-E-67985/67920**	224	219	260	275	3.5	3.3	−15.9	0.51	1.18	0.65	8.4
	336.550	98.425	100.012	77.788	1 230	2 030	**T-E-H242649/H242610**	231	227	306	318	3.3	3.3	25.4	0.33	1.80	0.99	34
	482.600	117.475	95.250	73.025	1 460	1 860	☆**T-E-EE380081/380190G2**	264	258	402	428.5	6.4	6.4	−34.3	0.87	0.69	0.38	107
209.550	282.575	46.038	46.038	36.512	400	785	**T-E-67989/67920**	227	221	260	275	3.5	3.3	−15.9	0.51	1.18	0.65	7.23
	317.500	63.500	63.500	46.038	685	1 160	**T-E-93825/93125**	233	227	286	300	4.3	3.3	−7.9	0.52	1.15	0.63	15.8
212.725	285.750	46.038	46.038	34.925	420	820	**T-E-LM742745/LM742710**	230	225	266	279	3.5	3.3	−14.2	0.48	1.25	0.69	8.01
215.900	285.750	46.038	46.038	34.925	420	820	**T-E-LM742749/LM742710**	233	227	266	279	3.5	3.3	−14.2	0.48	1.25	0.69	7.63
	290.010	31.750	31.750	22.225	229	405	**E-543085/543114**	232	226	272	276	3.5	3.3	−12.5	0.38	1.58	0.87	5.3
216.408	285.750	46.038	49.212	34.925	420	820	**T-E-LM742747/LM742710**	233	227	266	279	3.5	3.3	−14.2	0.48	1.25	0.69	7.66
219.969	290.010	31.750	31.750	22.225	229	405	**E-543086/543114**	235	229	271	276	3.5	3.3	−12.5	0.38	1.58	0.87	4.97
219.974	384.175	112.712	112.712	90.488	1 620	2 730	**T-E-H247540/H247510**	269	259	346	362	6.4	6.4	28.1	0.33	1.80	0.99	54.9
220.662	314.325	61.912	61.912	49.212	695	1 220	**T-E-M244249/M244210**	245	235	293	300	6.4	3.3	4.4	0.33	1.80	0.99	14.7
228.397	431.800	92.075	85.725	49.212	950	1 240	**E-EE113089/113170**	274	267	375	397	6.4	6.4	−40.3	0.88	0.68	0.37	48.1
228.460	431.800	92.075	85.725	49.212	950	1 240	**E-EE113091/113170**	274	267	375	397	6.4	6.4	−40.3	0.88	0.68	0.37	48.1

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

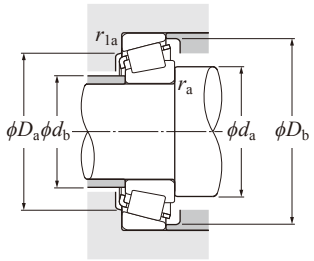
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 228.600-241.300 mm

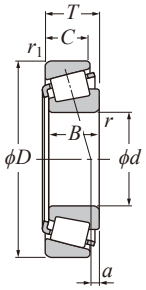
Boundary dimensions mm					Basic load rating kN		Bearing number [1]	Installation-related dimensions mm						Load center [2] mm	Constant	Axial load factors		Mass kg
					dynamic	static						r_{as}	r_{1as}					
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	Max.	Max.	a	e	Y_2	Y_0	(approx.)
228.600	295.275	33.338	31.750	23.812	239	435	T-E-544090/544116	244	240	279	287	3.5	3.3	−15.7	0.40	1.49	0.82	5.25
	300.038	33.338	31.750	23.812	239	435	T-E-544090/544118	244	240	282	287	3.5	3.3	−15.8	0.40	1.49	0.82	5.69
	327.025	52.388	52.388	36.512	525	950	T-E-8573/8520	255	244	305	313	6.4	3.3	−7.8	0.41	1.48	0.81	13.2
	355.600	68.262	66.675	47.625	710	1 270	T-E-96900/96140	260	249	318	334	7	3.3	−16.9	0.59	1.02	0.56	23.6
	355.600	69.850	69.850	49.212	795	1 260	T-E-EE130902/131400	257	247	329	330	6.8	1.5	9.9	0.33	1.82	1.00	23.2
	355.600	69.850	69.850	50.800	800	1 240	E-HM746646/HM746610	258	248	324	338.7	6.4	6.4	−6	0.47	1.27	0.70	22.7
	355.600	69.850	69.850	50.800	800	1 240	T-E-HM746646/HM746610G2	258	248	324	339	6.4	6.4	−6.9	0.47	1.27	0.70	24.7
	358.775	71.438	71.438	53.975	900	1 640	T-E-M249732/M249710	256	251	335	343	3.5	3.3	6.9	0.33	1.80	0.99	27.2
	400.050	88.900	87.312	63.500	1 050	1 620	E-EE430900/431575	271	253	360	364	10.5	3.3	2.8	0.44	1.36	0.75	46
	488.950	123.825	111.125	73.025	1 750	2 260	☆T-E-HH949549/HH949510G2	297	280	416	456	6.4	6.4	−39.9	0.94	0.64	0.35	99.3
231.775	300.038	33.338	31.750	23.812	239	435	T-E-544091/544116	246.9	243.1	280	287	3.5	3.3	−15.8	0.40	1.49	0.82	4.99
	300.038	33.338	31.750	23.812	239	435	T-E-544091/544118	247	243	282	287	3.5	3.3	−15.8	0.40	1.49	0.82	5.46
	336.550	65.088	65.088	50.800	790	1 410	T-E-M246942/M246910	258	249	313	322	6.4	3.3	4.7	0.33	1.80	0.99	18.5
	358.775	71.438	71.438	53.975	900	1 640	T-E-M249734/M249710	263	254	335	343	6.4	3.3	6.9	0.33	1.80	0.99	26.2
234.950	311.150	46.038	46.038	33.338	450	820	E-LM446349/LM446310	252	246	294	301	3.5	3.3	−6.6	0.36	1.66	0.91	8.38
	314.325	49.212	49.212	36.512	525	935	T-E-LM545849/LM545810	252	246	296	306	3.5	3.3	−8.4	0.40	1.51	0.83	9.38
	327.025	52.388	52.388	36.512	525	950	T-E-8575/8520	259	248	305	313	6.4	3.3	−7.8	0.41	1.48	0.81	9.8
	355.600	68.262	66.675	47.625	710	1 270	T-E-96925/96140	265	254	318	334	7	3.3	−16.9	0.59	1.02	0.56	22.5
	381.000	74.612	74.612	57.150	980	1 790	T-E-M252330/M252310	271	261	356	364	6.4	3.3	6.2	0.33	1.80	0.99	31.4
	384.175	112.712	112.712	90.488	1 620	2 730	T-E-H247548/H247510	269	259	346	362.1	6.4	6.4	28	0.33	1.80	0.99	51.2
	384.175	112.712	112.712	90.488	1 670	2 850	☆T-E-H247548/H247510G2	269	259	346	362.1	6.4	6.4	28	0.33	1.80	0.99	51.2
	384.175	112.712	112.712	90.488	1 620	2 730	T-E-H247549/H247510	269	259	346	362.1	6.4	6.4	28	0.33	1.80	0.99	45.5
237.330	336.550	65.088	65.088	50.800	790	1 410	T-E-M246949/M246910	262	253	313	322	6.4	3.3	4.7	0.33	1.80	0.99	17.5
	358.775	71.438	71.438	53.975	900	1 640	T-E-M249736/M249710	267	258	335	343	6.4	3.3	6.9	0.33	1.80	0.99	22.6
241.300	327.025	52.388	52.388	36.512	525	950	T-E-8578/8520	264	253	305	313	6.4	3.3	−7.8	0.41	1.48	0.81	11.2
	349.148	57.150	57.150	44.450	610	1 000	E-EE127095/127135	267	257	325	329	6.4	3.3	−3.2	0.35	1.70	0.93	15.9

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

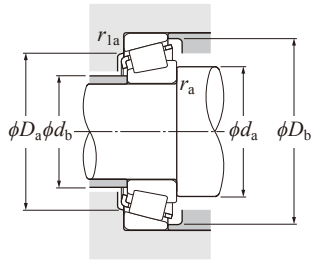
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 241.300-263.525 mm

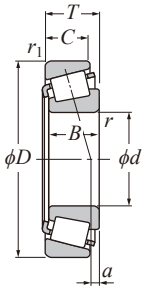
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
241.300	368.300	50.800	50.800	33.338	510	815	**E-EE170950/171450**	269	260	340	337	6.4	3.3	−6.2	0.36	1.65	0.90	17.2
	393.700	73.817	69.850	50.005	865	1 400	**T-E-EE275095/275155**	278	268	366	378	6.4	6.4	−2.5	0.40	1.49	0.82	34.3
	508.000	117.475	95.250	73.025	1 420	1 900	**E-EE390095/390200**	287	277	423	456.2	6.4	6.4	−49.5	0.94	0.64	0.35	94.9
	444.500	101.600	100.012	76.200	1 540	2 120	☆**T-E-EE923095/923175G2**	277	268	403	407	6.4	4.8	19.3	0.34	1.78	0.98	68
244.475	381.000	79.375	76.200	57.150	840	1 440	**E-EE126097/126150**	275	266	343	358	6.4	4.8	−8	0.52	1.16	0.64	32.6
247.650	346.075	63.500	63.500	50.800	800	1 450	**T-E-M348449/M348410**	273	263	321	332	6.4	6.4	1.3	0.34	1.75	0.96	16.2
	368.300	50.800	50.800	33.338	510	815	**E-EE170975/171450**	274	264	340	337	6.4	3.3	−6.2	0.36	1.65	0.90	16.5
	381.000	74.612	74.612	57.150	980	1 790	**T-E-M252337/M252310**	280	271	356	364	6.4	3.3	6.2	0.33	1.80	0.99	27.3
	406.400	115.888	117.475	93.662	1 830	3 000	**E-HH249949/HH249910**	284	275	366	383	6.4	6.4	28.9	0.33	1.80	0.99	55.6
249.250	381.000	79.375	76.200	57.150	840	1 440	**E-EE126098/126150**	279	269	343	358	6.4	4.8	−8	0.52	1.16	0.64	31.7
254.000	323.850	22.225	22.225	15.875	140	315	**E-29875/29820**	267	266	310	312	1.5	1.5	−21.1	0.35	1.73	0.95	3.92
	358.775	71.438	71.438	53.975	900	1 640	**T-E-M249749/M249710**	274	270	335	343	3.5	3.3	6.9	0.33	1.80	0.99	20.1
	365.125	58.738	58.738	42.862	680	1 190	**T-E-EE134100/134143**	281	272	339	347	6.4	6.4	−5	0.37	1.60	0.88	17.7
	393.700	73.817	69.850	50.005	865	1 400	**T-E-EE275100/275155**	287	277	366	378	6.4	6.4	−2.5	0.40	1.49	0.82	32.1
	422.275	86.121	79.771	66.675	1 290	1 800	**T-E-HM252343/HM252310**	287	281	392	400	6.8	3.3	9.3	0.33	1.80	0.99	47.1
	533.400	133.350	120.650	77.788	1 860	2 610	**E-HH953749/HH953710**	328	306.3	455	496	6.4	6.4	−44.7	0.94	0.64	0.35	141
	558.800	123.825	104.775	69.850	1 640	2 170	**E-EE620100/620220**	317	308	501.9	477	8	8	−45.3	0.87	0.69	0.38	122
257.175	342.900	57.150	57.150	44.450	645	1 270	**E-M349549/M349510**	281	269	322	333	6.4	3.3	−2.5	0.35	1.73	0.95	12.9
	342.900	57.150	57.150	44.450	645	1 270	**E-M349549A/M349510**	289	269	322	333	10.7	3.3	−2.5	0.35	1.73	0.95	12.9
	358.775	71.437	76.200	53.975	900	1 640	**T-E-M249747/M249710**	277	271.5	343	335	1.57	3.3	6.9	0.33	1.80	0.99	21
260.350	365.125	58.738	58.738	42.862	680	1 190	**T-E-EE134102/134143**	286	276	339	347	6.4	6.4	−5	0.37	1.60	0.88	16.8
	400.050	69.850	67.470	46.038	790	1 230	**E-EE221026/221575**	296	280	366	372	9.7	6.4	−1.8	0.39	1.52	0.84	27
	419.100	85.725	84.138	61.912	1 020	1 610	**E-EE435102/435165**	295	285	376	395	6.4	3.3	−20.7	0.61	0.99	0.54	44.4
	422.275	86.121	79.771	66.675	1 290	1 800	**T-E-HM252348/HM252310**	292	285	392	400	6.8	3.3	9.3	0.33	1.80	0.99	45.7
	488.950	120.650	120.650	92.075	1 950	2 970	**E-EE295102/295193**	299	290	444	451	6.4	6.4	28.7	0.31	1.92	1.06	90.3
263.525	325.438	28.575	28.575	25.400	235	520	**T-E-38880/38820**	275	275	312	315	1.5	1.5	−20.5	0.37	1.64	0.90	4.56

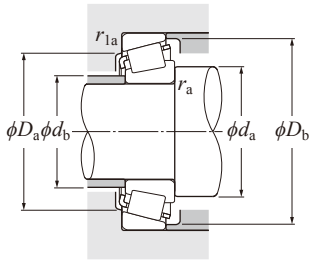
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 263.525-292.100 mm

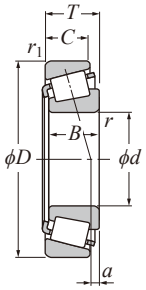
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
263.525	355.600	57.150	57.150	44.450	695	1 340	**T-E-LM451345/LM451310**	283	279	335	343	3.5	3.3	−4.7	0.36	1.67	0.92	14.2
266.700	323.850	22.225	22.225	15.875	140	315	**E-29880/29820**	277	275	310	312	1.5	1.5	−21.1	0.35	1.73	0.95	3.28
	325.438	28.575	28.575	25.400	235	520	**T-E-38885/38820**	277	277	312	315	1.5	1.5	−20.5	0.37	1.64	0.90	4.35
	355.600	57.150	57.150	44.450	695	1 340	**T-E-LM451349/LM451310**	285	281	335	343	3.5	3.3	−4.7	0.36	1.67	0.92	15
	355.600	57.150	57.150	44.450	555	995	**T-E-LM451349A/LM451310**	299	281	335	343	10.5	3.3	−4.7	0.36	1.67	0.92	13.8
	393.700	73.817	69.850	50.005	865	1 400	**T-E-EE275105/275155**	296	287	366	378	6.4	6.4	−2.5	0.40	1.49	0.82	29.7
	444.500	120.650	117.475	88.900	1 740	3 050	**E-H852849/H852810**	315	297	390	422	6.4	0.6	0.3	0.58	1.04	0.57	73.3
269.875	381.000	74.612	74.612	57.150	980	1 790	**T-E-M252349/M252310**	296	287	356	364	6.4	3.3	6.2	0.33	1.80	0.99	25.4
273.050	393.700	73.817	69.850	50.005	865	1 400	**T-E-EE275108/275155**	301	291	366	378	6.4	6.4	−2.5	0.40	1.49	0.82	28.5
	406.400	69.850	69.850	46.038	865	1 400	**T-E-EE275108/275160**	301	291	373	378.5	6.4	6.4	1.2	0.40	1.49	0.82	28.8
276.225	352.425	36.512	34.925	23.812	325	605	**E-L853049/L853010**	293	288	332	342	3.5	3.3	−34.8	0.54	1.12	0.62	8.4
279.400	317.500	24.384	24.384	18.288	175	445	**E-LL352149/LL352110**	286	288	309	312	1.5	1.5	20.5	0.35	1.73	0.95	2.54
	374.650	47.625	47.625	34.925	525	1 010	**E-L555233/L555210**	300	296	355	362	3.5	3.3	−17	0.40	1.49	0.82	13
	469.900	95.250	93.662	69.850	1 310	2 170	**E-EE722110/722185**	321	314	430	433	9.7	3.3	6.3	0.38	1.58	0.87	65.3
	488.950	120.650	120.650	92.075	1 950	2 970	**E-EE295110/295193**	303	304	444	451	1.3	6.4	28.7	0.31	1.92	1.06	84.9
279.982	380.898	65.088	65.088	49.212	735	1 560	**T-E-LM654642/LM654610**	302	298	356	368	3.5	3.3	−11.5	0.43	1.39	0.76	19
280.000	406.400	69.850	67.673	53.975	845	1 550	**E-EE128112/128160**	308	307	378	384	6.4	3.3	−4.4	0.39	1.56	0.86	29.1
280.192	406.400	69.850	67.673	53.975	845	1 550	**E-EE128111/128160**	309	307	378	384	6.8	3.3	−4.4	0.39	1.56	0.86	29.1
285.750	358.775	33.338	31.750	22.225	292	540	**E-545112/545141A**	302	298	340	345	3.5	3.3	−33.9	0.49	1.22	0.67	7.54
	380.898	65.088	65.088	49.212	735	1 550	**T-E-LM654649/LM654610**	306	302	356	368	3.5	3.3	−11.5	0.43	1.39	0.76	18
288.925	406.400	77.788	77.788	60.325	1 120	2 080	**E-M255449/M255410A**	316	310	379	388	6.4	3.3	4.1	0.34	1.78	0.98	27.8
292.100	374.650	47.625	47.625	34.925	525	1 010	**E-L555249/L555210**	309	305	355	362	3.5	3.3	−17	0.40	1.49	0.82	11.5
	393.700	63.500	50.800	44.450	510	945	**E-84115/84155**	313	309	363	378	3.5	6.4	−36.6	0.61	0.99	0.54	18.7
	469.900	95.250	93.662	69.850	1 310	2 170	**E-EE722115/722185**	330	324	430	433	9.7	3.3	6.3	0.38	1.58	0.87	62
	520.700	107.950	107.950	76.200	1 850	2 820	☆**T-E-EE224115/224204G2**	331	321	468	470	6.4	6.4	17.8	0.33	1.83	1.01	92.6
	558.800	136.525	136.525	98.425	2 170	3 800	**E-EE790114/790221**	335	329	501	513	6.4	6.4	23.8	0.39	1.52	0.84	135

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

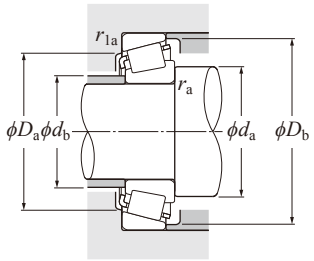
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

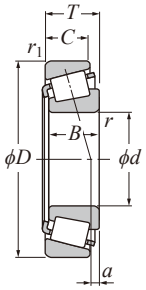
d 298.450-346.075 mm

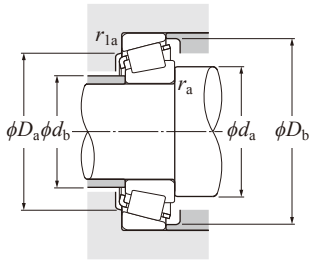
Boundary dimensions mm					Basic load rating kN		Bearing number [1]	Installation-related dimensions mm						Load center [2] mm	Constant	Axial load factors		Mass kg
					dynamic	static						r_{as}	r_{1as}					
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	Max.	Max.	a	e	Y_2	Y_0	(approx.)
298.450	444.500	63.500	61.912	39.688	695	1 150	**E-EE291175/291750**	332	320	416	415	8	1.5	−9.1	0.38	1.58	0.87	33.1
299.974	495.300	141.288	141.288	114.300	2 710	4 900	☆**E-HH258248/HH258210G2**	342	332	448	467	6.4	6.4	35.4	0.33	1.80	0.99	96
300.038	422.275	82.550	82.550	63.500	1 260	2 400	☆**T-E-HM256849/HM256810G2**	328	319	394	403	6.4	3.3	5.7	0.34	1.78	0.98	31.9
	393.700	50.800	50.800	38.100	540	1 030	**E-L357049/L357010**	329	319	374	380	6.4	3.3	−12.5	0.36	1.67	0.92	13.8
	406.400	63.500	63.500	47.625	780	1 580	**T-E-LM757049/LM757010**	331	322	380	393	6.4	3.3	−16.3	0.44	1.36	0.75	20.1
	438.048	76.200	76.992	53.975	895	1 600	**T-E-EE129120X/129172**	334	328	406	411	6.4	4.8	−7.3	0.42	1.44	0.79	34.8
304.800	444.500	63.500	61.912	39.688	695	1 150	**E-EE291201/291750**	337	324	416	415	8	1.5	−9.1	0.38	1.58	0.87	31.9
	495.300	76.200	74.612	53.975	1 260	1 940	**E-EE941205/941950A**	339	329	459	463	6.4	3.3	−10	0.40	1.49	0.82	55.8
	495.300	95.250	92.075	69.850	1 370	2 350	**E-EE724120/724195**	359	330	450	459	16	6.4	0.9	0.40	1.49	0.82	69.7
	558.800	136.525	136.525	98.425	2 170	3 800	**E-EE790120/790221**	335	335	501	513	1.3	6.4	23.8	0.39	1.52	0.84	131
314.325	495.300	120.650	119.062	88.900	1 750	3 100	**E-H859049/H859010**	361	344.8	439	473	6.4	6.4	−9.5	0.58	1.04	0.57	82.8
	444.500	63.500	61.912	39.688	695	1 150	**E-EE291250/291750**	346	334	416	415	8	1.5	−9.1	0.38	1.58	0.87	29.5
317.500	447.675	85.725	85.725	68.262	1 280	2 390	**T-E-HM259048/HM259010**	341	337	418	428	3.5	3.3	4.8	0.33	1.79	0.99	37.3
	622.300	147.638	131.762	82.550	2 310	3 550	☆**E-H961649/H961610G2**	410	373	531	582	14.3	12.7	−60.7	0.95	0.63	0.35	203
323.850	381.000	28.575	28.575	20.638	246	590	**T-E-LL758744/LL758715**	339	330	365	373.1	3.5	3.3	−34.9	0.44	1.36	0.75	5.38
	415.925	47.625	47.625	34.925	490	1 060	**T-E-L860048/L860010**	367	345	394	402	12.7	3.3	−35.4	0.50	1.20	0.66	13.3
330.200	415.925	47.625	47.625	34.925	490	1 060	**T-E-L860049/L860010**	349	345	394	402	3.5	3.3	−35.4	0.50	1.20	0.66	13.3
	482.600	66.675	63.500	44.450	855	1 460	**E-EE203130/203190**	364	354	449	456.1	6.8	6.8	−17.8	0.42	1.43	0.79	32.7
	482.600	85.725	80.167	60.325	1 060	1 970	**E-EE526130/526190**	360	351	449	454	6.4	3.3	−2.8	0.39	1.53	0.84	51
333.375	469.900	90.488	90.488	71.438	1 500	2 760	**E-HM261049/HM261010A**	363	357	439	449	6.4	3.3	5.4	0.33	1.79	0.99	43.4
	450.850	66.675	66.675	52.388	870	1 780	**E-LM361649/LM361610**	373	360	425	435	8.5	3.5	−8.7	0.35	1.71	0.94	25
342.900	457.098	68.262	63.500	47.625	785	1 640	**E-LM961548/LM961511**	367	363	423	443	3.3	3.3	−53.6	0.71	0.84	0.46	30
	533.400	76.200	76.200	50.800	1 190	1 730	**E-EE971354/972100**	373	367	501	501	4.8	3.3	−2.5	0.33	1.80	0.99	55.6
	482.600	60.325	55.562	38.100	775	1 430	**T-E-EE161363/161900**	379	368	451	455	7	6.4	−33.6	0.50	1.20	0.66	32.8
346.075	482.600	66.675	63.500	44.450	855	1 460	**E-EE203136/203190**	376	366	449	456.1	6.8	6.8	−17.8	0.42	1.43	0.79	32.7
	488.950	95.249	95.250	74.612	1 570	3 000	**T-E-HM262748/HM262710**	377	367	456	467	6.4	3.3	6.4	0.33	1.79	0.99	52.5

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 346.075-384.175 mm

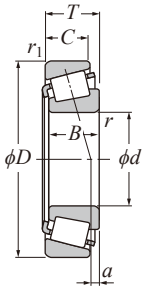
Boundary dimensions mm					Basic load rating kN		Bearing number [1]	Installation-related dimensions mm						Load center [2] mm	Constant	Axial load factors		Mass kg
					dynamic	static						r_{as}	r_{1as}					
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	Max.	Max.	a	e	Y_2	Y_0	(approx.)
346.075	488.950	95.250	95.250	74.612	1 650	3 200	☆**T-E-HM262749/HM262710G2**	377	367	456	467	6.4	3.3	6.4	0.33	1.79	0.99	49.7
349.250	501.650	90.488	84.138	69.850	1 320	2 280	**E-EE333137/333197**	382	372	470	478	6.4	3.3	−1.9	0.36	1.65	0.90	56.4
	444.500	60.325	60.325	47.625	725	1 740	**T-E-L163149/L163110**	374	370	422	430	3.5	3.3	−7.2	0.31	1.95	1.07	18.8
	469.900	60.325	55.562	38.100	775	1 430	**T-E-EE161400/161850**	386	375	445	455	7	6.4	−33.6	0.50	1.20	0.66	27.3
	482.600	60.325	55.562	38.100	775	1 430	**T-E-EE161400/161900**	386	375	451	455	7	6.4	−33.6	0.50	1.20	0.66	30.8
355.600	501.650	74.612	66.675	50.800	1 000	1 830	**T-E-EE231400/231975**	388	379	472	481	6.4	3.3	−19.8	0.44	1.36	0.75	44.9
	501.650	90.488	84.138	69.850	1 320	2 280	**E-EE333140/333197**	387	377	470	483	6.4	3.3	−1.9	0.36	1.65	0.90	50.8
	514.350	74.612	66.675	50.800	1 000	1 830	**T-E-EE231400/232025**	388	379	478	481.1	6.4	3.3	−19.8	0.44	1.36	0.75	44.5
	673.100	152.400	152.400	114.300	3 650	5 950	☆**E-EE121140/121265G2**	425	396	603	611.8	16	6.4	23.5	0.38	1.59	0.87	243
361.950	406.400	23.812	23.812	17.462	192	470	**E-LL562749/LL562710**	372	371	396	401	2.3	1.5	−38.3	0.40	1.49	0.82	3.56
368.249	523.875	101.600	101.600	79.375	1 690	3 250	☆**E-HM265049/HM265010G2**	400	394	487	499	6.4	6.4	8	0.33	1.80	0.99	61.7
368.300	596.900	95.250	92.075	60.325	1 620	2 420	**E-EE181453/182350**	415	402	552	552	9.7	6.4	−10	0.42	1.44	0.79	86.7
	609.600	142.875	139.700	111.125	3 150	5 350	☆**T-E-EE321145/321240G2**	413	404	555	571	8	6.4	22.7	0.36	1.68	0.91	161
371.475	501.650	74.612	66.675	50.800	1 000	1 830	**T-E-EE231462/231975**	400	390	472	481	6.4	3.3	−19.8	0.44	1.36	0.75	40.7
374.650	431.800	28.575	28.575	20.638	276	650	**T-E-LL264648/LL264610**	389	384	417	424	3.5	3.3	−27.9	0.33	1.80	0.99	5.9
	522.288	85.725	84.138	61.912	1 170	2 270	**E-LM565943/LM565910**	407	397	493	500	6.4	3.3	−7.6	0.39	1.56	0.86	54.5
	479.425	49.212	47.625	34.925	600	1 270	**E-L865547/L865512**	407	395	456	465	6.4	3.3	−42.4	0.49	1.21	0.67	20
	508.000	63.500	58.738	38.100	595	1 140	**E-EE192150/192200**	410	400	478	482	6.4	3.3	−40.6	0.53	1.13	0.62	34.4
	522.288	85.725	84.138	61.912	1 170	2 270	**E-LM565949/LM565910**	411	402	493	500	6.4	3.3	−7.6	0.39	1.56	0.86	52.5
381.000	523.875	85.725	84.138	61.912	1 170	2 270	**E-LM565949/LM565912**	411	402	493	500	6.4	3.3	−7.6	0.39	1.56	0.86	53.2
	546.100	104.775	104.775	82.550	1 910	3 700	**T-E-HM266446/HM266410**	415	405	507	520	6.4	6.4	7.1	0.33	1.80	0.99	76
	546.100	104.775	104.775	82.550	2 040	4 000	☆**T-E-HM266447/HM266410G2**	415	405	507	520	6.4	6.4	7.1	0.33	1.80	0.99	70.1
	590.550	114.300	114.300	88.900	2 370	4 700	☆**T-E-M268730/M268710G2**	425	415	549	561	6.4	6.4	9.4	0.33	1.80	0.99	102
	441.325	28.575	28.575	20.638	273	655	**E-LL365348/LL365310**	399	393	427	433	3.5	3.3	−30	0.34	1.77	0.97	5.89
384.175	546.100	104.775	104.775	82.550	1 910	3 700	**T-E-HM266448/HM266410**	417	407	507	519	6.4	6.4	7.1	0.33	1.80	0.99	69
	546.100	104.775	104.775	82.550	2 040	4 000	☆**T-E-HM266449/HM266410G2**	417	407	507	519	6.4	6.4	7.1	0.33	1.80	0.99	69

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

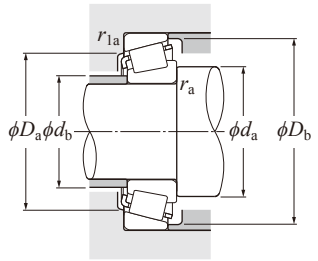
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 385.762-447.675 mm

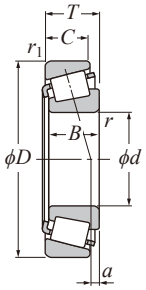
Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
385.762	514.350	82.550	82.550	63.500	1 370	2 780	**E-LM665949/LM665910**	415	406	482	495	6.4	3.3	−16.3	0.42	1.43	0.79	41.8
387.248	546.100	87.312	87.312	68.262	1 540	3 150	☆**E-M667935/M667911G2**	424	414	510	528	6.4	6.4	−16.2	0.42	1.43	0.79	56.6
393.700	546.100	76.200	61.120	55.562	865	1 640	**E-EE234154/234215**	426	416	504	515.6	6.4	6.4	−35.8	0.47	1.27	0.70	44.9
396.875	546.100	76.200	61.120	55.562	935	1 750	**T-E-EE234156/234215**	428	418	504	516	6.4	6.4	−35.6	0.48	1.26	0.69	44.2
	558.800	65.088	61.120	44.450	935	1 750	**T-E-EE234156/234220**	428	418	516	516	6.4	6.4	−35.6	0.48	1.26	0.69	43.7
403.225	460.375	28.575	28.575	20.638	228	605	**E-LL566848/LL566810**	418	414	445	452	3.5	3.3	−41.5	0.40	1.49	0.82	6.17
406.400	508.000	61.912	61.912	47.625	730	1 690	**E-L467549/L467510**	426	423	483	492	3.3	3.3	−19.6	0.37	1.63	0.90	25.1
	546.100	76.200	61.120	55.562	865	1 640	**E-EE234160/234215**	435	425	504	516	6.4	6.4	−35.8	0.47	1.27	0.70	48.7
	546.100	87.312	87.312	68.262	1 490	3 050	**E-M667944/M667911**	438	428	510	526.7	6.4	6.4	−16.2	0.42	1.43	0.79	55.2
	549.275	85.725	84.138	61.912	1 470	2 920	**E-LM567949/LM567910**	437	427	519	525	6.4	3.3	−14.7	0.41	1.47	0.81	56.2
	558.800	65.088	61.120	44.450	935	1 750	**T-E-EE234160/234220**	435	425	516	516	6.4	6.4	−35.6	0.48	1.26	0.69	40.6
	574.675	76.200	67.866	50.800	1 020	1 860	**E-EE285160/285226**	442	431	534	535.6	6.8	3.3	−38.8	0.50	1.20	0.66	53.7
	590.550	107.950	107.950	80.962	1 820	3 400	**E-EE833160X/833232**	448	435	549	561	9.7	6.4	8.5	0.33	1.84	1.01	86.6
	609.600	92.075	84.138	60.325	1 400	2 400	**E-EE911600/912400**	443	439	567	570	6.8	6.4	−11.5	0.38	1.57	0.86	91.3
409.575	546.100	87.312	87.312	68.262	1 490	3 050	**E-M667948/M667911**	440	431	510	528	6.4	6.4	−16.2	0.42	1.43	0.79	49.8
415.925	590.550	114.300	114.300	88.900	2 370	4 700	☆**T-E-M268749/M268710G2**	451	441	549	561	6.4	6.4	9.4	0.33	1.80	0.99	87.8
425.450	685.698	142.875	142.800	104.775	2 810	5 000	**E-EE328167/328269**	482	463	624	636.1	12.7	6.4	9.9	0.40	1.49	0.82	191
430.212	603.250	76.200	73.025	50.800	1 080	2 050	**E-EE241693/242375**	465	455	558	562.8	6.4	6.4	−46.5	0.53	1.14	0.63	59.5
431.800	533.400	46.038	46.038	34.925	620	1 320	**T-E-80385/80325**	450	446	510	510	3.3	3.3	−23.4	0.31	1.94	1.07	19.7
	533.400	50.800	50.800	36.512	765	1 550	**T-E-L269143/L269110**	450	445	516	522	3.3	3.3	−25.9	0.33	1.80	0.99	22.7
	552.450	44.450	44.450	31.750	680	1 340	**E-80170/80217**	456	452	531	536	3.3	3.3	−27.5	0.32	1.88	1.04	23.1
	571.500	74.612	74.612	52.388	1 210	2 470	**T-E-LM869448/LM869410**	457	453	537	549	3.3	3.3	−50.1	0.55	1.10	0.60	45.7
	603.250	76.200	73.025	50.800	1 080	2 050	**E-EE241701/242375**	446	457	558	564	6.4	6.4	−46.5	0.53	1.14	0.63	64.9
	673.100	88.900	87.833	60.325	1 660	2 670	**E-EE571703/572650**	472	466	630	632.6	6.4	3.3	−21.4	0.40	1.49	0.82	114
431.902	685.698	177.800	174.625	142.875	4 400	8 200	**T-E-EE650170/650270G2**	477	471	627	648.5	6.4	6.4	36.3	0.32	1.85	1.04	248
447.675	552.450	44.450	44.450	31.750	680	1 340	**E-80176/80217**	467	464	531	536	3.3	3.3	−27.5	0.32	1.88	1.04	20.4

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

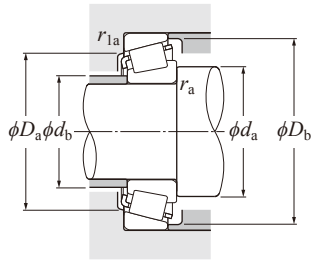
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Tapered Roller Bearings
NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 447.675-549.275 mm

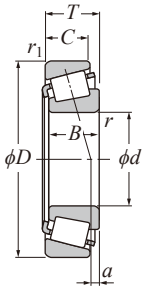
Boundary dimensions mm					Basic load rating kN		Bearing number [1]	Installation-related dimensions mm						Load center [2] mm	Constant	Axial load factors		Mass kg
d	D	T	B	C	dynamic C_r	static C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
447.675	565.150	44.450	44.450	31.750	680	1 340	**E-80176/80222**	467	464	537	531	3.3	3.3	−27.5	0.32	1.88	1.04	21.3
	635.000	120.650	120.650	95.250	2 680	5 550	☆**E-M270749/M270710AG2**	484	474	591	606	6.4	6.4	8.5	0.33	1.80	0.99	107
450.850	603.250	85.725	84.138	60.325	1 270	2 680	**E-LM770945/E-LM770910**	484	474	570	579	6.4	3.3	−29.7	0.46	1.32	0.72	63.2
457.200	552.450	44.450	44.450	31.750	680	1 340	**E-80180/80217**	474	471	531	536	3.3	3.3	−27.5	0.32	1.88	1.04	18.7
	573.088	74.612	74.612	57.150	1 120	2 680	**E-L570649/L570610**	485	475	543	558	6.4	6.4	−26.2	0.40	1.49	0.82	38.9
	596.900	76.200	73.025	53.975	1 080	2 350	**E-EE244180/244235**	494	478	567	570	9.7	3.3	−27.1	0.40	1.48	0.82	53.9
	603.250	85.725	84.138	60.325	1 270	2 680	**E-LM770949/LM770910**	489	479	570	579	6.4	3.3	−29.7	0.46	1.32	0.72	63.8
	615.950	85.725	85.725	66.675	1 500	3 350	☆**E-LM272235/LM272210G2**	493	483	585	597	6.4	6.4	−11.3	0.33	1.80	0.99	63.8
	660.400	91.280	85.725	62.705	1 570	2 800	**E-EE737181/737260**	503.9	489	614.9	618	10.5	6.4	−17.7	0.37	1.60	0.88	90.7
	730.148	120.650	114.300	82.550	2 820	4 400	**E-EE671801/672873**	507	491	675	681	9.7	6.4	−6.6	0.39	1.53	0.84	188
476.250	565.150	41.275	41.275	31.750	450	1 200	**E-LL771948/E-LL771911**	495	491	543	549	3.3	3.3	−58.4	0.47	1.28	0.70	16.7
479.425	679.450	128.588	128.588	101.600	3 150	6 500	☆**T-E-M272749/M272710G2**	516	507	633	648	6.4	6.4	8.9	0.33	1.80	0.99	130
482.600	615.950	53.975	46.038	41.275	670	1 520	**E-80480/80425**	504	501	582	579	3.3	3.3	−35.9	0.35	1.72	0.95	34.9
	615.950	85.725	85.725	66.675	1 500	3 350	☆**E-LM272249/LM272210G2**	513	501	585	597	6.4	6.4	−11.3	0.33	1.80	0.99	54.9
	634.873	80.962	80.962	63.500	1 300	3 100	**E-EE243190/243250**	516	510	603	609	6.4	3.3	−18.5	0.34	1.76	0.97	60.2
488.671	660.400	93.662	94.458	69.850	2 030	4 000	☆**T-E-EE640191/640260G2**	522	513	624	630.5	6.4	6.4	−4.2	0.31	1.95	1.07	82
488.950	634.873	84.138	84.138	61.912	1 620	3 500	**E-LM772748/LM772710A**	522	510	600	613	6.4	3.3	−40.4	0.47	1.27	0.70	60.3
	660.400	93.662	94.458	69.850	2 030	4 000	☆**T-E-EE640192/640260G2**	522	513	624	630	6.4	6.4	−4.9	0.31	1.95	1.07	85.2
489.026	634.873	80.962	80.962	63.500	1 300	3 100	**E-EE243192/243250**	522	516	603	609	6.4	3.3	−18.5	0.34	1.76	0.97	58
498.475	634.873	80.962	80.962	63.500	1 300	3 100	**E-EE243196/243250**	528	522	603	609	6.4	3.3	−18.5	0.34	1.76	0.97	54.7
501.650	711.200	136.525	136.525	106.362	3 250	6 850	☆**E-M274149/M274110G2**	540	534	663	678	6.4	6.4	11.8	0.33	1.80	0.99	152
508.000	838.200	146.050	139.700	104.775	3 500	6 400	**T-E-EE426200/426330**	564	552	759	768	9.7	9.7	−26.1	0.48	1.25	0.69	296
533.400	635.000	50.800	50.800	38.100	770	1 680	**E-LL575343/LL575310**	558	549	612	621	6.4	6.4	−50.3	0.41	1.48	0.81	26.4
536.575	761.873	146.050	146.050	114.300	3 800	7 600	☆**E-M276449/M276410G2**	576	570	711	726	6.4	6.4	10.5	0.33	1.80	0.99	187
539.750	635.000	50.800	50.800	38.100	770	1 680	**E-LL575349/LL575310**	564	555	612	621	6.4	6.4	−50.3	0.41	1.48	0.81	24.9
549.275	692.150	80.962	80.962	61.912	1 500	3 500	**E-L476549/L476510**	579	570	657	666	6.4	6.4	−32.2	0.38	1.59	0.88	68.2

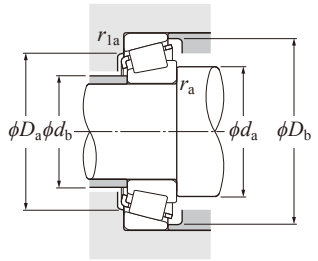
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

d 558.800-762.000 mm

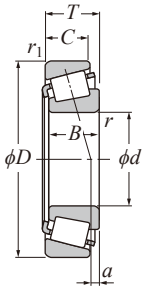
Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm						Load center [2] mm	Constant	Axial load factors		Mass kg
				dynamic	static												
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
	736.600	76.200	76.200	50.800	1 330	2 700	**E-EE542220/542290**	594	585	696	705	6.4	6.4	−66.6	0.51	1.17	0.65	76.7
558.800	736.600	88.108	88.108	63.500	1 610	3 350	**E-EE843220/843290**	591	585	699	708	6.4	6.4	−21.8	0.34	1.76	0.97	88.7
	736.600	104.775	104.775	80.962	2 050	4 400	**E-LM377449/LM377410**	594	585	696	708	6.4	6.4	−15.6	0.35	1.73	0.95	106
571.500	812.800	155.575	155.575	120.650	4 500	9 150	☆**E-M278749/E-M278710AG2**	615	609	756	774	6.4	6.4	12.7	0.33	1.80	0.99	227
584.200	685.800	49.212	49.212	34.925	780	1 930	**T-E-LL778149/E-LL778110**	603	600	663	669	3.5	3.3	−64.5	0.44	1.37	0.75	27.8
	901.700	150.020	139.700	107.950	4 100	7 450	**E-EE662303/663550G2**	633	624	843	848.1	8	9.7	0.3	0.33	1.80	0.99	324
596.900	685.800	31.750	31.750	25.400	370	895	**E-680235/680270**	615	615	663	669	3.5	3.3	−94.8	0.53	1.14	0.63	15.8
609.397	762.000	95.250	92.075	71.438	1 960	4 850	**E-L879946/L879910**	642	633	720	741	6.4	6.4	−58.2	0.49	1.23	0.68	95.7
	762.000	95.250	92.075	71.438	1 960	4 850	**E-L879947/L879910**	642	633	720	741	6.4	6.4	−58.2	0.49	1.23	0.68	95.6
609.600	787.400	93.662	93.662	69.850	2 430	5 050	☆**E-EE649240/649310G2**	642	633	747	764	6.4	6.4	−23.8	0.33	1.80	0.99	112
	812.800	82.550	82.550	60.325	1 850	3 900	**E-EE743240/743320**	645	636	768	768	6.4	6.4	−31.8	0.33	1.83	1.01	104
615.950	708.025	41.275	41.275	29.367	610	1 550	**E-LL580049/LL580010**	633	630	687	690	3.5	3.3	−61.1	0.39	1.55	0.85	22.9
635.000	736.600	57.150	53.975	41.275	775	1 980	**E-80780/80720**	654	651	714	717	3.3	3.3	−69.2	0.44	1.37	0.75	38.3
646.112	857.250	141.288	141.288	109.538	4 050	9 200	☆**T-E-LM281049/LM281010G2**	684	678	810	824.5	6.4	6.4	−2.5	0.33	1.80	0.99	220
660.400	812.800	95.250	95.250	73.025	2 160	5 200	**E-L281148/L281110A**	693	681	777	789	6.4	6.4	−27.7	0.33	1.80	0.99	93.5
673.100	793.750	66.675	61.912	49.212	1 090	2 700	**E-LL481448/LL481411**	702	690	765	771	6.4	6.4	−53.8	0.36	1.67	0.92	51.3
685.800	876.300	93.662	92.075	69.850	2 280	5 450	☆**E-EE655270/655345G2**	723	714	831	843	6.4	6.4	−56.6	0.42	1.43	0.79	134
711.200	914.400	85.725	82.550	60.325	2 010	4 450	☆**E-EE755280/755360G2**	750	741	873	876	6.4	6.4	−52.4	0.38	1.58	0.87	136
723.900	914.400	84.138	80.962	60.325	2 010	4 450	☆**E-EE755285/755360G2**	756	750	873	876	5.5	6.4	−54	0.38	1.58	0.87	126
749.300	965.200	93.662	80.962	66.675	1 690	3 450	**E-EE752295/752380**	789	780	921	923.5	6.4	3.3	−66.6	0.40	1.49	0.82	145
	990.600	159.500	160.337	123.000	4 750	11 300	☆**E-LM283649/LM283610G2**	792	786	936	952	6.4	6.4	−4.4	0.33	1.80	0.99	309
759.925	889.000	69.850	69.850	50.800	1 340	3 900	**E-LL483448/LL483418**	783	777	855	858	3.3	3.3	−62.3	0.38	1.58	0.87	70.5
	889.000	88.900	88.900	72.000	2 020	5 450	**E-L183448/L183410**	783	780	864	872	3.3	3.3	−34.6	0.31	1.97	1.30	89.9
	889.000	69.850	69.850	50.800	1 340	3 900	**E-LL483449/LL483418**	783	780	855	858	3.3	3.3	−62.3	0.38	1.58	0.87	69.2
762.000	889.000	88.900	88.900	72.000	2 260	6 300	☆**E-L183449/L183410G2**	783	780	864	872	3.3	3.3	−34.6	0.31	1.97	1.30	92.5
	965.200	93.662	80.962	66.675	1 690	3 450	**E-EE752300/752380**	798	789	921	923.5	6.4	3.3	−66.6	0.40	1.49	0.82	132

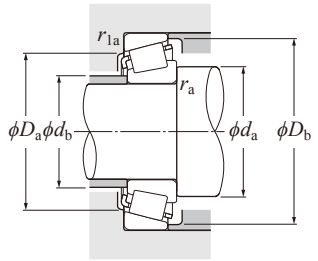
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	0	0.4	Y_2

Static equivalent radial load

$P_{0r} = 0.5F_r + Y_0F_a$

When,

$P_{0r} < F_r$ use $P_{0r} = F_r$.

For values of e, Y_2 and Y_0 see the table below.

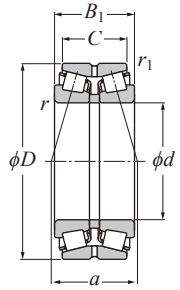
d 774.700-1 270.000 mm

Boundary dimensions					Basic load rating		Bearing number [1]	Installation-related dimensions						Load center [2]	Constant	Axial load factors		Mass
mm					dynamic kN	static kN		mm						mm				kg
d	D	T	B	C	C_r	C_{0r}		d_a	d_b	D_a	D_b	r_{as} Max.	r_{1as} Max.	a	e	Y_2	Y_0	(approx.)
774.700	965.200	93.662	80.962	66.675	1 690	3 450	**E-EE752305/752380**	810	798	921	924	6.4	3.3	−66.6	0.40	1.49	0.82	126
801.688	914.400	58.738	58.738	41.275	1 160	3 250	**E-LL584449/LL584410**	822	819	888	894	3.5	3.3	−78.6	0.40	1.51	0.83	51.7
838.200	1 041.400	93.662	88.900	66.675	2 350	5 200	☆**E-EE763330/763410G2**	876	870	996	1 000	6.4	6.4	−85.3	0.44	1.36	0.75	172
863.600	1 130.300	174.625	185.738	138.112	5 950	14 800	☆**E-LM286249/LM286210G2**	915	906	1 065	1 090.4	9.7	12.7	−12	0.33	1.80	0.99	471
977.900	1 130.300	66.675	63.500	47.625	1 330	3 600	**E-LL687949/LL687910**	1 010	1 005	1 095	1 100	6.4	6.4	−118.2	0.44	1.37	0.75	103
1 063.625	1 219.200	65.088	65.088	42.862	1 560	4 300	**E-LL788345/LL788310**	1 090	1 085	1 185	1 190	3.3	3.3	−142.8	0.48	1.26	0.69	422
1 066.800	1 219.200	65.088	65.088	42.862	1 560	4 300	**E-LL788349/LL788310**	1 090	1 090	1 185	1 190	3.3	3.3	−142.8	0.48	1.26	0.69	422
	1 320.800	95.250	88.900	69.850	2 580	6 200	**E-EE776420/776520**	1 115	1 115	1 260	1 289	6.4	6.4	−175.6	0.57	1.05	0.58	796
1 092.200	1 320.800	95.250	88.900	69.850	2 580	6 200	**E-EE776430/776520**	1 135	1 130	1 260	1 289	6.4	6.4	−175.6	0.57	1.05	0.58	794
1 155.700	1 435.100	120.650	120.650	95.250	4 450	11 500	☆**T-E-EE277455/277565G2**	1 205	1 195	1 370	1 370	6.4	6.4	−87.9	0.36	1.66	0.91	428
1 270.000	1 435.100	69.850	65.088	47.625	1 760	5 050	**E-LL889049/LL889010**	1 305	1 300	1 395	1 405	6.4	6.4	−220.2	0.58	1.04	0.57	666

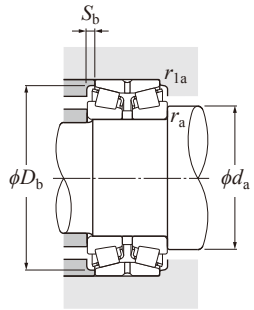
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions on the back face of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

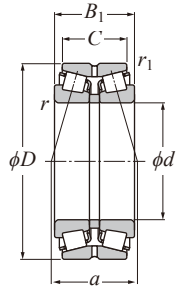
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 100-130 mm

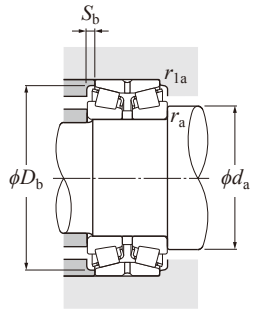
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN	Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
100	180	83	67	3	1	490	675	74.5	**430220XU**	114	169.5	8	2.5	1	81.5	0.42	1.61	2.39	1.57	8.27
	180	107	87	3	1	630	925	102	**432220XU**	114	172	10	2.5	1	92	0.42	1.61	2.39	1.57	11
	215	112	87	4	1	780	995	106	**430320XU**	118	198.5	12.5	3	1	92	0.35	1.96	2.91	1.91	17.9
	215	162	127	4	1	1 090	1 540	164	**432320U**	118	201.5	17.5	3	1	113	0.35	1.96	2.91	1.91	26.8
105	190	88	70	3	1	545	760	82.5	**430221XU**	119	178.5	9	2.5	1	86	0.42	1.61	2.39	1.57	9.8
	190	115	95	3	1	720	1 080	118	**432221XU**	119	181.5	10	2.5	1	97.5	0.42	1.61	2.39	1.57	13.3
110	160	57.5	47.5	1.5	0.5	242	450	50.5	**CRI-2258**	118.5	146	5	1.5	0.5	60.5	0.36	1.90	2.83	1.86	3.41
	180	56	50	2.5	0.6	253	340	37.5	**413122**	122	170.5	3	2	0.6	66.5	0.40	1.68	2.50	1.64	4.93
	180	70	56	2.5	0.6	330	485	53.0	**423122**	122	167.5	7	2	0.6	66.5	0.33	2.03	3.02	1.98	6.38
	200	92	74	3	1	615	865	92.5	**430222XU**	124	188.5	9	2.5	1	90	0.42	1.61	2.39	1.57	11.4
	200	121	101	3	1	800	1 210	130	**432222XU**	124	192	10	2.5	1	102	0.42	1.61	2.39	1.57	15.8
	240	118	93	4	1	910	1 180	120	**430322U**	128	222	12.5	3	1	100	0.35	1.96	2.91	1.91	23.9
	240	181	142	4	1	1 340	1 940	199	**432322U**	128	224	19.5	3	1	127	0.35	1.96	2.91	1.91	37.4
120	180	46	41	2.5	0.6	214	298	32.0	**413024**	132	172	2.5	2	0.6	59	0.37	1.80	2.69	1.76	3.85
	180	58	46	2.5	0.6	255	375	40.0	**423024**	132	171.5	6	2	0.6	66	0.37	1.80	2.69	1.76	4.35
	200	62	55	2.5	0.6	291	435	46.0	**413124**	132	185.5	3.5	2	0.6	76.5	0.43	1.57	2.34	1.53	7.24
	200	78	62	2.5	0.6	415	610	64.5	**423124**	132	189.5	8	2	0.6	76.5	0.37	1.80	2.69	1.76	8.69
	200	100	84	2.5	1	585	1 100	115	**CRI-2416**	132	190.5	8	2	1	87.5	0.34	1.96	2.92	1.92	12.6
	215	97	78	3	1	660	940	98.5	**430224XU**	134	203	9.5	2.5	1	98	0.44	1.55	2.31	1.52	13.8
	215	132	109	3	1	875	1 360	143	**432224XU**	134	206	11.5	2.5	1	112	0.44	1.55	2.31	1.52	19.2
	260	128	101	4	1	1 060	1 390	139	**430324XU**	138	239	13.5	3	1	107	0.35	1.96	2.91	1.91	30.3
	260	188	145	4	1	1 550	2 270	228	**432324U**	138	240.5	21.5	3	1	130	0.35	1.96	2.91	1.91	47
130	200	52	46	2.5	0.6	249	365	38.5	**413026**	142	188	3	2	0.6	66	0.37	1.80	2.69	1.76	5.55
	200	65	52	2.5	0.6	325	490	51.5	**423026**	142	190.5	6.5	2	0.6	71.5	0.37	1.80	2.69	1.76	6.62
	210	64	57	2.5	0.6	350	485	50.5	**413126**	142	197	3.5	2	0.6	69	0.33	2.03	3.02	1.98	7.83
	210	80	64	2.5	0.6	455	675	70.5	**423126**	142	199.5	8	2	0.6	79.5	0.37	1.80	2.69	1.76	9.4

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "＊" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

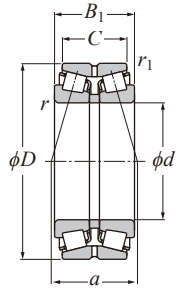
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 130-150 mm

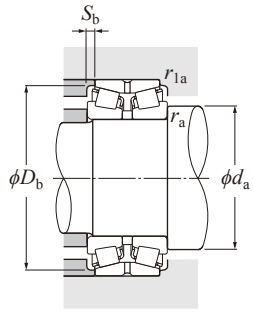
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
130	210	109	90	2.5	0.6	585	1 100	115		**CRI-2619**	142	191.5	9.5	2	0.6	89	0.34	1.96	2.92	1.92	14.2
	214	115	98	2.5	0.6	595	1 040	109		**CRI-2651**	142	198	8.5	2	0.6	111	0.46	1.47	2.19	1.44	15.5
	230	98	78.5	4	1	710	1 010	103		**430226XU**	148	218	9.5	3	1	102	0.44	1.55	2.31	1.52	15.3
	230	145	117.5	4	1	1 010	1 630	167		**432226XU**	148	220.5	13.5	3	1	124	0.44	1.55	2.31	1.52	24
	280	137	107.5	5	1.5	1 230	1 660	162		**430326XU**	152	257.5	14.5	4	1.5	116	0.35	1.96	2.91	1.91	37.9
	280	137	107.5	5	1.5	1 430	1 660	162	*	**430326XUUTG**	152	257.5	14.5	4	1.5	116	0.35	1.96	2.91	1.91	37.9
	280	205	163.5	4	1.5	1 700	2 470	243		**432326**	148	264	20.5	3	1.5	143	0.35	1.95	2.90	1.90	56.6
	280	205	163.5	4	1.5	1 960	2 470	243	*	**432326UTG**	148	264	20.5	3	1.5	143	0.35	1.95	2.90	1.90	56.6
140	210	53	47	2.5	0.6	291	415	43.0		**413028**	152	200	3	2	0.6	68.5	0.37	1.80	2.69	1.76	5.73
	210	66	53	2.5	0.6	335	535	55.0		**423028**	152	198	6.5	2	0.6	75	0.37	1.84	2.74	1.80	7.07
	210	106	94	2.5	0.6	640	1 220	126		**CRI-2818**	152	201.5	6	2	0.6	93	0.35	1.95	2.90	1.91	12.5
	225	68	61	3	1	410	580	59.0		**413128**	154	212	3.5	2.5	1	73.5	0.33	2.03	3.02	1.98	9.29
	225	84	68	3	1	435	650	66.0		**423128**	154	211	8	2.5	1	88	0.37	1.80	2.69	1.76	11.1
	230	140	110	3	1	830	1 470	149		**CRI-2825**	154	216	15	2.5	1	106	0.32	2.12	3.15	2.07	20.5
	250	102	82.5	4	1	800	1 140	114		**430228XU**	158	235	9.5	3	1	107	0.44	1.55	2.31	1.52	19.2
	250	153	125.5	4	1	1 160	1 840	184		**432228XU**	158	239.5	13.5	3	1	131	0.44	1.55	2.31	1.52	30
	300	102	77	2.5	1	715	1 010	97.0		**CRI-2834**	152	264	12.5	2	1	129	0.55	1.24	1.84	1.21	32.4
	300	145	115.5	4	1.5	1 220	1 560	150		**430328X**	158	275.5	14.5	4	1.5	123.5	0.35	1.95	2.90	1.91	43.2
	300	145	115.5	5	1.5	1 400	1 900	183		**430328XU**	162	275.5	14.5	4	1.5	122.5	0.35	1.96	2.91	1.91	45.3
	300	145	115.5	5	1.5	1 620	1 900	183	*	**430328XUUTG**	162	275.5	14.5	4	1.5	122.5	0.35	1.96	2.91	1.91	45.3
	300	223	177.5	4	1.5	1 880	2 740	264		**432328**	158	280.5	22.5	3	1.5	156	0.35	1.95	2.90	1.91	68.9
	300	223	177.5	4	1.5	2 170	2 740	264	*	**432328UTG**	158	280.5	22.5	3	1.5	156	0.35	1.95	2.90	1.91	68.9
150	225	56	50	3	1	305	430	43.5		**413030**	164	213.5	3	2.5	1	73.5	0.37	1.80	2.69	1.76	6.66
	225	70	56	3	1	395	630	64.0		**423030**	164	213	7	2.5	1	79.5	0.37	1.80	2.69	1.76	8.48
	250	80	71	3	1	540	805	79.5		**413130**	164	232.5	4.5	2.5	1	83.5	0.33	2.03	3.02	1.98	14.6
	250	100	80	3	1	670	1 040	103		**423130**	164	236	10	2.5	1	96.5	0.37	1.80	2.69	1.76	17.6

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

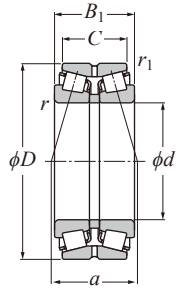
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 150-170 mm

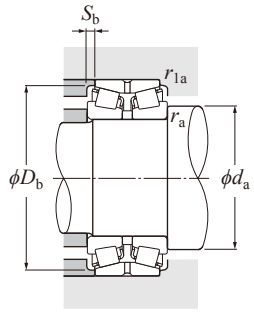
Boundary dimensions mm						Basic load rating kN dynamic	Basic load rating kN static	Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
150	270	109	87	4	1	855	1 210	118		**430230U**	168	251.5	11	3	1	114	0.44	1.55	2.31	1.52	24.1
	270	164	130	4	1	1 330	2 140	209		**432230XU**	168	256	17	3	1	139	0.44	1.55	2.31	1.52	38
	320	154	120	5	1.5	1 570	2 140	201		**430330U**	172	294.5	17	4	1.5	131.5	0.35	1.96	2.91	1.91	54.6
	320	154	120	5	1.5	1 810	2 140	201	*	**430330UUTG**	172	294.5	17	4	1.5	131.5	0.35	1.96	2.91	1.91	54.6
160	240	60	53	3	1	370	535	53.0		**413032**	174	228.5	3.5	2.5	1	79	0.37	1.80	2.69	1.76	8.39
	240	75	60	3	1	475	765	76.0		**423032**	174	228.5	7.5	2.5	1	85.5	0.37	1.80	2.69	1.76	10.7
	270	86	76	3	1	660	965	93.0		**413132E1**	174	256	5	2.5	1	98.5	0.40	1.68	2.50	1.64	18.2
	270	86	76	3	1	760	965	93.0	*	**413132UTG**	174	256	5	2.5	1	98.5	0.40	1.68	2.50	1.64	18.2
	270	108	86	3	1	750	1 180	114		**423132E1**	174	252	11	2.5	1	106	0.37	1.80	2.69	1.76	22.5
	270	108	86	3	1	865	1 180	114	*	**423132UTG**	174	252	11	2.5	1	106	0.37	1.80	2.69	1.76	22.5
	270	140	120	2.5	1	1 060	1 910	185		**CRI-3225**	172	251.5	10	2	1	113.5	0.32	2.12	3.15	2.07	31.8
	280	150	125	4	1	1 210	1 940	187		**CRI-3258**	178	264.5	12.5	3	1	119.5	0.32	2.12	3.15	2.07	34.8
	290	115	91	4	1	1 000	1 440	137		**430232U**	178	271	12	3	1	122	0.44	1.55	2.31	1.52	29.3
	290	115	91	4	1	1 150	1 440	137	*	**430232UUTG**	178	271	12	3	1	122	0.44	1.55	2.31	1.52	29.3
	290	178	144	4	1	1 690	2 840	272		**432232U**	178	277	17	3	1	149.5	0.44	1.55	2.31	1.52	49.9
	290	178	144	4	1	1 960	2 840	272	*	**432232UUTG**	178	277	17	3	1	149.5	0.44	1.55	2.31	1.52	49.9
	340	160	126	5	1.5	1 740	2 390	221		**430332XU**	182	312.5	17	4	1.5	137.5	0.35	1.96	2.91	1.91	63.8
	340	160	126	5	1.5	2 010	2 390	221	*	**430332XUUTG**	182	312.5	17	4	1.5	137.5	0.35	1.96	2.91	1.91	63.8
170	260	67	60	3	1	405	620	60.0		**413034**	184	243.5	3.5	2.5	1	86.5	0.37	1.80	2.69	1.76	11.6
	260	84	67	3	1	545	865	83.5		**423034**	184	245.5	8.5	2.5	1	93.5	0.37	1.80	2.69	1.76	14.3
	280	88	78	3	1	610	900	86.0		**413134E1**	184	262	5	2.5	1	104	0.40	1.68	2.50	1.64	19.2
	280	88	78	3	1	705	900	86.0	*	**413134UTG**	184	262	5	2.5	1	104	0.40	1.68	2.50	1.64	19.2
	280	110	88	3	1	805	1 270	122		**423134E1**	184	262	11	2.5	1	109	0.37	1.80	2.69	1.76	24.2
	280	110	88	3	1	930	1 270	122	*	**423134UTG**	184	262	11	2.5	1	109	0.37	1.80	2.69	1.76	24.2
	280	134	106	3	1	950	1 790	173		**CRI-3452**	184	250.5	14	2.5	1	132.5	0.44	1.52	2.26	1.49	32.8
	280	150	130	2.5	1	1 090	1 880	180		**CRI-3410**	182	265	10	2	1	125.5	0.33	2.03	3.02	1.98	34.3

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

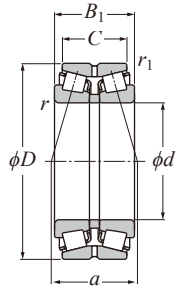
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 170-190 mm

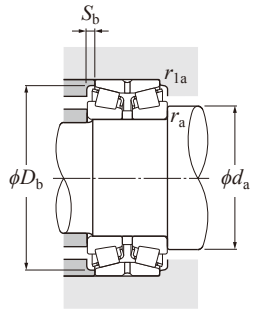
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN		Bearing number [2) 3)]	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
170	310	125	97	5	1.5	1 160	1 690	159		**430234U**	192	290.5	14	4	1.5	132.5	0.44	1.55	2.31	1.52	37.1
	310	125	97	5	1.5	1 340	1 690	159	*	**430234UUTG**	192	290.5	14	4	1.5	132.5	0.44	1.55	2.31	1.52	37.1
	310	192	152	5	1.5	1 900	3 200	300		**432234XU**	192	296	20	4	1.5	160	0.44	1.55	2.31	1.52	61.3
	310	192	152	5	1.5	2 190	3 200	300	*	**432234XUUTG**	192	296	20	4	1.5	160	0.44	1.55	2.31	1.52	61.3
180	280	74	66	3	1	470	735	69.5		**413036E1**	194	262	4	2.5	1	94	0.37	1.80	2.69	1.76	15.2
	280	74	66	3	1	545	735	69.5	*	**413036UTG**	194	262	4	2.5	1	94	0.37	1.80	2.69	1.76	15.2
	280	93	74	3	1	645	1 050	100		**423036**	194	264	9.5	2.5	1	102	0.37	1.80	2.69	1.76	19
	280	93	74	3	1	745	1 050	100	*	**423036UTG**	194	264	9.5	2.5	1	102	0.37	1.80	2.69	1.76	19
	300	96	85	4	1.5	785	1 190	111		**413136E1**	198	282	5.5	3	1.5	110.5	0.40	1.68	2.50	1.64	25
	300	96	85	4	1.5	910	1 190	111	*	**413136UTG**	198	282	5.5	3	1.5	110.5	0.40	1.68	2.50	1.64	25
	300	120	96	4	1.5	980	1 530	144		**423136E1**	198	281	12	3	1.5	119	0.37	1.80	2.69	1.76	30.1
	300	120	96	4	1.5	1 130	1 530	144	*	**423136UTG**	198	281	12	3	1.5	119	0.37	1.80	2.69	1.76	30.1
	320	127	99	5	1.5	1 200	1 780	165		**430236U**	202	300	14	4	1.5	139	0.45	1.50	2.23	1.47	39.1
	320	127	99	5	1.5	1 380	1 780	165	*	**430236UUTG**	202	300	14	4	1.5	139	0.45	1.50	2.23	1.47	39.1
	320	192	152	5	1.5	1 960	3 350	315		**432236U**	202	305.5	20	4	1.5	165	0.45	1.50	2.23	1.47	63.8
	320	192	152	5	1.5	2 260	3 350	315	*	**432236UUTG**	202	305.5	20	4	1.5	165	0.45	1.50	2.23	1.47	63.8
	340	180	140	4	1.5	1 540	2 590	238		**CRI-3618**	198	302	20	3	1.5	142.5	0.32	2.12	3.15	2.07	68.5
190	290	75	67	3	1	480	740	69.5		**413038E1**	204	272.5	4	2.5	1	96	0.37	1.80	2.69	1.76	15.9
	290	75	67	3	1	555	740	69.5	*	**413038UTG**	204	272.5	4	2.5	1	96	0.37	1.80	2.69	1.76	15.9
	290	94	75	3	1	685	1 110	104		**423038E1**	204	274	9.5	2.5	1	104.5	0.37	1.80	2.69	1.76	16.1
	290	94	75	3	1	790	1 110	104	*	**423038UTG**	204	274	9.5	2.5	1	104.5	0.37	1.80	2.69	1.76	16.1
	320	104	92	4	1.5	865	1 280	118		**413138**	208	303	6	3	1.5	118.5	0.40	1.68	2.50	1.64	30.3
	320	104	92	4	1.5	1 000	1 280	118	*	**413138UTG**	208	303	6	3	1.5	118.5	0.40	1.68	2.50	1.64	30.3
	320	130	104	4	1.5	1 090	1 710	157		**423138**	208	302	13	3	1.5	126.5	0.37	1.80	2.69	1.76	37.7
	320	130	104	4	1.5	1 260	1 710	157	*	**423138UTG**	208	302	13	3	1.5	126.5	0.37	1.80	2.69	1.76	37.7
	340	133	105	5	1.5	1 360	2 010	183		**430238U**	212	321	14	4	1.5	141.5	0.44	1.55	2.31	1.52	47

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

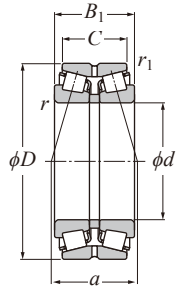
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 190-220 mm

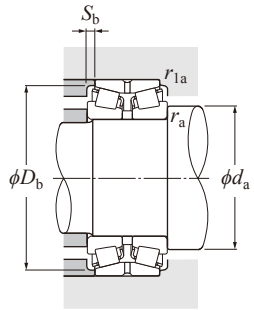
Boundary dimensions mm						Basic load rating kN dynamic	Basic load rating kN static	Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
190	340	133	105	5	1.5	1 570	2 010	183	*	**430238UUTG**	212	321	14	4	1.5	141.5	0.44	1.55	2.31	1.52	47
	340	204	160	5	1.5	2 190	3 700	335		**432238U**	212	325.5	22	4	1.5	173.5	0.44	1.55	2.31	1.52	75.6
	340	204	160	5	1.5	2 530	3 700	335	*	**432238UUTG**	212	325.5	22	4	1.5	173.5	0.44	1.55	2.31	1.52	75.6
200	310	82	73	3	1	585	940	87.0		**413040E1**	214	289.5	4.5	2.5	1	103	0.37	1.80	2.69	1.76	20.9
	310	82	73	3	1	680	940	87.0	*	**413040UTG**	214	289.5	4.5	2.5	1	103	0.37	1.80	2.69	1.76	20.9
	310	103	82	3	1	795	1 320	121		**423040E1**	214	293	10.5	2.5	1	112	0.37	1.80	2.69	1.76	26.6
	310	103	82	3	1	920	1 320	121	*	**423040UTG**	214	293	10.5	2.5	1	112	0.37	1.80	2.69	1.76	26.6
	310	151	123	2.5	1	1 140	2 080	191		**CRI-4020**	212	296	14	2	1	141	0.37	1.80	2.69	1.76	38.2
	330	180	140	4	1.5	1 480	2 610	238		**CRI-4030**	218	314	20	3	1.5	161.5	0.42	1.60	2.39	1.57	55.5
	340	112	100	4	1.5	1 070	1 660	150		**413140**	218	320	6	3	1.5	125.5	0.40	1.68	2.50	1.64	38.6
	340	112	100	4	1.5	1 240	1 660	150	*	**413140UTG**	218	320	6	3	1.5	125.5	0.40	1.68	2.50	1.64	38.6
	340	140	112	4	1.5	1 210	1 910	173		**423140**	218	319	14	3	1.5	134.5	0.37	1.80	2.69	1.76	47.3
	340	140	112	4	1.5	1 400	1 910	173	*	**423140UTG**	218	319	14	3	1.5	134.5	0.37	1.80	2.69	1.76	47.3
	360	142	110	5	1.5	1 500	2 210	198		**430240U**	222	338	16	4	1.5	154	0.44	1.55	2.31	1.52	55.8
	360	142	110	5	1.5	1 730	2 210	198	*	**430240UUTG**	222	338	16	4	1.5	154	0.44	1.55	2.31	1.52	55.8
	360	218	174	5	1.5	2 510	4 250	380		**432240U**	222	342.5	22	4	1.5	180	0.41	1.66	2.47	1.62	91.5
	360	218	174	5	1.5	2 900	4 250	380	*	**432240UUTG**	222	342.5	22	4	1.5	180	0.41	1.66	2.47	1.62	91.5
220	340	90	80	4	1.5	665	1 060	94.5		**413044E1**	238	320	5	3	1.5	111.5	0.37	1.80	2.69	1.76	27.1
	340	90	80	4	1.5	765	1 060	94.5	*	**413044UTG**	238	320	5	3	1.5	111.5	0.37	1.80	2.69	1.76	27.1
	340	113	90	4	1.5	975	1 650	148		**423044E1**	238	321	11.5	3	1.5	124.5	0.37	1.80	2.69	1.76	33
	340	113	90	4	1.5	1 130	1 650	148	*	**423044UTG**	238	321	11.5	3	1.5	124.5	0.37	1.80	2.69	1.76	33
	370	120	107	5	1.5	1 230	1 920	169		**413144**	242	349	6.5	4	1.5	135	0.40	1.68	2.50	1.64	47.8
	370	120	107	5	1.5	1 420	1 920	169	*	**413144UTG**	242	349	6.5	4	1.5	135	0.40	1.68	2.50	1.64	47.8
	370	150	120	5	1.5	1 350	2 260	199		**423144**	242	344	15	4	1.5	154	0.40	1.68	2.50	1.64	58.1
	370	150	120	5	1.5	1 570	2 260	199	*	**423144UTG**	242	344	15	4	1.5	154	0.40	1.68	2.50	1.64	58.1
	370	150	120	5	1.5	1 600	2 550	225		**CRI-4416**	242	346.5	15	4	1.5	142	0.35	1.95	2.90	1.91	59

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

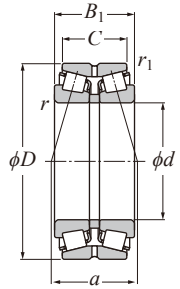
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 220-260 mm

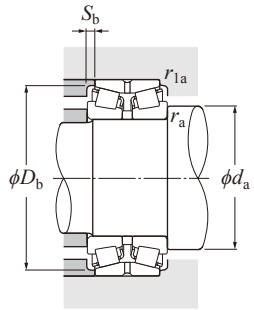
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
220	400	158	122	4	1.5	1 550	2 440	212		**430244**	238	368	18	3	1.5	178.5	0.49	1.38	2.06	1.35	77
	400	158	122	4	1.5	1 790	2 440	212	*	**430244UTG**	238	368	18	3	1.5	178.5	0.49	1.38	2.06	1.35	77
230	380	175	115	4	2	1 710	2 890	253		**CRI-4612**	248	359	30	3	2	154.5	0.40	1.68	2.50	1.64	67
	380	200	160	4	2	1 930	3 700	320		**CRI-4606**	248	355	20	3	2	164	0.33	2.03	3.02	1.98	84.4
235	330	115	85	5	1.5	830	1 700	152		**CRI-4701**	257	312.5	15	4	1.5	129.5	0.41	1.66	2.47	1.62	27.3
240	360	92	82	4	1.5	725	1 160	101		**413048E1**	258	341	5	3	1.5	117.5	0.37	1.80	2.69	1.76	29.1
	360	92	82	4	1.5	840	1 160	101	*	**413048UTG**	258	341	5	3	1.5	117.5	0.37	1.80	2.69	1.76	29.1
	360	115	92	4	1.5	1 010	1 770	155		**423048E1**	258	340.5	11.5	3	1.5	130.5	0.37	1.80	2.69	1.76	36.3
	360	115	92	4	1.5	1 170	1 770	155	*	**423048UTG**	258	340.5	11.5	3	1.5	130.5	0.37	1.80	2.69	1.76	36.3
	360	170	142	3	1	1 510	2 810	246		**CRI-4805**	254	347	14	2.5	1	161	0.37	1.80	2.69	1.76	53.8
	400	128	114	5	1.5	1 370	2 130	183		**413148**	262	378	7	4	1.5	144.5	0.40	1.68	2.50	1.64	58.5
	400	128	114	5	1.5	1 580	2 130	183	*	**413148UTG**	262	378	7	4	1.5	144.5	0.40	1.68	2.50	1.64	58.5
	400	160	128	5	1.5	1 550	2 600	223		**423148**	262	376	16	4	1.5	164	0.40	1.68	2.50	1.64	71.4
	400	160	128	5	1.5	1 790	2 600	223	*	**423148UTG**	262	376	16	4	1.5	164	0.40	1.68	2.50	1.64	71.4
	440	165	127	4	1.5	1 860	2 960	250		**430248**	258	406	19	3	1.5	189	0.49	1.38	2.06	1.35	100
	440	165	127	4	1.5	2 150	2 960	250	*	**430248UTG**	258	406	19	3	1.5	189	0.49	1.38	2.06	1.35	100
	440	266	212	4	1.5	3 250	5 500	465		**432248**	258	421.5	27	3	1.5	226	0.43	1.57	2.34	1.53	160
	440	266	212	4	1.5	3 750	5 500	465	*	**432248UTG**	258	421.5	27	3	1.5	226	0.43	1.57	2.34	1.53	160
260	400	104	92	5	1.5	930	1 540	131		**413052**	282	375	6	4	1.5	130.5	0.37	1.80	2.69	1.76	43.4
	400	104	92	5	1.5	1 070	1 540	131	*	**413052UTG**	282	375	6	4	1.5	130.5	0.37	1.80	2.69	1.76	43.4
	400	130	104	5	1.5	1 270	2 190	187		**423052**	282	377	13	4	1.5	143	0.37	1.80	2.69	1.76	53
	400	130	104	5	1.5	1 470	2 190	187	*	**423052UTG**	282	377	13	4	1.5	143	0.37	1.80	2.69	1.76	53
	440	144	128	5	1.5	1 660	2 630	220		**413152**	282	415	8	4	1.5	161	0.40	1.68	2.50	1.64	82
	440	144	128	5	1.5	1 920	2 630	220	*	**413152UTG**	282	415	8	4	1.5	161	0.40	1.68	2.50	1.64	82
	440	172	145	4	2	2 180	3 750	313		**CRI-5224**	278	416.5	13.5	3	1.5	175	0.40	1.68	2.50	1.64	99
	440	180	144	5	1.5	2 180	3 750	310		**423152**	282	416	18	4	1.5	176.5	0.40	1.68	2.50	1.64	100

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

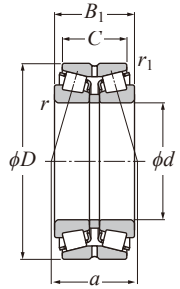
For values of e, Y_1, Y_2 and Y_0 see the table below.

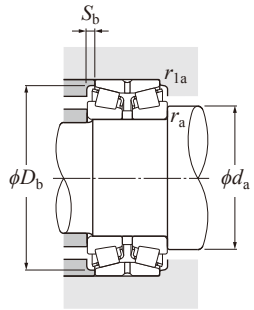
d 260-320 mm

Boundary dimensions mm						Basic load rating kN dynamic	Basic load rating kN static	Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
260	440	180	144	5	1.5	2 510	3 750	310	*	**423152UTG**	282	416	18	4	1.5	176.5	0.40	1.68	2.50	1.64	100
	400	150	120	5	1.5	1 530	3 150	266		**CRI-5615**	302	383	15	4	1.5	161	0.39	1.70	2.59	1.70	53.8
	420	106	94	5	1.5	990	1 630	137		**413056**	302	396.5	6	4	1.5	136.5	0.37	1.80	2.69	1.76	46
	420	106	94	5	1.5	1 140	1 630	137	*	**413056UTG**	302	396.5	6	4	1.5	136.5	0.37	1.80	2.69	1.76	46
	420	133	106	5	1.5	1 340	2 340	196		**423056**	302	399.5	13.5	4	1.5	148.5	0.37	1.80	2.69	1.76	56.8
280	420	133	106	5	1.5	1 540	2 340	196	*	**423056UTG**	302	399.5	13.5	4	1.5	148.5	0.37	1.80	2.69	1.76	56.8
	460	146	130	6	2	1 820	2 900	239		**413156**	308	438	8	5	2	168	0.40	1.68	2.50	1.64	85.5
	460	146	130	6	2	2 100	2 900	239	*	**413156UTG**	308	438	8	5	2	168	0.40	1.68	2.50	1.64	85.5
	460	183	146	6	2	2 150	3 650	300		**423156**	308	435.5	18.5	5	2	182.5	0.40	1.68	2.50	1.64	110
	460	183	146	6	2	2 480	3 650	300	*	**423156UTG**	308	435.5	18.5	5	2	182.5	0.40	1.68	2.50	1.64	110
290	430	150	135	4	1.5	1 500	3 200	265		**CRI-5810**	308	407	7.5	3	1.5	162	0.39	1.74	2.59	1.70	72.7
	460	118	105	5	1.5	1 190	1 990	163		**413060**	322	431	6.5	4	1.5	151	0.37	1.80	2.69	1.76	65.6
	460	118	105	5	1.5	1 370	1 990	163	*	**413060UTG**	322	431	6.5	4	1.5	151	0.37	1.80	2.69	1.76	65.6
	460	148	118	5	1.5	1 790	3 150	257		**423060**	322	436.5	15	4	1.5	163	0.37	1.80	2.69	1.76	77.8
	460	148	118	5	1.5	2 070	3 150	257	*	**423060UTG**	322	436.5	15	4	1.5	163	0.37	1.80	2.69	1.76	77.8
300	500	160	142	6	2	2 230	3 600	290		**413160**	328	475	9	5	2	182	0.40	1.68	2.50	1.64	110
	500	160	142	6	2	2 580	3 600	290	*	**413160UTG**	328	475	9	5	2	182	0.40	1.68	2.50	1.64	110
	500	200	160	6	2	2 330	4 050	325		**423160**	328	467	20	5	2	201.5	0.40	1.68	2.50	1.64	140
	500	200	160	6	2	2 690	4 050	325	*	**423160UTG**	328	467	20	5	2	201.5	0.40	1.68	2.50	1.64	140
	540	208	158	5	2.5	2 710	4 450	350		**CRI-6010**	322	498	25	4	2	238	0.49	1.38	2.06	1.35	184
320	480	121	108	5	1.5	1 320	2 250	181		**413064**	342	452	6.5	4	1.5	156.5	0.37	1.80	2.69	1.76	69.2
	480	121	108	5	1.5	1 520	2 250	181	*	**413064UTG**	342	452	6.5	4	1.5	156.5	0.37	1.80	2.69	1.76	69.2
	480	151	121	5	1.5	1 760	3 100	247		**423064**	342	457.5	15	4	1.5	170	0.37	1.80	2.69	1.76	82
	480	151	121	5	1.5	2 030	3 100	247	*	**423064UTG**	342	457.5	15	4	1.5	170	0.37	1.80	2.69	1.76	82
	540	176	157	6	2	2 480	4 100	320		**413164**	348	509	9.5	5	2	197.5	0.40	1.68	2.50	1.64	150
	540	176	157	6	2	2 870	4 100	320	*	**413164UTG**	348	509	9.5	5	2	197.5	0.40	1.68	2.50	1.64	150

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

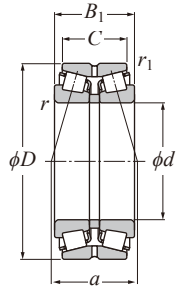
d 320-380 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
	540	220	176	6	2	2 770	4 900	385		**423164**	348	504.5	22	5	2	216.5	0.40	1.68	2.50	1.64	190
320	540	220	176	6	2	3 200	4 900	385	*	**423164UTG**	348	504.5	22	5	2	216.5	0.40	1.68	2.50	1.64	190
	550	240	180	5	2.5	3 700	6 500	345	☆	**CRI-6410**	342	514	30	4	2	233	0.40	1.68	2.50	1.64	223
	520	133	118	6	2	1 640	2 870	226		**413068**	368	491	7.5	5	2	169.5	0.37	1.80	2.69	1.76	93.1
	520	133	118	6	2	1 890	2 870	226	*	**413068UTG**	368	491	7.5	5	2	169.5	0.37	1.80	2.69	1.76	93.1
	520	165	133	6	2	2 090	3 750	295		**423068**	368	492	16	5	2	184	0.37	1.80	2.69	1.76	110
	520	165	133	6	2	2 420	3 750	295	*	**423068UTG**	368	492	16	5	2	184	0.37	1.80	2.69	1.76	110
340	580	190	169	6	2	2 980	4 900	380		**413168**	368	548	10.5	5	2	213	0.40	1.68	2.50	1.64	190
	580	190	169	6	2	3 450	4 900	380	*	**413168UTG**	368	548	10.5	5	2	213	0.40	1.68	2.50	1.64	190
	580	238	190	6	2	3 750	6 500	500		**423168**	368	546	24	5	2	237	0.40	1.68	2.50	1.64	240
	580	238	190	6	2	4 300	6 500	500	*	**423168UTG**	368	546	24	5	2	237	0.40	1.68	2.50	1.64	240
	540	134	120	6	2	1 630	2 810	218		**413072**	388	510	7	5	2	176	0.37	1.80	2.69	1.76	98.2
	540	134	120	6	2	1 880	2 810	218	*	**413072UTG**	388	510	7	5	2	176	0.37	1.80	2.69	1.76	98.2
	540	169	134	6	2	2 270	4 200	325		**423072**	388	512	17.5	5	2	192	0.37	1.80	2.69	1.76	120
	540	169	134	6	2	2 630	4 200	325	*	**423072UTG**	388	512	17.5	5	2	192	0.37	1.80	2.69	1.76	120
360	600	192	171	6	2	3 000	5 050	385		**413172**	388	565	10.5	5	2	218.5	0.40	1.68	2.50	1.64	200
	600	192	171	6	2	3 500	5 050	385	*	**413172UTG**	388	565	10.5	5	2	218.5	0.40	1.68	2.50	1.64	200
	600	240	192	6	2	3 550	6 500	495		**423172**	388	563.5	24	5	2	239.5	0.40	1.68	2.50	1.64	250
	600	240	192	6	2	4 100	6 500	495	*	**423172UTG**	388	563.5	24	5	2	239.5	0.40	1.68	2.50	1.64	250
	560	135	122	6	2	1 880	3 350	255		**413076**	408	532	6.5	5	2	183	0.37	1.80	2.69	1.76	100
	560	135	122	6	2	2 170	3 350	255	*	**413076UTG**	408	532	6.5	5	2	183	0.37	1.80	2.69	1.76	100
	560	171	135	6	2	2 310	4 350	335		**423076**	408	532	18	5	2	196.5	0.37	1.80	2.69	1.76	130
380	560	171	135	6	2	2 670	4 350	335	*	**423076UTG**	408	532	18	5	2	196.5	0.37	1.80	2.69	1.76	130
	620	194	173	6	2	3 150	5 250	395		**413176**	408	587	10.5	5	2	224.5	0.40	1.68	2.50	1.64	210
	620	194	173	6	2	3 650	5 250	395	*	**413176UTG**	408	587	10.5	5	2	224.5	0.40	1.68	2.50	1.64	210
	620	241	170	5	2	4 100	7 400	555		**CRI-7614**	402	582	35.5	4	2	263	0.46	1.47	2.19	1.44	252

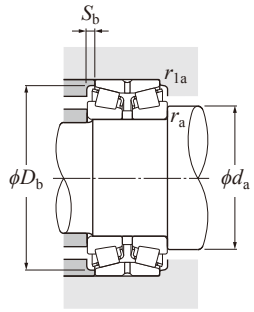
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Double Row Back-to-Back Tapered Roller Bearings NTN

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

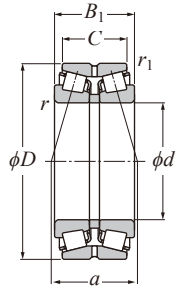
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 380-440 mm

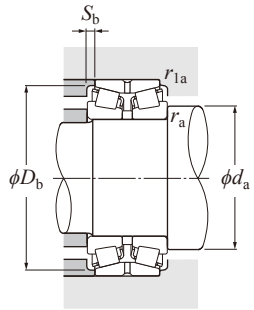
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN		Bearing number [2) 3)]	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
380	620	243	194	6	2	3 700	6 700	505		**423176**	408	582	24.5	5	2	249	0.40	1.68	2.50	1.64	260
	620	243	194	6	2	4 250	6 700	505	*	**423176UTG**	408	582	24.5	5	2	249	0.40	1.68	2.50	1.64	260
390	600	185	130	4	2	2 970	5 550	415		☆**CRI-7803**	408	564	27.5	3	2	216.5	0.40	1.70	2.53	1.66	175
400	600	148	132	6	2	2 070	3 700	276		**413080**	428	567	8	5	2	194	0.37	1.80	2.69	1.76	130
	600	148	132	6	2	2 390	3 700	276	*	**413080UTG**	428	567	8	5	2	194	0.37	1.80	2.69	1.76	130
	600	185	148	6	2	2 800	5 450	410		**423080**	428	567	18.5	5	2	210	0.37	1.80	2.69	1.76	170
	600	185	148	6	2	3 250	5 450	410	*	**423080UTG**	428	567	18.5	5	2	210	0.37	1.80	2.69	1.76	170
	650	200	178	6	3	3 350	5 800	430		**413180**	428	614	11	5	2.5	232	0.40	1.68	2.50	1.64	240
	650	200	178	6	3	3 850	5 800	430	*	**413180UTG**	428	614	11	5	2.5	232	0.40	1.68	2.50	1.64	240
	650	250	200	6	3	4 150	7 850	580		**423180**	428	613.5	25	5	2.5	256.5	0.40	1.68	2.50	1.64	290
	650	250	200	6	3	4 800	7 850	580	*	**423180UTG**	428	613.5	25	5	2.5	256.5	0.40	1.68	2.50	1.64	290
420	620	150	134	6	2	2 340	4 250	315		**413084**	448	589	8	5	2	199.5	0.37	1.80	2.69	1.76	140
	620	150	134	6	2	2 710	4 250	315	*	**413084UTG**	448	589	8	5	2	199.5	0.37	1.80	2.69	1.76	140
	620	188	150	6	2	2 940	5 900	435		**423084**	448	586	19	5	2	220	0.37	1.80	2.69	1.76	180
	620	188	150	6	2	3 400	5 900	435	*	**423084UTG**	448	586	19	5	2	220	0.37	1.80	2.69	1.76	180
	700	224	200	6	3	4 100	7 200	525		**413184**	448	658.5	12	5	2.5	258	0.40	1.68	2.50	1.64	320
	700	224	200	6	3	4 750	7 200	525	*	**413184UTG**	448	658.5	12	5	2.5	258	0.40	1.68	2.50	1.64	320
	700	280	224	6	3	5 350	9 700	705		**423184**	448	663	28	5	2.5	287	0.40	1.68	2.50	1.64	380
	700	280	224	6	3	6 150	9 700	705	*	**423184UTG**	448	663	28	5	2.5	287	0.40	1.68	2.50	1.64	380
440	650	157	140	6	3	2 740	5 150	375		**413088**	468	618	8.5	5	2.5	208	0.37	1.80	2.69	1.76	160
	650	157	140	6	3	3 150	5 150	375	*	**413088UTG**	468	618	8.5	5	2.5	208	0.37	1.80	2.69	1.76	160
	650	196	157	6	3	2 890	5 450	400		**423088**	468	617.5	19.5	5	2.5	229.5	0.37	1.80	2.69	1.76	190
	650	196	157	6	3	3 350	5 450	400	*	**423088UTG**	468	617.5	19.5	5	2.5	229.5	0.37	1.80	2.69	1.76	190
	720	226	201	6	3	4 450	7 800	560		**413188**	468	675	12.5	5	2.5	263	0.40	1.68	2.50	1.64	330
	720	226	201	6	3	5 150	7 800	560	*	**413188UTG**	468	675	12.5	5	2.5	263	0.40	1.68	2.50	1.64	330
	720	283	226	6	3	5 550	10 300	740		**423188**	468	681.5	28.5	5	2.5	288.5	0.40	1.68	2.50	1.64	460

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

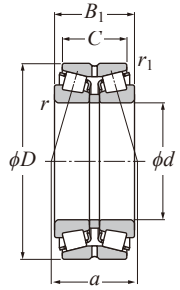
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 440-560 mm

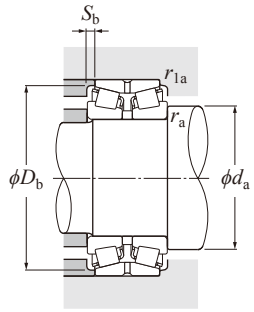
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN		Bearing number [2) 3)]	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)		d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
440	720	283	226	6	3	6 400	10 300	740	*	**423188UTG**	468	681.5	28.5	5	2.5	288.5	0.40	1.68	2.50	1.64	460
460	680	163	145	6	3	2 880	5 350	390		**413092**	488	650	9	5	2.5	217.5	0.37	1.80	2.69	1.76	180
	680	163	145	6	3	3 350	5 350	390	*	**413092UTG**	488	650	9	5	2.5	217.5	0.37	1.80	2.69	1.76	180
	680	204	163	6	3	3 450	6 750	485		**423092**	488	647.5	20.5	5	2.5	239.5	0.37	1.80	2.69	1.76	230
	680	204	163	6	3	3 950	6 750	485	*	**423092UTG**	488	647.5	20.5	5	2.5	239.5	0.37	1.80	2.69	1.76	230
	760	300	240	7.5	4	5 450	10 300	725		**423192**	496	715.5	30	6	3	305	0.40	1.68	2.50	1.64	480
	760	300	240	7.5	4	6 300	10 300	725	*	**423192UTG**	496	715.5	30	6	3	305	0.40	1.68	2.50	1.64	480
480	700	165	147	6	3	2 760	5 000	360		**413096**	508	669	9	5	2.5	222.5	0.37	1.80	2.69	1.76	190
	700	165	147	6	3	3 200	5 000	360	*	**413096UTG**	508	669	9	5	2.5	222.5	0.37	1.80	2.69	1.76	190
	700	206	165	6	3	3 400	6 700	480		**423096**	508	667.5	20.5	5	2.5	245.5	0.37	1.80	2.69	1.76	240
	700	206	165	6	3	3 900	6 700	480	*	**423096UTG**	508	667.5	20.5	5	2.5	245.5	0.37	1.80	2.69	1.76	240
	790	310	248	7.5	4	5 850	11 100	775		**423196**	516	761.5	31	6	3	328.5	0.40	1.68	2.50	1.64	540
	790	310	248	7.5	4	6 750	11 100	775	*	**423196UTG**	516	761.5	31	6	3	328.5	0.40	1.68	2.50	1.64	540
500	720	167	149	6	3	2 900	5 400	380		**4130/500**	528	690	9	5	2.5	230	0.37	1.80	2.69	1.76	200
	720	167	149	6	3	3 350	5 400	380	*	**4130/500UTG**	528	690	9	5	2.5	230	0.37	1.80	2.69	1.76	200
	720	209	167	6	3	3 400	6 900	485		**4230/500**	528	687	21	5	2.5	249.5	0.37	1.80	2.69	1.76	250
	720	209	167	6	3	3 950	6 900	485	*	**4230/500UTG**	528	687	21	5	2.5	249.5	0.37	1.80	2.69	1.76	250
	830	264	235	7.5	4	5 800	10 500	725		**4131/500**	536	784	14.5	6	3	296	0.40	1.68	2.50	1.64	530
	830	264	235	7.5	4	6 700	10 500	725	*	**4131/500UTG**	536	784	14.5	6	3	296	0.40	1.68	2.50	1.64	530
	830	330	264	7.5	4	7 100	14 000	965	☆	**4231/500G2**	536	777	33	6	3	331	0.40	1.68	2.50	1.64	677
530	780	185	163	6	3	3 250	5 900	410		**4130/530**	558	740	11	5	2.5	249.5	0.37	1.80	2.69	1.76	270
	780	185	163	6	3	3 750	5 900	410	*	**4130/530UTG**	558	740	11	5	2.5	249.5	0.37	1.80	2.69	1.76	270
	780	231	185	6	3	4 500	9 050	625		**4230/530**	558	738.5	23	5	2.5	276	0.37	1.80	2.69	1.76	331
	870	272	239	7.5	4	6 650	12 200	815	☆	**4131/530G2**	566	820	16.5	6	3	303	0.38	1.77	2.64	1.73	620
	870	340	272	7.5	4	8 600	16 700	1 130	☆	**4231/530AG2**	566	822.5	34	6	3	340	0.39	1.74	2.59	1.70	770
560	735	225	180	6.4	1.5	3 500	8 800	610		**CRI-11206**	588	709	22.5	5	1.5	257	0.35	1.95	2.90	1.91	232

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Metric series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

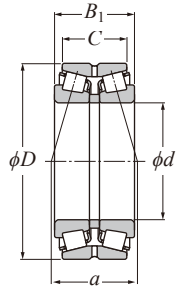
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 560-710 mm

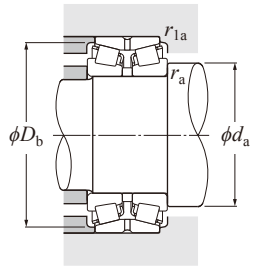
Boundary dimensions mm						Basic load rating kN dynamic		Fatigue load limit kN	Bearing number 2) 3)	Installation-related dimensions mm					Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3)	d_a Min.	D_a Min.	S_b Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
	740	190	140	6.4	1.5	2 620	6 250	430	**CRI-11211**	588	705.5	25	5	1.5	231	0.34	1.98	2.94	1.93	198
560	920	280	246	7.5	4	6 350	12 100	805	**4131/560**	596	865	17	6	3	326	0.40	1.68	2.50	1.64	1 310
	920	350	280	7.5	4	8 450	17 400	1 160	☆**4231/560G2**	596	865	35	6	3	362	0.40	1.68	2.50	1.64	894
590	780	255	178	5	2.5	4 350	10 500	715	**CRI-11801**	612	754	38.5	4	2	288	0.39	1.74	2.59	1.70	291
	870	200	176	6	3	4 350	8 550	570	**4130/600**	628	828	12	5	2.5	277	0.37	1.80	2.69	1.76	350
600	870	200	176	6	3	5 000	8 550	570	* **4130/600UTG**	628	828	12	5	2.5	277	0.37	1.80	2.69	1.76	350
	980	300	264	7.5	4	8 200	15 400	1 000	☆**4131/600G2**	636	925	18	6	3	350	0.40	1.68	2.50	1.64	858
	980	388	300	7.5	4	9 500	18 400	1 200	☆**4231/600G2**	636	923	44	6	3	380	0.38	1.77	2.64	1.73	1 050
	880	185	130	4	2	3 900	9 100	600	☆**CRI-13401**	688	845.5	27.5	3	2	317	0.45	1.51	2.25	1.48	277
670	1 090	336	295	7.5	4	10 300	19 700	1 240	☆**4131/670G2**	706	1 033	20.5	6	3	397	0.40	1.68	2.50	1.64	1 180
	1 090	392	336	7.5	4	11 700	24 800	1 570	☆**4231/670G2**	706	1 021	28	6	3	397	0.37	1.80	2.69	1.76	1 410
710	1 030	236	208	7.5	4	6 550	13 900	885	☆**4130/710G2**	746	974	14	6	3	327	0.37	1.80	2.69	1.76	640
	1 030	236	208	7.5	4	6 400	14 000	890	☆**CRI-14207**	746	974	14	6	3	324	0.36	1.87	2.79	1.83	654

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "*" designate ULTAGE ™ series.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

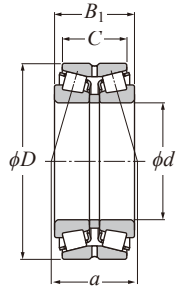
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 139.700-200.025 mm

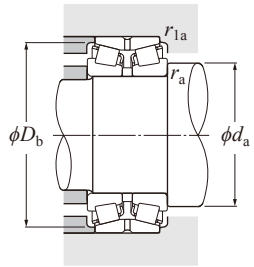
Boundary dimensions mm				Basic load rating kN dynamic	static	Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	C_r	C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
139.700	307.975	200.025	155.575	1 930	2 780	**T-E-HH234031/HH234011D+A**	180	285	9.7	2.3	149.5	0.33	2.07	3.08	2.02	65.9
	268.288	160.338	125.412	1 250	2 110	**T-E-EE107060/107105CD+A**	181	249.4	6.4	1.5	130.4	0.39	1.74	2.59	1.70	35.9
152.400	307.975	200.025	146.050	1 670	2 620	**T-E-EE450601/451215D+A**	189	274.8	9.7	2.3	143.5	0.33	2.07	3.08	2.02	62.6
	307.975	200.025	155.575	1 930	2 780	**T-E-HH234048/HM234011D+A**	191	285	9.7	2.3	149.5	0.33	2.07	3.08	2.02	62.6
160.325	288.925	142.875	111.125	1 290	2 140	**T-E-HM237532/HM237510D+A**	192	274.8	7	1.5	119.5	0.32	2.12	3.15	2.07	36.1
165.100	288.925	142.875	111.125	1 040	1 900	**T-E-94649/94114D+A**	197	272	7	1.5	141	0.47	1.44	2.15	1.41	35.1
	288.925	142.875	111.125	1 290	2 140	**T-E-HM237535/HM237510D+A**	195	274.8	7	1.5	119.5	0.32	2.12	3.15	2.07	35.1
171.450	288.925	142.875	111.125	1 040	1 900	**T-E-94675/94114D+A**	202	272	7	1.5	141	0.47	1.44	2.15	1.41	36
174.625	288.925	142.875	111.125	1 040	1 900	**T-E-94687/94114D+A**	204	272	7	1.5	141	0.47	1.44	2.15	1.41	33.1
	288.925	142.875	111.125	1 290	2 140	**T-E-HM237542/HM237510D+A**	202	274.8	7	1.5	119.5	0.32	2.12	3.15	2.07	33.1
177.800	269.875	119.062	93.662	870	1 750	**T-E-M238840/M238810D+A**	198	256	3.5	1.5	107	0.33	2.03	3.02	1.98	23.2
	288.925	142.875	111.125	1 040	1 900	**T-E-94700/94114D+A**	207	272	7	1.5	141	0.47	1.44	2.15	1.41	32.4
	288.925	142.875	111.125	1 290	2 140	**T-E-HM237545/HM237510D+A**	205	274.8	7	1.5	119.5	0.32	2.12	3.15	2.07	32.4
	320.675	185.738	138.112	1 440	2 480	**E-EE222070/222127D+A**	204	298	3.5	1.5	152.5	0.40	1.68	2.50	1.64	57.8
	320.675	185.738	138.112	1 760	2 790	**T-E-H239640/H239612D+A**	202	301	3.5	1.5	141	0.32	2.12	3.15	2.07	57.8
179.975	317.500	146.050	111.125	1 170	2 310	**T-E-93708/93127D+A**	209	298.5	3.5	1.5	162	0.52	1.29	1.92	1.26	47.3
187.325	269.875	119.062	93.662	870	1 750	**T-E-M238849/M238810CD+A**	205	256	3.5	1.5	107	0.33	2.03	3.02	1.98	20.7
	282.575	107.950	79.375	695	1 230	**T-E-87737/87112D+A**	207	267	3.5	1.5	115.5	0.42	1.62	2.42	1.59	21.1
	320.675	185.738	138.112	1 760	2 790	**T-E-H239649/H239612D+A**	214	301	5.5	1.5	141	0.32	2.12	3.15	2.07	55
190.500	282.575	107.950	79.375	695	1 230	**T-E-87750/87112D+A**	209	267	3.5	1.5	115.5	0.42	1.62	2.42	1.59	20.6
	317.500	146.050	111.125	1 170	2 310	**T-E-93750/93127D+A**	218	300	4.3	1.5	162	0.52	1.29	1.92	1.26	41.2
	368.300	193.675	136.525	1 850	3 200	**T-E-EE420751/421451D+A**	227	334.4	6.4	1.5	163	0.40	1.68	2.50	1.64	84.1
193.675	282.575	107.950	79.375	695	1 230	**T-E-87762/87112D+A**	211	267	3.5	1.5	115.5	0.42	1.62	2.42	1.59	20
196.850	317.500	146.050	111.125	1 170	2 310	**T-E-93775/93127D+A**	223	298.5	4.3	1.5	161.9	0.52	1.29	1.92	1.26	41.5
200.025	292.100	125.415	101.600	1 010	2 070	**T-E-M241543/M241510D+A**	219	279	3.5	1.5	116	0.33	2.03	3.02	1.98	24.8
	317.500	146.050	111.125	1 170	2 310	**T-E-93787/93727D+A**	225	298.5	4.3	1.5	162	0.52	1.29	1.92	1.26	38.8

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

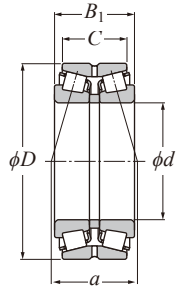
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 200.025-228.600 mm

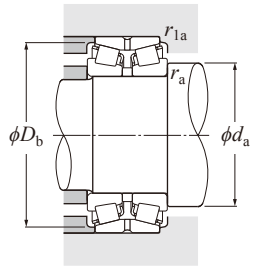
Boundary dimensions mm				Basic load rating kN dynamic	static	Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	C_r	C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
200.025	384.175	238.125	193.675	2 770	5 450	**T-E-H247535/H247510D+A**	241	362.1	6.4	1.5	182	0.33	2.03	3.02	1.98	112
203.200	276.225	90.485	73.025	650	1 380	**E-LM241149/LM241110D+A**	220	267	3.5	0.8	95	0.32	2.12	3.15	2.07	13.8
	282.575	101.600	82.550	685	1 570	**T-E-67983/67920D+A**	222	275	3.5	0.8	133.5	0.51	1.33	1.97	1.30	17.1
	292.100	125.415	101.600	1 010	2 070	**T-E-M241547/M241510D+A**	221	279	3.5	1.5	116	0.33	2.03	3.02	1.98	24.1
	317.500	146.050	111.125	1 170	2 310	**T-E-93800/93127D+A**	227	298.5	4.3	1.5	162	0.52	1.29	1.92	1.26	37.1
	368.300	193.675	136.525	1 850	3 200	**T-E-EE420801/421451D+A**	230.1	334.4	3.3	1.5	163	0.40	1.68	2.50	1.64	79.9
	406.400	196.850	127.000	1 830	2 950	**E-EE114080/114161D+A**	246	373.7	6.4	3.3	252.5	0.80	0.85	1.26	0.83	107
204.788	292.100	125.415	101.600	1 010	2 070	**T-E-M241549/M241510D+A**	223	279	3.5	1.5	116	0.33	2.03	3.02	1.98	23.8
206.375	282.575	101.600	82.550	685	1 570	**T-E-67985/67920D+A**	224	275	3.5	0.8	133.5	0.51	1.33	1.97	1.30	16.5
	336.550	211.138	169.862	2 110	4 050	**T-E-H242649/H242610D+A**	231	318	3.3	1.5	160	0.33	2.03	3.02	1.98	65.2
209.550	282.575	101.600	82.550	685	1 570	**T-E-67989/67920D+A**	227	275	3.5	0.8	133.5	0.51	1.33	1.97	1.30	16
	317.500	146.050	111.125	1 170	2 310	**T-E-93825/93127D+A**	233	298.5	4.3	1.5	161	0.52	1.29	1.92	1.26	36.3
	333.375	149.225	114.300	1 240	2 220	**E-HM743345/HM743310D+A**	238	317	6.4	1.5	149.7	0.44	1.54	2.29	1.50	44.7
	355.600	152.400	111.125	1 220	2 540	**T-E-96825/96140D+A**	246	334	7	1.5	186.1	0.59	1.14	1.70	1.12	59.7
212.725	285.750	98.425	76.200	720	1 640	**T-E-LM742745/LM742710D+A**	230	279	3.5	0.8	126.5	0.48	1.40	2.09	1.37	15.7
215.900	285.750	98.425	76.200	720	1 640	**T-E-LM742749/LM742710D+A**	233	279	3.5	0.8	126.5	0.48	1.40	2.09	1.37	15.1
	287.338	69.850	50.800	395	810	**E-543085/543115D+A**	232	276	3.5	0.8	94.5	0.38	1.77	2.64	1.73	11
	406.400	195.262	147.638	2 050	3 850	**E-EE820085/820161D+A**	251	372.1	6.4	1.5	177.2	0.42	1.62	2.42	1.59	108
219.969	287.338	69.850	50.800	395	810	**E-543086/543115D+A**	235	276	3.5	0.8	96.4	0.38	1.77	2.64	1.73	10.5
220.662	314.325	131.762	106.362	1 190	2 450	**T-E-M244249/M244210D+A**	245	300	6.4	1.5	122.5	0.33	2.03	3.02	1.98	28.9
228.397	431.800	196.850	111.125	1 630	2 480	**E-EE113089/113171D+A**	274	397.2	6.4	3.3	277.5	0.88	0.77	1.14	0.75	104
228.460	431.800	196.850	111.125	1 630	2 480	**E-EE113091/113171D+A**	274	397.2	6.4	3.3	277.5	0.88	0.77	1.14	0.75	116
228.600	327.025	114.300	82.550	905	1 900	**T-E-8573/8520D+A**	255	312	6.4	1.5	129.5	0.41	1.66	2.47	1.62	27.3
	355.600	152.400	111.125	1 220	2 540	**T-E-96900/96140D+A**	260	334	7	1.5	185	0.59	1.14	1.70	1.12	49.4
	355.600	152.400	111.125	1 360	2 510	**T-E-EE130902/131401D+A**	257	330	6.8	1.5	132.5	0.33	2.04	3.04	2.00	49.4
	355.600	152.400	114.300	1 370	2 490	**E-HM746646/HM746610D+A**	258	338.7	6.4	1.5	164	0.47	1.43	2.12	1.40	49.4

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

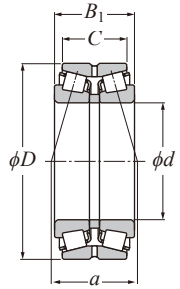
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 228.600-254.000 mm

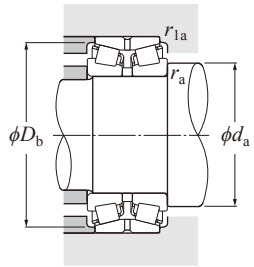
Boundary dimensions mm				Basic load rating dynamic kN	static kN	Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	C_r	C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
	358.775	152.400	117.475	1 550	3 300	**T-E-M249732/M249710D+A**	256	343	3.5	1.5	138.5	0.33	2.03	3.02	1.98	50.9
228.600	400.050	187.325	136.525	1 800	3 250	**E-EE430900/431576D+A**	271	364.2	10.5	1.5	181.5	0.44	1.54	2.29	1.50	88.3
	488.950	254.000	152.400	2 990	4 550	☆ **T-E-HH949549/HH949510DG2+A**	297	456	6.4	1.5	333.5	0.94	0.72	1.07	0.70	207
231.775	358.775	152.400	117.475	1 550	3 300	**T-E-M249734/M249710D+A**	263	343	6.4	1.5	138.5	0.33	2.03	3.02	1.98	50
	311.150	98.425	73.025	740	1 590	**T-E-LM446349/LM446310D+A**	252	301	3.5	0.8	111.5	0.36	1.86	2.77	1.82	17.9
234.950	327.025	114.300	82.550	905	1 900	**T-E-8575/8520D+A**	259	313	6.4	1.5	129.5	0.41	1.66	2.47	1.62	25.9
	355.600	152.400	111.125	1 220	2 540	**T-E-96925/96140D+A**	265	334	7	1.5	185	0.59	1.14	1.70	1.12	47.5
	384.175	238.125	193.675	2 770	5 450	**T-E-H247549/H247510D+A**	273	362.1	6.4	1.5	181.5	0.33	2.03	3.02	1.98	96.2
237.330	358.775	152.400	117.475	1 550	3 300	**T-E-M249736/M249710D+A**	267	343	6.4	1.5	138.5	0.33	2.03	3.02	1.98	48.2
	327.025	114.300	82.550	905	1 900	**T-E-8578/8520D+A**	264	312	6.4	1.5	129.5	0.41	1.66	2.47	1.62	24.3
	349.148	127.000	101.600	1 040	2 010	**E-EE127095/127136D+A**	267	329	6.4	1.5	133	0.35	1.91	2.85	1.87	35.4
	368.300	120.650	85.725	875	1 630	**E-EE170950/171450D+A**	269	337	6.4	1.5	132.5	0.36	1.85	2.76	1.81	40.8
241.300	393.700	157.162	109.538	1 480	2 800	**T-E-EE275095/275156D+A**	278	378.1	6.4	1.5	162	0.40	1.68	2.50	1.64	66.5
	406.400	215.900	184.150	2 730	4 750	**T-E-H249148/H249111D+A**	273	385	6.4	1.5	177.5	0.33	2.03	3.02	1.98	101
	444.500	209.550	158.750	2 640	4 250	☆ **T-E-EE923095/923176DG2+A**	277	407	6.4	1.5	170.5	0.34	2.00	2.98	1.96	128
	488.950	254.000	196.850	3 350	5 950	**E-EE295950/295192D+A**	285	450.5	6.4	1.5	196.5	0.31	2.16	3.22	2.12	212
244.475	381.000	171.450	127.000	1 440	2 880	**E-EE126097/126151D+A**	275	358	6.4	1.5	186.5	0.52	1.31	1.95	1.28	64
	368.300	120.650	85.725	875	1 630	**E-EE170975/171451D+A**	274	337	6.4	1.5	132.5	0.36	1.85	2.76	1.81	39.2
247.650	381.000	158.750	123.825	1 680	3 600	**T-E-M252337/M252310CD+A**	280	364	6.4	1.5	146.5	0.33	2.03	3.02	1.98	63.4
	406.400	247.650	203.200	3 150	6 000	**E-HH249949/HH249910D+A**	284	383	6.4	1.5	189.5	0.33	2.03	3.02	1.98	112
249.250	381.000	171.450	127.000	1 440	2 880	**E-EE126098/126151D+A**	279	358	6.4	1.5	186.5	0.52	1.31	1.95	1.28	62.2
	323.850	63.500	50.800	239	635	**E-29875/29820D+A**	267	312	1.5	0.8	105	0.35	1.95	2.90	1.91	11.2
	358.775	152.400	117.475	1 550	3 300	**T-E-M249749/M249710D+A**	274	343	3.5	1.5	138.5	0.33	2.03	3.02	1.98	42.8
254.000	365.125	130.175	98.425	1 170	2 380	**T-E-EE134100/134144D+A**	281	347	6.4	1.5	140	0.37	1.80	2.69	1.76	39.2
	393.700	157.162	109.538	1 480	2 800	**T-E-EE275100/275156D+A**	287	378.1	6.4	1.5	162.5	0.40	1.68	2.50	1.64	62.2
	422.275	173.038	128.588	2 210	3 600	**T-E-HM252343/HM252311D+A**	287	400	6.8	1.5	154.4	0.33	2.03	3.02	1.98	84.9

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

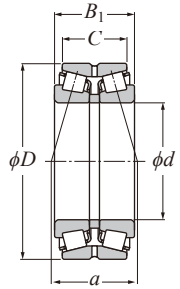
For values of e, Y_1, Y_2 and Y_0 see the table below.

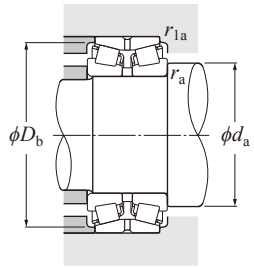
d 254.000-292.100 mm

Boundary dimensions mm				Basic load rating kN dynamic	static	Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	C_r	C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
254.000	422.275	178.592	139.700	2 210	3 600	**T-E-HM252343/HM252310D+A**	287	400	6.8	1.5	160	0.33	2.03	3.02	1.98	88.9
	533.400	276.225	165.100	3 200	5 200	**E-HH953749/HH953710D+A**	328	495.7	6.4	1.5	365.5	0.94	0.71	1.06	0.70	266
260.350	365.125	130.175	98.425	1 170	2 380	**T-E-EE134102/134144D+A**	286	347	6.4	1.5	140	0.37	1.80	2.69	1.76	37.3
	400.050	155.575	107.950	1 350	2 460	**E-EE221026/221576D+A**	296	371.5	9.7	1.5	159	0.39	1.71	2.54	1.67	62.7
	419.100	184.150	136.525	1 760	3 250	**E-EE435102/435165D+A**	295	395.1	6.4	1.5	225.5	0.61	1.11	1.66	1.09	86.8
	422.275	173.038	128.588	2 210	3 600	**T-E-HM252348/HM252311D+A**	292	400	6.8	1.5	154.4	0.33	2.03	3.02	1.98	84.9
	422.275	178.592	139.700	2 210	3 600	**T-E-HM252348/HM252310D+A**	292	400	6.8	1.5	153.6	0.33	2.03	3.02	1.98	84.1
	422.275	178.592	139.700	2 210	3 600	☆**T-E-HM252349/HM252310CD+A**	292	400	6.8	1.5	160	0.33	2.03	3.02	1.98	87.4
	488.950	254.000	196.850	3 350	5 950	**E-EE295102/295192D+A**	299	450.5	6.4	1.5	196.5	0.31	2.16	3.22	2.12	190
263.525	355.600	127.000	101.600	1 190	2 670	**T-E-LM451345/LM451310D+A**	283	342.9	3.5	1.5	136.5	0.36	1.87	2.79	1.83	31.7
266.700	323.850	63.500	50.800	239	635	**E-29880/29820D+A**	277	312	1.5	0.8	105	0.35	1.95	2.90	1.91	9.37
	355.600	127.000	101.600	1 190	2 670	**T-E-LM451349/LM451310D+A**	285	342.9	3.5	1.5	136.5	0.36	1.87	2.79	1.83	30.7
	393.700	157.162	109.538	1 480	2 800	**T-E-EE275105/275156D+A**	296	378.5	6.4	1.5	162.5	0.40	1.68	2.50	1.64	57.6
269.875	381.000	158.750	123.825	1 680	3 600	**T-E-M252349/M252310D+A**	296	364	6.4	1.5	146.4	0.33	2.03	3.02	1.98	52.3
273.050	393.700	157.162	109.538	1 480	2 800	**T-E-EE275108/275156D+A**	301	378.5	6.4	1.5	162.5	0.40	1.68	2.50	1.64	55.3
279.400	374.650	104.775	79.375	900	2 020	**E-L555233/L555210D+A**	300	362	3.5	1.5	138.5	0.40	1.68	2.50	1.64	28.5
	469.900	200.025	149.225	2 250	4 350	**E-EE722110/722186D+A**	321	432.9	9.7	1.5	187.5	0.38	1.78	2.65	1.74	125
	488.950	254.000	196.850	3 350	5 950	**E-EE295110/295192D+A**	303	450.5	1.3	1.5	196.5	0.31	2.16	3.22	2.12	179
279.982	380.898	139.700	107.950	1 260	3 100	**T-E-LM654642/LM654610D+A**	302	368	3.5	1.5	163	0.43	1.56	2.33	1.53	40.7
280.192	406.400	149.225	117.475	1 450	3 100	**E-EE128111/128160CD+A**	309	384	6.8	1.5	158	0.39	1.75	2.61	1.71	56.5
285.750	358.775	76.200	53.975	500	1 080	**E-545112/545142DA+A**	302	345	3.5	1.5	144	0.49	1.38	2.05	1.34	15.7
	380.898	139.700	107.950	1 260	3 100	**T-E-LM654649/LM654610D+A**	306	368	3.5	1.5	163	0.43	1.56	2.33	1.53	38.7
	501.650	203.200	120.650	2 170	3 700	**E-EE147112/147198D+A**	329	468.1	6.4	3.3	307	0.84	0.81	1.20	0.79	151
288.925	406.400	165.100	130.175	1 920	4 150	**E-M255449/M255410DA+A**	317	387.9	6.4	1.5	157	0.34	2.00	2.98	1.96	59
292.100	374.650	104.775	79.375	900	2 020	**E-L555249/L555210D+A**	309	362	3.5	1.5	138.5	0.40	1.68	2.50	1.64	25.2
	469.900	200.025	149.225	2 250	4 350	**E-EE722115/722186D+A**	330	432.9	9.7	1.5	187.5	0.38	1.78	2.65	1.74	118

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

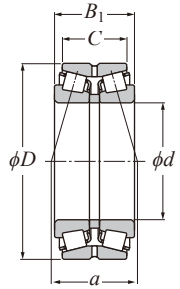
d 292.100-368.249 mm

Boundary dimensions mm			Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C dynamic C_r	static C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
292.100	558.800	298.450	222.250	4 700	8 300	☆ **T-E-EE790114/790223DG2+A**	335	514.2	6.4	1.5	252.1	0.40	1.71	2.54	1.67	315
298.450	444.500	146.050	98.425	1 200	2 300	**E-EE291175/291751D+A**	332	413.9	8	1.5	164	0.38	1.78	2.65	1.74	69.3
299.975	495.300	301.625	247.650	4 650	9 800	☆ **E-HH258248/HH258210DG2+A**	342	467	6.4	1.5	231	0.33	2.03	3.02	1.98	205
300.038	422.275	174.625	136.525	2 160	4 800	☆ **T-E-HM256849/HM256810DG2+A**	328	403	6.4	1.5	163.5	0.34	2.00	2.99	1.96	67.4
304.800	393.700	107.950	82.550	925	2 070	**E-L357049/L357010D+A**	329	380	6.4	1.5	133	0.36	1.87	2.79	1.83	29.3
	412.750	123.825	92.075	925	1 990	**E-EE109120/109163DE1+A**	330	394.4	6.4	1.5	165.3	0.43	1.57	2.34	1.53	41.6
	438.048	165.100	120.650	1 530	3 200	**T-E-EE129120X/129173D+A**	334	411	6.4	1.5	179.5	0.42	1.62	2.42	1.59	71.4
	444.500	146.050	98.425	1 200	2 300	**E-EE291201/291751D+A**	337	413.9	8	1.5	164	0.38	1.78	2.65	1.74	66.8
	495.300	196.850	146.050	2 350	4 700	**E-EE724120/724196D+A**	359	458.9	16	1.5	195	0.40	1.68	2.50	1.64	131
	558.800	298.450	222.250	4 700	8 300	☆ **T-E-EE790120/790223DG2**	335	514.2	1.3	1.5	252.1	0.40	1.71	2.54	1.67	302
317.500	444.500	146.050	98.425	1 200	2 300	**E-EE291250/291751D+A**	346	413.9	8	1.5	164	0.38	1.78	2.65	1.74	61.8
	447.675	180.975	146.050	2 200	4 800	**T-E-HM259049/HM259010D+A**	341	427.7	3.5	1.5	162	0.33	2.02	3.00	1.97	78.8
	622.300	304.800	174.625	3 550	6 250	☆ **E-H961649/H961610DG2+A**	410	581.6	14.3	3.3	430	0.95	0.71	1.06	0.70	382
330.200	482.600	133.350	88.900	1 230	2 580	**T-E-EE161300/161901D+A**	367	455	7	1.5	200.5	0.50	1.35	2.01	1.32	72.2
	482.600	177.800	127.000	1 820	3 950	**E-EE526130/526191D+A**	360	454	6.4	1.5	183.5	0.39	1.72	2.56	1.68	96.3
333.375	469.900	190.500	152.400	2 570	5 500	**E-HM261049/HM261010DA+A**	363	449.5	6.4	1.5	179.5	0.33	2.02	3.00	1.97	91.3
342.900	457.098	142.875	104.775	1 350	3 300	**E-LM961548/LM961511D+A**	367	443.1	3.3	1.5	253.5	0.71	0.95	1.41	0.93	57.1
	533.400	165.100	114.300	2 030	3 450	**E-EE971354/972102D+A**	373	496.3	4.8	1.5	170	0.33	2.03	3.02	1.98	120
346.075	482.600	133.350	88.900	1 230	2 580	**T-E-EE161363/161901D+A**	379	455	7	1.5	200.5	0.50	1.35	2.01	1.32	66
	488.950	200.025	158.750	2 820	6 400	☆ **T-E-HM262749/HM262710DG2+A**	377	467	6.4	1.5	187.5	0.33	2.02	3.00	1.97	104
349.250	514.350	193.675	152.400	2 270	4 550	**E-EE333137/333203D+A**	382	478	6.4	1.5	197.5	0.36	1.85	2.76	1.81	121
355.600	444.500	136.525	111.125	1 250	3 500	**T-E-L163149/L163110D+A**	374	430	3.5	1.5	151	0.31	2.20	3.27	2.15	42.5
	482.600	133.350	88.900	1 330	2 870	**T-E-EE161400/161901D+A**	386	455	7	1.5	200.5	0.50	1.35	2.01	1.32	62.1
	501.650	155.575	107.950	1 710	3 650	**T-E-EE231400/231976D+A**	388	481	6.4	1.5	195	0.44	1.53	2.28	1.50	85.2
	514.350	193.675	152.400	2 270	4 550	**E-EE333140/333203D+A**	388	478.3	6.4	1.5	197.5	0.36	1.85	2.76	1.81	117
368.249	523.875	214.312	169.862	2 890	6 550	☆ **E-HM265049/HM265010DG2+A**	400	499	6.4	1.5	198.5	0.33	2.03	3.02	1.98	142

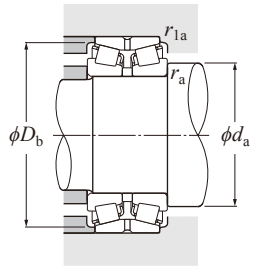
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Double Row Back-to-Back Tapered Roller Bearings NTN

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

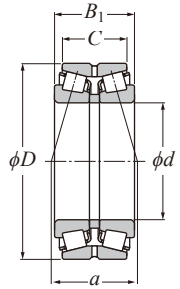
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 368.300-457.200 mm

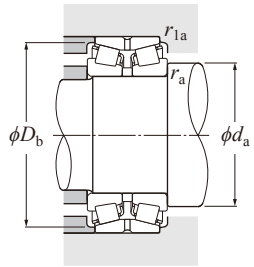
Boundary dimensions mm				Basic load rating kN dynamic	static	Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	C_r	C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
368.300	596.900	203.200	133.350	2 780	4 850	**E-EE181453/182351D+A**	415	551.6	9.7	2.3	223.2	0.42	1.62	2.42	1.59	185
371.475	501.650	155.575	107.950	1 710	3 650	**T-E-EE231462/231976D+A**	400	481	6.4	1.5	195	0.44	1.53	2.28	1.50	77.3
	514.350	155.575	107.950	1 710	3 650	**T-E-EE231462/232026D+A**	400	481.1	6.4	1.5	195.2	0.44	1.53	2.28	1.50	83.3
381.000	508.000	139.700	88.900	1 020	2 270	**E-EE192150/192201D+A**	410	482	6.4	1.5	221	0.53	1.27	1.89	1.24	69
	546.100	222.250	177.800	3 300	7 350	**T-E-HM266446/HM266410D+A**	415	520	6.4	1.5	208	0.33	2.03	3.02	1.98	149
	546.100	222.250	177.800	3 500	8 050	☆**T-E-HM266447/HM266410DG2+A**	415	520	6.4	1.5	208	0.33	2.03	3.02	1.98	164
	590.550	244.475	193.675	4 050	9 450	☆**T-E-M268730/M268710DG2+A**	425	562	6.4	1.5	226	0.33	2.03	3.02	1.98	247
384.175	441.325	68.262	52.388	470	1 310	**E-LL365340/LL365310D+A**	399	433	3.5	0.8	128.5	0.34	1.99	2.96	1.94	14.1
	546.100	222.250	177.800	3 300	7 350	**T-E-HM266448/HM266410D+A**	417	520	6.4	1.5	208	0.33	2.03	3.02	1.98	146
	546.100	222.250	177.800	3 500	8 050	☆**T-E-HM266449/HM266410DG2+A**	417	520	6.4	1.5	208	0.33	2.03	3.02	1.98	146
385.762	514.350	177.800	139.700	2 350	5 550	**E-LM665949/LM665910D+A**	415	495	6.4	1.5	210.5	0.42	1.61	2.40	1.58	90
393.700	546.100	158.750	117.475	1 600	3 500	**T-E-EE234154/234216D+A**	426	515.6	6.4	1.5	229.9	0.48	1.42	2.11	1.39	99.2
396.875	539.750	142.875	101.600	1 480	3 300	**E-EE234156/234213D+A**	428	515.6	6.4	1.5	214.5	0.47	1.43	2.12	1.40	83.6
	546.100	158.750	117.475	1 480	3 300	**E-EE234156/234216D+A**	428	516	6.4	1.5	230.5	0.47	1.43	2.12	1.40	97.7
406.400	539.750	142.875	101.600	1 480	3 300	**E-EE234160/234213D+A**	435	515.6	6.4	1.5	214.5	0.47	1.43	2.12	1.40	78.8
	609.600	187.325	123.825	2 400	4 800	**E-EE911600/912401D+A**	443	569	6.8	1.5	209	0.38	1.76	2.62	1.72	169
	673.100	192.639	127.000	2 840	5 350	**E-EE571602/572651D+A**	453	629.5	6.4	1.5	235.4	0.40	1.68	2.50	1.64	245
415.925	590.550	244.475	193.675	4 050	9 450	☆**T-E-M268749/M268710DG2+A**	451	562	6.4	1.5	226	0.33	2.03	3.02	1.98	188
431.800	571.500	155.575	111.125	2 080	4 950	**T-E-LM869448/LM869410D+A**	457	549	3.3	1.5	255.5	0.55	1.24	1.84	1.21	95.3
	603.250	159.639	104.775	1 860	4 100	**E-EE241701/242377D+A**	446	561	6.4	1.5	252.5	0.53	1.28	1.91	1.25	124
	673.100	192.639	127.000	2 840	5 350	**E-EE571703/572651D+A**	472	629.5	6.4	1.5	235.5	0.40	1.68	2.50	1.64	225
431.902	685.698	365.125	295.275	7 550	16 400	☆**T-E-EE650170/650270CDG2+A**	477	648.5	6.4	3.3	283	0.32	2.08	3.09	2.03	507
447.675	635.000	257.175	206.375	4 600	11 100	☆**E-M270749/M270710DAG2+A**	484	605.1	6.4	1.5	240	0.33	2.03	3.02	1.98	228
457.200	596.900	165.100	120.650	1 850	4 700	**E-EE244180/244236D+A**	494	570	9.7	1.5	219	0.40	1.67	2.49	1.63	106
	660.400	195.262	138.112	2 690	5 600	**E-EE737181/737261D+A**	503.9	618.2	10.5	1.5	230.6	0.37	1.80	2.69	1.76	182
	730.148	254.000	177.800	4 850	8 750	**E-EE671801/672875D+A**	507	681	9.7	1.5	266	0.39	1.72	2.56	1.68	360

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series



Double Row Back-to-Back Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

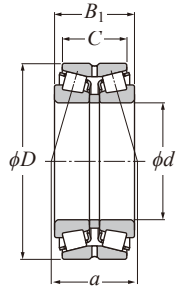
For values of e, Y_1, Y_2 and Y_0 see the table below.

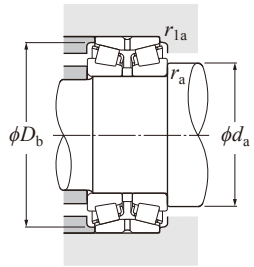
d 479.425-685.800 mm

Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	dynamic C_r	static C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
479.425	679.450	276.225	222.250	5 400	13 000	☆**T-E-M272749/M272710DG2+A**	516	648	6.4	1.5	258.5	0.33	2.03	3.02	1.98	310
482.600	615.950	184.150	146.050	2 580	6 700	☆**E-LM272249/LM272210DG2+A**	513	597	6.4	1.5	206.5	0.33	2.03	3.02	1.98	118
	634.873	177.800	142.875	2 220	6 150	**E-EE243190/243251D+A**	516	609	6.4	1.5	215	0.34	1.98	2.94	1.93	148
488.950	634.873	180.975	136.525	2 780	6 950	**E-LM772748/LM772710DA+A**	522	613.5	6.4	1.5	262	0.47	1.43	2.12	1.40	130
	660.400	206.375	158.750	3 500	8 050	☆**T-E-EE640192/640261DG2+A**	522	630.5	6.4	1.5	216	0.31	2.20	3.27	2.15	178
489.026	634.873	177.800	142.875	2 220	6 150	**E-EE243192/243251D+A**	522	609	6.4	1.5	215	0.34	1.98	2.94	1.93	140
498.475	634.873	177.800	142.875	2 220	6 150	**E-EE243196/243251D+A**	528	609	6.4	1.5	215	0.34	1.98	2.94	1.93	129
501.650	711.200	292.100	231.775	5 600	13 700	☆**E-M274149/M274110CDG2+A**	540	678	6.4	1.5	268.5	0.33	2.03	3.02	1.98	355
508.000	838.200	304.800	222.250	6 500	14 200	☆**E-EE426200/426331DG2+A**	564	767.7	9.7	3.3	357.1	0.48	1.41	2.09	1.37	592
536.575	761.873	311.150	247.650	6 550	15 200	☆**E-M276449/M276410DG2+A**	576	725.6	6.4	1.5	290	0.33	2.03	3.02	1.98	398
549.275	692.150	174.625	136.525	2 570	6 950	**E-L476549/L476510D+A**	579	666	6.4	1.5	239	0.38	1.79	2.67	1.75	135
558.800	736.600	165.100	114.300	2 280	5 400	**E-EE542220/542291D+A**	594	705.1	6.4	3.3	298	0.51	1.32	1.96	1.29	166
	736.600	187.328	138.112	2 770	6 750	**E-EE843220/843291D+A**	591	708	6.4	1.5	231	0.34	1.98	2.94	1.93	189
	736.600	225.425	177.800	3 500	8 800	**E-LM377449/LM377410D+A**	594	708	6.4	1.5	256.5	0.35	1.95	2.90	1.91	227
	742.950	187.328	138.112	2 620	6 250	**E-EE843220/843292D+A**	591	707.1	6.4	1.5	231	0.34	1.98	2.94	1.93	203
571.500	812.800	333.375	263.525	7 700	18 300	☆**E-M278749/M278710DAG2+A**	615	774	6.4	1.5	308	0.33	2.03	3.02	1.98	487
584.200	901.700	298.453	214.312	7 050	14 900	☆**E-EE662303/663551DG2+A**	633	848.1	8	1.5	297.9	0.33	2.03	3.02	1.98	652
602.945	787.400	206.375	158.750	4 150	10 100	☆**E-EE649237/649311DG2+A**	639	755.3	6.4	1.5	254	0.33	2.03	3.02	1.98	245
609.600	787.400	206.375	158.750	4 150	10 100	☆**E-EE649240/649311DG2+A**	642	755.3	6.4	1.5	254	0.33	2.03	3.02	1.98	235
	793.750	206.375	158.750	4 150	10 100	☆**E-EE649240/649313DG2+A**	642	755.3	6.4	1.5	254	0.33	2.03	3.02	1.98	246
	812.800	190.500	146.050	3 150	7 850	**E-EE743240/743321D+A**	645	765.1	6.4	3.3	254	0.33	2.06	3.06	2.01	241
646.112	857.250	304.800	241.300	6 400	16 800	**T-E-LM281049/LM281010CD+A**	684	824.5	6.4	1.5	287.7	0.33	2.03	3.02	1.98	443
660.400	812.800	203.200	158.750	3 700	10 300	**E-L281148/L281110DA+A**	693	789	6.4	1.5	667.5	0.37	1.80	2.69	1.76	199
679.450	901.700	307.975	244.475	7 200	19 000	☆**E-LM281849/LM281810CDG2+A**	726	866.6	9.7	1.5	319	0.33	2.03	3.02	1.98	520
682.625	965.200	396.875	311.150	10 400	25 300	☆**E-M282249/M282210CG2+A**	738	919.8	9.7	1.5	366.3	0.33	2.03	3.02	1.98	884
685.800	876.300	200.025	152.400	3 900	10 900	☆**E-EE655270/655346CDG2+A**	723	841.4	6.4	1.5	313.2	0.42	1.61	2.40	1.58	285

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

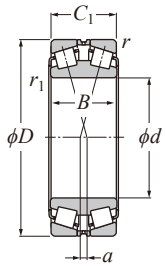
d 711.200-1 270.000 mm

Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center mm	Constant	Axial load factors			Mass kg
d	D	B_1	C	dynamic C_r	static C_{0r}		d_a Min.	D_b Max.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
711.200	914.400	190.500	139.700	3 450	8 950	☆ **E-EE755280/755361DG2+A**	750	877	6.4	3.3	295.5	0.38	1.77	2.64	1.73	275
723.900	914.400	187.325	139.700	3 450	8 950	☆ **E-EE755285/755361DG2+A**	756	877	5.5	3.3	295.5	0.38	1.77	2.64	1.73	256
774.700	965.200	187.325	133.350	2 900	6 900	**E-EE752305/752381D+A**	810	923.5	6.4	1.5	320.6	0.40	1.68	2.50	1.64	255
812.800	1 016.000	190.500	146.050	4 300	11 700	☆ **E-EE762320/762401DAG2+A**	849	976.6	6.4	1.5	348.9	0.43	1.59	2.36	1.55	334
	1 066.800	190.500	146.050	4 300	11 700	☆ **E-EE762320/762420XDAG2+A**	849	976.6	6.4	3.3	348.9	0.43	1.59	2.36	1.55	432
914.400	1 066.800	139.700	101.900	2 390	7 050	**E-LL686947/LL686910D+A**	945	1 037.2	6.4	3.3	320.3	0.41	1.64	2.44	1.60	191
977.900	1 130.300	139.700	101.600	2 270	7 200	**E-LL687949/LL687910D+A**	1 010	1 100	6.4	3.3	376	0.44	1.54	2.30	1.51	196
1 270.000	1 435.100	146.050	101.600	3 050	10 100	**E-LL889049/LL889010D+A**	1 305	1 405	6.4	3.3	586.5	0.58	1.17	1.75	1.15	285

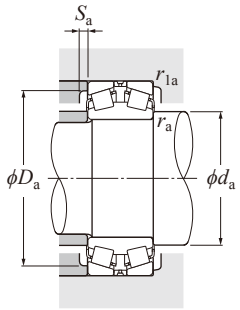
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

Double Row Back-to-Back Tapered Roller Bearings NTN

Metric series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

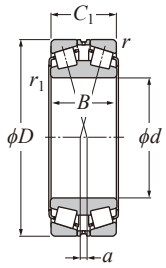
d 100-190 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3) 4)	Installation-related dimensions mm						Load center 5) mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3) 4)		d_a Max.	D_a Max.	S_a Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_1	Y_2	Y_0	(approx.)
100	250	116	116	4	4	875	1 050	108		**CRD-2051**	135	232	200	4.5	3	3	−14.5	0.40	1.68	2.50	1.64	30
110	180	56	56	2	2.5	330	485	53.0		**323122**	126.5	170	157.5	8	2	2	1	0.33	2.03	3.02	1.98	5.54
120	180	46	46	2	2.5	255	375	40.0		**323024**	134	168	162.5	8	2	2	12	0.37	1.80	2.69	1.76	4.08
	200	62	62	2	2.5	415	610	64.5		**323124**	141.5	190	176	8	2	2	6.5	0.37	1.80	2.69	1.76	7.82
130	200	52	52	2	2.5	325	490	51.5		**323026**	148.5	190	178.5	8	2	2	13.5	0.37	1.80	2.69	1.76	5.74
	210	64	64	2	2.5	455	675	70.5		**323126**	147.5	200	185	8	2	2	7.5	0.37	1.80	2.69	1.76	8.38
140	210	53	53	2	2.5	335	535	55.0		**323028**	157.5	200	187.5	8	2	2	10	0.37	1.84	2.74	1.80	6.36
	225	68	68	2.5	3	435	650	66.0		**323128**	161	213	197.5	10	2	2.5	8	0.37	1.80	2.69	1.76	9.82
150	225	56	56	2.5	3	395	630	64.0		**323030**	167.5	213	200	10	2	2.5	15.5	0.37	1.80	2.69	1.76	7.63
	250	80	80	2.5	3	670	1 040	103		**323130**	175.5	238	219	10	2	2.5	6.5	0.37	1.80	2.69	1.76	15.7
	320	130	144	4	1.5	1 290	1 750	165		**CRD-3016**	191.5	302	264	3	3	1.5	−19	0.37	1.80	2.69	1.76	53
	321.5	130	144	4	1.5	1 490	2 010	189		**CRD-3017**	188.5	303.5	269.5	4.1	3	1.5	−22	0.35	1.96	2.91	1.91	54.1
160	240	60	60	2.5	3	475	765	76.0		**323032**	179	228	215.5	10	2	2.5	17.5	0.37	1.80	2.69	1.76	9.42
	270	86	86	2.5	3	750	1 180	114		**323132E1**	187.5	258	233.5	10	2	2.5	8	0.37	1.80	2.69	1.76	20
	270	86	86	2.5	3	865	1 180	114	*	**323132UTG**	187.5	258	233.5	10	2	2.5	8	0.37	1.80	2.69	1.76	20
	341	228	242	4	1.5	2 820	4 500	415	☆	**CRD-3256**	195.5	323	275	7.1	3	1.5	−63	0.35	1.95	2.90	1.91	110
170	260	67	67	2.5	3	545	865	83.5		**323034**	192	248	231	10	2	2.5	18	0.37	1.80	2.69	1.76	12.8
	280	88	88	2.5	3	805	1 270	122		**323134E1**	195.5	268	244	10	2	2.5	8.5	0.37	1.80	2.69	1.76	21.8
	280	88	88	2.5	3	930	1 270	122	*	**323134UTG**	195.5	268	244	10	2	2.5	8.5	0.37	1.80	2.69	1.76	21.8
180	280	74	74	2.5	3	645	1 050	99.5		**323036E1**	205	268	248.5	10	2	2.5	17	0.37	1.80	2.69	1.76	16.5
	280	74	74	2.5	3	745	1 050	99.5	*	**3203036UTG**	205	268	248.5	10	2	2.5	17	0.37	1.80	2.69	1.76	16.5
	300	96	96	3	4	980	1 530	144		**323136E1**	206	286	262	12	2.5	3	8	0.37	1.80	2.69	1.76	27.2
	300	96	96	3	4	1 130	1 530	144	*	**323136UTG**	206	286	262	12	2.5	3	8	0.37	1.80	2.69	1.76	27.2
190	290	75	75	2.5	3	685	1 110	104		**323038E1**	213	278	258	12	2	2.5	17.5	0.37	1.80	2.69	1.76	17.9
	290	75	75	2.5	3	790	1 110	104	*	**323038UTG**	213	278	258	12	2	2.5	17.5	0.37	1.80	2.69	1.76	17.9
	320	104	104	3	4	1 090	1 710	157		**323138**	220.5	306	279.5	12	2.5	3	8.5	0.37	1.80	2.69	1.76	33.2
	320	104	104	3	4	1 260	1 710	157	*	**323138UTG**	220.5	306	279.5	12	2.5	3	8.5	0.37	1.80	2.69	1.76	33.2

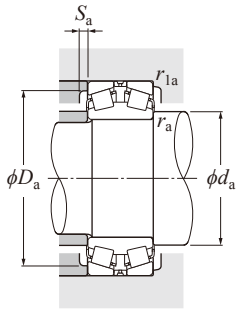
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "*" designate ULTAGE ™ series.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

5) When the value is negative "−", the load center is outside the inner ring.

Metric series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

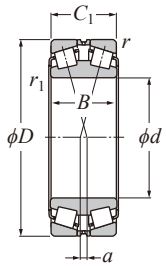
d 190-260 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3) 4)	Installation-related dimensions mm						Load center 5) mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3) 4)		d_a Max.	D_a Max.	S_a Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_1	Y_2	Y_0	(approx.)
195	305	120	120	2.5	3	1 250	2 200	203		**CRD-3906**	215	293	267	5.4	2	2.5	−1	0.37	1.80	2.69	1.76	32.5
200	310	82	82	2.5	3	795	1 320	121		**323040E1**	225.5	298	275	12	2	2.5	19	0.37	1.80	2.69	1.76	22.3
	310	82	82	2.5	3	920	1 320	121	*	**323040UTG**	225.5	298	275	12	2	2.5	19	0.37	1.80	2.69	1.76	22.3
	340	112	112	3	4	1 210	1 910	173		**323140**	233	326	294.5	12	2.5	3	8.5	0.37	1.80	2.69	1.76	41.8
	340	112	112	3	4	1 400	1 910	173	*	**323140UTG**	233	326	294.5	12	2.5	3	8.5	0.37	1.80	2.69	1.76	41.8
	340	150	150	3	1.5	1 430	2 490	226		**CRD-4015**	224	326	277.5	3.1	2.5	1.5	−2.5	0.42	1.60	2.39	1.57	55.9
	420	235	235	5	2	3 350	5 350	460	☆	**CRD-4020**	248.5	398	341	6.3	4	2	−48.5	0.37	1.80	2.69	1.76	158
220	340	90	90	3	4	975	1 650	148		**323044E1**	249	326	302.5	12	2.5	3	21.5	0.37	1.80	2.69	1.76	29.8
	340	90	90	3	4	1 130	1 650	148	*	**323044UTG**	249	326	302.5	12	2.5	3	21.5	0.37	1.80	2.69	1.76	29.8
	370	120	120	4	5	1 350	2 260	199		**323144**	254.5	352	317	14	3	4	14	0.40	1.68	2.50	1.64	52.2
	370	120	120	4	5	1 570	2 260	199	*	**323144UTG**	254.5	352	317	14	3	4	14	0.40	1.68	2.50	1.64	52.2
	400	250	254	4	1.5	3 300	5 750	500	☆	**CRD-4424**	247.5	382	330	15.2	3	1.5	65	0.39	1.74	2.59	1.70	142
	400	254	254	4	1.5	3 050	5 250	455	☆	**CRD-4418**	247	382	329	13.7	3	1.5	−56	0.47	1.43	2.12	1.40	138
	401.5	254	254	4	1.5	3 050	5 250	455	☆	**CRD-4423**	247	383.5	329	13.7	3	1.5	−56	0.47	1.43	2.12	1.40	140
	440	254	254	4	1.5	3 050	5 250	455	☆	**CRD-4428**	247	422	329	13.7	3	1.5	−56	0.47	1.43	2.12	1.40	190
240	360	92	92	3	4	1 010	1 770	155		**323048E1**	269	346	322	14	2.5	3	23.5	0.37	1.80	2.69	1.76	32.5
	360	92	92	3	4	1 170	1 770	155	*	**323048UTG**	269	346	322	14	2.5	3	23.5	0.37	1.80	2.69	1.76	32.5
	395	124	124	4	4	1 560	2 630	226		**CRD-4804**	276	377	345	6.6	3	3	20.5	0.40	1.68	2.50	1.64	60.2
	400	128	128	4	5	1 550	2 600	223		**323148**	277.5	382	347	14	3	4	17	0.40	1.68	2.50	1.64	63.4
	400	128	128	4	5	1 790	2 600	223	*	**323148UTG**	277.5	382	347	14	3	4	17	0.40	1.68	2.50	1.64	63.4
259.5	481	250	250	5	2	3 600	6 650	545		**CRD-5222**	297	459	385	3.5	4	2	−7	0.49	1.38	2.06	1.35	208
260	400	104	104	4	5	1 270	2 190	187		**323052**	291.5	382	354.5	14	3	4	25	0.37	1.80	2.69	1.76	47.7
	400	104	104	4	5	1 470	2 190	187	*	**323052UTG**	291.5	382	354.5	14	3	4	25	0.37	1.80	2.69	1.76	47.7
	400	150	150	4	4	1 630	3 200	272		**CRD-5212**	289	382	345	3.4	3	3	15	0.43	1.57	2.34	1.53	68.3
	400	174	174	4	1.5	2 290	4 550	385		**CRD-5230**	287	382	352	7.3	3	1.5	−3	0.43	1.55	2.31	1.52	81.3

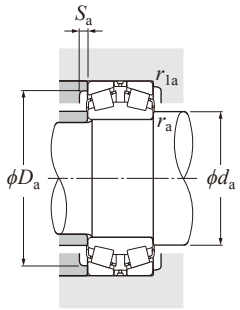
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "*" designate ULTAGE ™ series.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

5) When the value is negative "−", the load center is outside the inner ring.

Metric series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

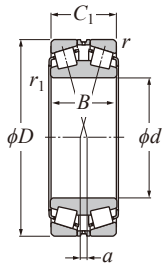
d 260-340 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3) 4)	Installation-related dimensions mm						Load center 5) mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3) 4)		d_a Max.	D_a Max.	S_a Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_1	Y_2	Y_0	(approx.)
260	440	144	144	4	5	2 180	3 750	310		**323152**	300.5	422	381.5	16	3	4	16.5	0.40	1.68	2.50	1.64	90.5
	440	144	144	4	5	2 510	3 750	310	*	**323152UTG**	300.5	422	381.5	16	3	4	16.5	0.40	1.68	2.50	1.64	90.5
	445	180	180	4	5	2 340	4 050	335		**CRD-5228**	298	427	378.5	8	3	4	−0.5	0.40	1.68	2.50	1.64	111
	490	250	250	5	2	4 200	7 300	595	☆	**CRD-5227**	304.5	468	400.5	10.8	4	2	−11.5	0.49	1.38	2.06	1.35	222
270	395	94	94	3	4	1 200	2 290	194		**CRD-5403**	300	381	353	7.1	2.5	3	27	0.35	1.95	2.90	1.91	38.5
280	420	106	106	4	5	1 340	2 340	196		**323056**	311.5	402	376	16	3	4	29.5	0.37	1.80	2.69	1.76	50.5
	420	106	106	4	5	1 540	2 340	196	*	**323056UTG**	311.5	402	376	16	3	4	29.5	0.37	1.80	2.69	1.76	50.5
	460	146	146	5	6	2 150	3 650	300		**323156**	318.5	438	402	16	4	5	19.5	0.40	1.68	2.50	1.64	93.6
	460	146	146	5	6	2 480	3 650	300	*	**323156UTG**	318.5	438	402	16	4	5	19.5	0.40	1.68	2.50	1.64	93.6
299	541	298	298	5	2	4 550	8 450	665	☆	**CRD-6035**	351.5	519	443	3.7	4	2	30	0.47	1.43	2.12	1.40	302
300	460	118	118	4	5	1 790	3 150	257		**323060**	337	442	566	16	3	4	31	0.37	1.80	2.69	1.76	69.2
	460	118	118	4	5	2 070	3 150	257	*	**323060UTG**	337	442	566	16	3	4	31	0.37	1.80	2.69	1.76	69.2
	500	160	160	5	6	2 330	4 050	325		**323160**	344.5	478	432	16	4	5	16.5	0.40	1.68	2.50	1.64	130
	500	160	160	5	6	2 690	4 050	325	*	**323160UTG**	344.5	478	432	16	4	5	16.5	0.40	1.68	2.50	1.64	130
	540	280	298	5	2	4 400	8 250	650		**CRD-6031**	345	518	438	2.6	4	2	−26.5	0.49	1.38	2.06	1.35	289
320	450	110	110	3	4	1 480	2 820	229	☆	**CRD-6426**	350.5	436	410	6	2.5	3	37.5	0.38	1.78	2.64	1.74	55.8
	480	121	121	4	5	1 760	3 100	247		**323064**	354	462	432	16	3	4	34	0.37	1.80	2.69	1.76	73.4
	480	121	121	4	5	2 030	3 100	247	*	**323064UTG**	354	462	432	16	3	4	34	0.37	1.80	2.69	1.76	73.4
	540	176	176	5	6	2 770	4 900	385		**323164**	369.5	518	464	18	4	5	18.5	0.40	1.68	2.50	1.64	170
	540	176	176	5	6	3 200	4 900	385	*	**323164UTG**	369.5	518	464	18	4	5	18.5	0.40	1.68	2.50	1.64	170
	580	240	240	5	3	4 100	7 800	605	☆	**CRD-6415**	379	558	480	5.5	2.5	4	3	0.43	1.57	2.34	1.53	288
	620	280	280	5	5	5 800	10 300	785	☆	**CRD-6420**	360	598	544	19.5	4	4	−16.5	0.43	1.57	2.34	1.53	390
340	470	110	110	3	3	1 460	3 050	244		**CRD-6804**	369	456	424	6.5	2.5	2.5	49.5	0.40	1.68	2.50	1.64	57.8
	520	133	133	5	6	2 090	3 750	295		**323068**	379	498	463.5	18	4	5	36	0.37	1.80	2.69	1.76	100
	520	133	133	5	6	2 420	3 750	295	*	**323068UTG**	379	498	463.5	18	4	5	36	0.37	1.80	2.69	1.76	100
	580	190	190	5	6	3 750	6 500	500		**323168**	388.5	558	500	18	4	5	20.5	0.40	1.68	2.50	1.64	210

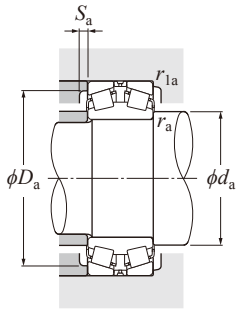
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "*" designate ULTAGE ™ series.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

5) When the value is negative "−", the load center is outside the inner ring.

Metric series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

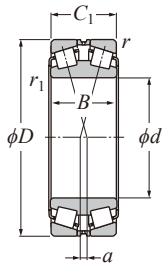
d 340-440 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3) 4)	Installation-related dimensions mm						Load center 5) mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3) 4)		d_a Max.	D_a Max.	S_a Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_1	Y_2	Y_0	(approx.)
340	580	190	190	5	6	4 300	6 500	500	*	**323168UTG**	388.5	558	500	18	4	5	20.5	0.40	1.68	2.50	1.64	210
350	480	110	110	4	4	1 550	3 150	250		**CRD-7015**	376.5	462	436	5.4	3	3	57.5	0.42	1.62	2.42	1.59	58.7
	590	192	192	5	5	3 550	6 100	465	☆	**CRD-7011**	407	568	515	3.5	4	4	6	0.33	2.03	3.02	1.98	218
360	540	134	134	5	6	2 270	4 200	325		**323072**	398	518	483.5	18	4	5	41	0.37	1.80	2.69	1.76	110
	540	134	134	5	6	2 630	4 200	325	*	**323072UTG**	398	518	483.5	18	4	5	41	0.37	1.80	2.69	1.76	110
	600	192	192	5	6	3 550	6 500	495		**323172**	412.5	578	518.5	18	4	5	25.5	0.40	1.68	2.50	1.64	220
	600	192	192	5	6	4 100	6 500	495	*	**323172UTG**	412.5	578	518.5	18	4	5	25.5	0.40	1.68	2.50	1.64	220
	680	320	330	6	6	7 200	13 900	1 030	☆	**CRD-7207**	431	652	552	16.5	5	5	−12	0.47	1.43	2.12	1.40	570
379	681.5	307	307	6	6	7 150	14 300	1 050	☆	**CRD-7621**	456	653.5	575	15.5	5	5	−18.5	0.40	1.68	2.50	1.64	525
380	560	135	135	5	6	2 310	4 350	335		**323076**	418	538	504	18	4	5	42.5	0.37	1.80	2.69	1.76	110
	620	194	194	5	6	3 700	6 700	505		**323176**	428	598	537.5	20	4	5	27	0.40	1.68	2.50	1.64	230
385	530	180	180	4	2	2 620	5 750	440		**CRD-7701**	407.5	512	476	7.5	2	3	26	0.43	1.57	2.34	1.53	116
400	590	142	142	5	5	2 310	4 150	310	☆	**CRD-8012**	440.5	568	533	8.5	4	4	36.5	0.33	2.03	3.02	1.98	134
	600	148	148	5	6	2 800	5 450	410		**323080**	444	578	535.5	18	4	5	45	0.37	1.80	2.69	1.76	150
	600	148	148	5	6	3 250	5 450	410	*	**323080UTG**	444	578	535.5	18	4	5	45	0.37	1.80	2.69	1.76	150
	650	200	200	6	6	4 150	7 850	580		**323180**	452.5	622	566	20	5	5	32.5	0.40	1.68	2.50	1.64	260
	650	200	200	6	6	4 800	7 850	580	*	**323180UTG**	452.5	622	566	20	5	5	32.5	0.40	1.68	2.50	1.64	260
	730	340	340	7.5	7.5	8 200	15 900	1 150	☆	**CRD-8029**	470	694	604	20.5	6	6	−32	0.40	1.68	2.50	1.64	672
	780	380	380	7.5	7.5	9 800	17 700	1 270	☆	**CRD-8040**	477.5	744	639	16.6	6	6	−47	0.40	1.68	2.50	1.64	895
420	520	90	90	4	1.5	1 140	2 700	206		**CRD-8402**	441	502	486	6.5	1.5	3	99.5	0.47	1.43	2.12	1.40	41.9
	620	150	150	5	6	2 940	5 900	435		**323084**	464.5	598	555	20	4	5	50	0.37	1.80	2.69	1.76	150
	620	150	150	5	6	3 400	5 900	435	*	**323084UTG**	464.5	598	555	20	4	5	50	0.37	1.80	2.69	1.76	150
	700	224	224	6	6	5 350	9 700	705		**323184**	475	672	611	25	5	5	35	0.40	1.68	2.50	1.64	350
	700	224	224	6	6	6 150	9 700	705	*	**323184UTG**	475	672	611	25	5	5	35	0.40	1.68	2.50	1.64	350
	735	406	406	7.5	7.5	9 550	20 400	1 460	☆	**CRD-8405**	489.5	699	609	6.2	6	6	−67	0.37	1.80	2.69	1.76	780
440	650	157	157	6	6	2 890	5 450	400		**323088**	485.5	622	584	20	5	5	52.5	0.37	1.80	2.69	1.76	180

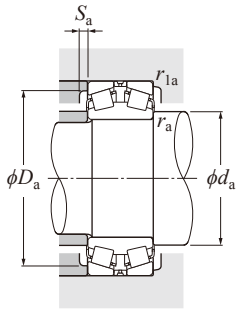
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "*" designate ULTAGE ™ series.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

5) When the value is negative "−", the load center is outside the inner ring.

Metric series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

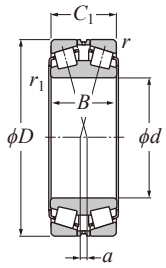
d 440-710 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number 2) 3) 4)	Installation-related dimensions mm						Load center 5) mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u	2) 3) 4)		d_a Max.	D_a Max.	S_a Min.	r_{as} Max.	r_{1as} Max.		a	e	Y_1	Y_2	Y_0	(approx.)
440	650	157	157	6	6	3 350	5 450	400	*	**323088UTG**	485.5	622	584	20	5	5	52.5	0.37	1.80	2.69	1.76	180
	720	226	226	6	6	5 550	10 300	740		**323188**	493.5	692	629	25	5	5	33	0.40	1.68	2.50	1.64	360
	720	226	226	6	6	6 400	10 300	740	*	**323188UTG**	493.5	692	629	25	5	5	33	0.40	1.68	2.50	1.64	360
450	720	300	300	7.5	4	6 150	12 600	900	☆	**CRD-9011**	500.5	684	619.5	15.5	3	6	−8	0.43	1.57	2.34	1.53	483
458	830.5	377	377	7.5	7.5	10 200	20 100	1 400	☆	**CRD-9212**	537	794.5	690.5	19.5	6	6	−29	0.40	1.68	2.50	1.64	890
460	680	163	163	6	6	3 450	6 750	485		**323092**	507.5	652	612.5	25	5	5	56.5	0.37	1.80	2.69	1.76	200
	680	163	163	6	6	3 950	6 750	485	*	**323092UTG**	507.5	652	612.5	25	5	5	56.5	0.37	1.80	2.69	1.76	200
	760	240	240	7.5	7.5	5 450	10 300	725		**323192**	525	724	660	25	6	6	31	0.40	1.68	2.50	1.64	430
	760	240	240	7.5	7.5	6 300	10 300	725	*	**323192UTG**	525	724	660	25	6	6	31	0.40	1.68	2.50	1.64	430
	860	420	420	6	6	11 700	22 700	1 570	☆	**CRD-9204**	547	832	709.5	19.5	5	5	−43	0.40	1.68	2.50	1.64	1 120
479.425	679.450	238.125	238.125	5	2.5	4 250	9 500	680	◎	**CRD-9612**	515.5	657.5	608.5	9.6	4	2	0.5	0.33	2.03	3.02	1.98	261
480	700	165	165	6	6	3 400	6 700	480		**323096**	527	672	632.5	25	5	5	60.5	0.37	1.80	2.69	1.76	210
	700	165	165	6	6	3 900	6 700	480	*	**323096UTG**	527	672	632.5	25	5	5	60.5	0.37	1.80	2.69	1.76	210
	790	248	248	7.5	7.5	5 850	11 100	775		**323196**	547.5	754	688.5	30	6	6	34.5	0.40	1.68	2.50	1.64	480
	790	248	248	7.5	7.5	6 750	11 100	775	*	**323196UTG**	547.5	754	688.5	30	6	6	34.5	0.40	1.68	2.50	1.64	480
500	670	150	150	5	2.5	2 660	6 100	435		**CRD-10005**	536	648	609	7.5	4	2	75.5	0.40	1.68	2.50	1.64	148
	720	167	167	6	6	3 400	6 900	485		**3230/500**	548.5	692	651.5	25	5	5	61.5	0.37	1.80	2.69	1.76	220
	720	167	167	6	6	3 950	6 900	485	*	**3230/500UTG**	548.5	692	651.5	25	5	5	61.5	0.37	1.80	2.69	1.76	220
	830	264	264	7.5	7.5	7 100	14 000	965	☆	**3231/500G2**	581	794	715	30	6	6	37.5	0.40	1.68	2.50	1.64	600
560	820	195	195	6	6	5 050	10 300	700	☆	**CRD-11207**	620	792	738	11	5	5	54.5	0.35	1.92	2.86	1.88	347
630	920	212	212	7.5	7.5	5 950	12 800	840	☆	**3230/630G2**	702.5	884	824.5	8.5	6	6	93.5	0.40	1.68	2.50	1.64	479
	1 030	315	315	8	7	10 100	19 300	1 240	☆	**CRD-12601**	720.5	994	901	8.7	7	6	44	0.37	1.80	2.69	1.76	1 080
690	980	355	355	6	6	10 400	25 700	1 650		**CRD-13802**	740.5	952	868	13.1	5	5	30.5	0.40	1.68	2.50	1.64	890
710	1 150	345	345	12	12	12 100	25 300	1 570	☆	**3231/710BG2**	828	1 098	1 012	1.5	10	10	23	0.32	2.12	3.15	2.07	1 460

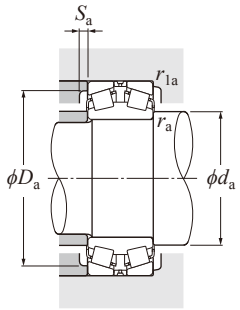
1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "*" designate ULTAGE ™ series.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

5) When the value is negative "−", the load center is outside the inner ring.

Inch series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

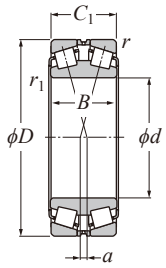
d 152.400-254.000 mm

Boundary dimensions mm				Basic load rating kN dynamic	static	Bearing number [1]	Installation-related dimensions mm				Load center [2] mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	C_r	C_{0r}		d_a Min.	D_a Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
152.400	244.475	92.075	87.312	615	990	**E-81601D/81962+A**	166.1	225	1.5	3.3	−1.5	0.35	1.92	2.86	1.88	15.5
	307.975	171.450	161.924	1 670	2 620	**T-E-450900D/451212+A**	187.5	269	9.7	6.8	−40.5	0.33	2.07	3.08	2.02	60.5
174.625	288.925	123.825	123.825	1 290	2 140	**T-E-HM237542D/HM237510+A**	191	266	1.5	3.3	−20	0.32	2.12	3.15	2.07	32.5
	247.650	90.488	90.488	570	1 180	**T-E-67790D/67720+A**	190	229	1.5	3.3	9.5	0.44	1.54	2.29	1.48	13.4
177.800	288.925	123.825	123.825	1 040	1 900	**T-E-94706D/94113+A**	195	259	1.5	3.3	1.5	0.47	1.44	2.15	1.41	31.6
	288.925	123.825	123.825	1 290	2 140	**T-E-HM237546D/HM237510+A**	194	266	1.5	3.3	−20	0.32	2.12	3.15	2.07	31.6
187.325	319.964	161.925	168.276	1 760	2 790	**T-E-H239649D/H239610+A**	209	293	3.3	4.8	−35	0.32	2.12	3.15	2.07	53.7
190.500	365.049	152.400	158.750	1 850	3 200	**T-E-EE420750D/421437+A**	221	329	3.3	3.3	−5.5	0.40	1.68	2.50	1.64	72.8
	317.500	123.825	123.825	1 170	2 310	**T-E-93800D/93125+A**	222	286	1.5	3.3	19	0.52	1.29	1.92	1.26	36.3
203.200	317.500	133.350	133.350	1 170	2 310	**T-E-93801D/93125+A**	227	286	3.3	6.4	19	0.52	1.29	1.92	1.26	38.9
	365.049	152.400	158.750	1 850	3 200	**T-E-EE420800D/421437+A**	230	329	3.3	3.3	−5.5	0.40	1.68	2.50	1.64	69
206.375	336.550	184.150	180.976	2 110	4 050	**T-E-H242649D/H242610+A**	227	306	1.5	3.3	−35	0.33	2.03	3.02	1.98	64.1
215.900	285.750	85.725	85.725	720	1 640	**T-E-LM742749D/LM742710+A**	229	266	2.3	3.3	35	0.48	1.40	2.09	1.37	14.8
219.075	358.775	200.025	196.850	2 370	4 550	**E-H244849D/H244810A+A**	242	323	1.5	6.4	−42	0.33	2.03	3.02	1.98	81.8
220.662	314.325	115.888	115.886	1 190	2 450	**T-E-M244249D/M244210+A**	235	293	1.5	3.3	−97	0.33	2.03	3.02	1.98	28.6
225.425	355.600	120.650	120.650	1 360	2 510	**T-E-EE130887D/131400E1+A**	252	329	1.5	5.5	−1	0.33	2.04	3.04	2.00	46.1
	355.600	165.100	165.100	1 360	2 510	**T-E-EE130903D/131400+A**	259	329	1.5	8	−32.5	0.33	2.04	3.04	2.00	57.4
228.600	400.050	139.700	139.700	1 670	2 870	**E-EE529091D/529157+A**	256	367	3.3	3.3	−8	0.31	2.18	3.24	2.13	74.2
	425.450	117.800	165.100	2 240	4 150	**E-EE700090D/700167+A**	279	381	6.4	3.3	−1	0.33	2.03	3.02	1.98	115
	431.800	158.750	158.750	1 630	2 480	**E-EE113090D/113170+A**	271.5	375	6.4	6.4	106	0.88	0.77	1.14	0.63	96.8
234.950	384.175	209.550	209.500	2 770	5 450	**T-E-H247549D/H247510+A**	259	346	1.5	6.4	−56.5	0.33	2.03	3.02	1.98	100
241.478	349.148	107.950	107.950	1 040	2 010	**E-EE127097D/127135+A**	258	325	1.5	3.3	12.5	0.35	1.91	2.85	1.87	33.8
244.475	327.025	92.075	92.075	925	2 050	**E-LM247748D/LM247710A+A**	257	310	1.5	3.3	12.5	0.32	2.09	3.11	2.04	21.4
	381.000	146.050	146.050	1 440	2 880	**E-EE126096D/126150+A**	269	343	3.3	4.8	28.5	0.52	1.31	1.95	1.28	61.4
247.650	406.400	219.075	215.900	3 150	6 000	**E-HH249949D/HH249910+A**	278	366	3.3	6.4	−42	0.33	2.03	3.02	1.98	112
254.000	358.775	130.175	130.175	1 550	3 300	**T-E-M249748D/M249710+A**	273	335	3.3	3.3	−1	0.33	2.03	3.02	1.98	41.2

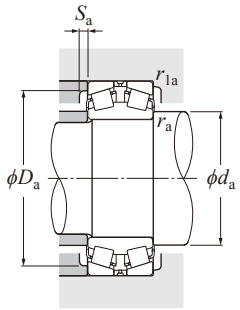
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

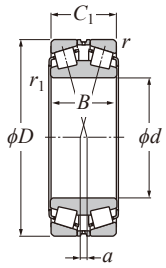
d 254.000-347.662 mm

Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center [2] mm	Constant	Axial load factors			Mass kg
				dynamic	static											
d	D	B	C_1	C_r	C_{0r}		d_a Min.	D_a Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
254.000	368.300	92.862	92.710	875	1 630	**E-EE170975D/171450+A**	269	340	1.5	3.3	20	0.36	1.85	2.76	1.81	32.5
	444.500	133.350	133.350	1 870	2 950	**E-EE822101D/822175+A**	281.9	404.9	3.3	6.4	8	0.34	1.98	2.94	1.93	84.7
260.350	400.050	114.300	119.060	1 350	2 460	**E-EE221025D/221575+A**	290	366	6.4	6.4	24.5	0.39	1.71	2.54	1.67	52
	419.100	158.750	155.575	1 760	3 250	**E-EE435103D/435165+A**	289	376	3.3	3.3	57	0.61	1.11	1.66	1.09	82.6
	444.500	196.850	196.850	2 540	4 700	**E-EE823103D/823175+A**	299	398	6.4	3.3	22	0.55	1.24	1.84	1.21	125
266.700	355.600	109.538	107.950	1 190	2 670	**T-E-LM451349D/LM451310+A**	281	335	1.5	3.3	16	0.36	1.87	2.79	1.83	29.9
269.875	381.000	136.525	136.525	1 680	3 600	**T-E-M252349D/M252310+A**	290	356	3.3	3.3	0.5	0.33	2.03	3.02	1.98	48.6
276.225	393.700	130.175	130.175	1 480	2 800	**T-E-EE275109D/275155+A**	294	366	1.5	6.4	22.5	0.40	1.68	2.50	1.64	50.5
279.400	393.700	127.000	127.000	1 250	2 670	**E-EE135111D/135155+A**	297	368	1.5	6.4	24	0.40	1.68	2.50	1.64	48.1
	457.200	244.475	244.475	3 950	7 900	**E-HH255149D/HH255110+A**	309	412	1.5	6.4	−49	0.33	2.03	3.02	1.98	158
285.750	380.898	117.475	117.475	1 260	3 100	**T-E-LM654648D/LM654610+A**	302	356	1.5	3.3	36	0.43	1.56	2.33	1.53	36.7
288.925	406.400	144.462	144.463	1 930	4 150	**E-M255449D/M255410A+A**	310	379	3.3	3.3	3	0.34	2.00	2.98	1.96	58.1
300.038	422.275	150.812	150.813	2 160	4 800	☆**T-E-HM256849D/HM256810G2+A**	322	394	3.3	3.3	66	0.34	2.00	2.99	1.96	65.6
303.212	495.300	263.525	263.525	4 650	9 800	☆**E-HH258249D/HH258210G2+A**	330.2	448	3.3	6.4	−51.5	0.33	2.03	3.02	1.98	214
304.800	419.100	130.175	130.175	1 550	3 400	**E-M257149D/M257110+A**	322	392	1.5	6.4	12.5	0.33	2.03	3.02	1.98	53.1
	444.500	107.950	111.126	1 200	2 300	**E-EE291200D/291750+A**	337	416	7.9	1.5	34	0.38	1.78	2.65	1.74	55.7
304.902	412.648	128.588	128.588	1 670	3 700	**E-M257248D/M257210+A**	325	388	3.3	3.3	9.5	0.32	2.12	3.15	2.07	49
305.000	438.048	133.350	134.938	1 530	3 200	**T-E-EE129123D/129172E1+A**	328	406	3.3	4.8	32	0.42	1.62	2.42	1.59	65.3
	438.048	134.145	138.112	1 700	3 450	**E-M757449D/M757410+A**	328	407	3.3	4.8	44	0.47	1.43	2.12	1.40	65.3
317.500	422.275	128.588	128.587	1 460	3 500	**E-LM258648D/LM258610+A**	334	398	1.5	3.3	9	0.32	2.10	3.13	2.06	49.1
	447.675	158.750	158.750	2 200	4 800	**T-E-HM259049D/HM259010+A**	340	418	3.3	3.3	3	0.33	2.02	3.00	1.97	77.9
333.375	469.900	166.688	166.688	2 570	5 500	**E-HM261049D/HM261010A+A**	357	439	3.3	3.3	3.5	0.33	2.02	3.00	1.97	90.1
343.052	457.098	122.238	122.238	1 530	3 450	**E-LM761649D/LM761610+A**	361	432	1.5	3.3	63	0.47	1.43	2.12	1.40	55
346.075	488.950	174.625	174.625	2 700	6 000	**T-E-HM262749D/HM262710E1+A**	371	456	3.3	3.3	2	0.33	2.02	3.00	1.97	106
	488.950	174.625	174.625	2 820	6 400	☆**T-E-HM262749D/HM262710G2+A**	371	456	3.3	3.3	2	0.33	2.02	3.00	1.97	103
347.662	469.900	138.112	138.112	2 060	4 550	**E-M262449D/M262410+A**	369	443	3.3	3.3	14.5	0.33	2.03	3.02	1.98	68

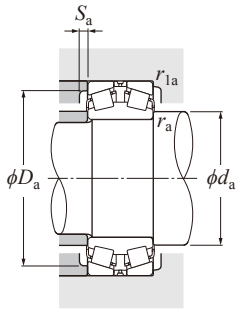
1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series



Double Row Face-to-Face Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

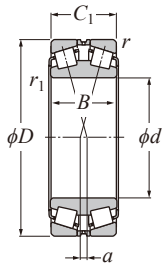
d 355.600-519.112 mm

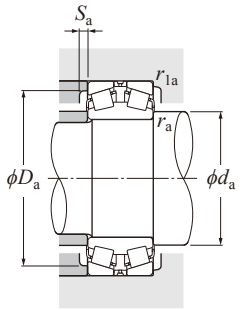
Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center [2] mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	dynamic C_r	static C_{0r}		d_a Min.	D_a Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
	444.500	114.300	112.712	1 250	3 500	**T-E-L163149D/L163110+A**	370	422	1.5	3.3	22.5	0.31	2.20	3.27	2.15	40.1
	457.200	120.650	120.650	1 600	3 900	**E-LM263149D/LM263110+A**	372	434	1.5	3.3	23	0.32	2.12	3.15	2.07	49.1
355.600	482.600	128.588	133.350	1 810	3 850	**E-LM763449D/LM763410+A**	375	453	1.5	3.3	62.5	0.47	1.43	2.14	1.40	67.4
	488.950	153.988	153.988	2 250	5 000	**E-M263349D/M263310+A**	374	459	1.5	3.3	11.5	0.33	2.03	3.02	1.98	85.4
	501.650	111.125	127.000	1 710	3 650	**T-E-EE231401D/231975+A**	382	472	3.3	3.3	62	0.44	1.53	2.28	1.50	68.5
368.300	523.875	185.738	185.738	2 890	6 550	☆ **E-HM265049D/HM265010G2+A**	394	487	3.3	6.4	1.5	0.33	2.03	3.02	1.98	130
	609.600	254.000	279.400	4 800	10 000	☆ **E-EE321146D/321240AG2+A**	428	508	3.3	6.4	−18	0.36	1.90	2.83	1.86	320
384.175	546.100	193.675	193.675	3 500	8 050	☆ **T-E-HM266449D/HM266410G2+A**	411	507	3.3	6.4	1.5	0.33	2.03	3.02	1.98	153
406.400	546.100	138.112	138.112	2 070	5 100	**E-LM767749D/LM767710+A**	427	510	1.5	6.4	78	0.48	1.42	2.11	1.38	90.5
	590.550	193.675	193.674	3 100	6 800	**E-EE833160XD/833232+A**	435	549	3.3	6.4	5.5	0.33	2.07	3.09	2.03	175
409.575	546.100	161.925	161.925	2 650	6 350	☆ **E-M667947D/M667910G2+A**	431	510	1.5	6.4	47	0.42	1.61	2.40	1.58	104
415.925	590.550	209.550	209.550	4 050	9 450	☆ **T-E-M268749D/M268710G2+A**	444	549	3.3	6.4	0.5	0.33	2.03	3.02	1.98	181
419.227	736.448	406.400	406.400	9 550	20 400	☆ **E-EE323166D/323290AG2+A**	477.3	657	6.4	6.4	−67.5	0.37	1.80	2.69	1.76	786
431.800	571.500	133.350	136.526	2 080	4 950	**T-E-LM869449D/LM869410+A**	453	537	1.5	3.3	113	0.55	1.24	1.84	1.21	92.1
	571.500	161.925	161.925	2 400	5 900	**E-LM769349D/LM769310+A**	453	534	1.5	6.4	62.5	0.44	1.52	2.26	1.49	112
447.675	635.000	223.838	223.838	4 600	11 100	☆ **E-M270749D/M270710AG2+A**	478	591	3.3	6.4	0.5	0.33	2.03	3.02	1.98	224
457.073	749.300	419.100	412.750	10 300	23 000	☆ **T-E-EE925179D/925295G2+A**	504	681	3.3	6.4	−96.5	0.31	2.21	3.29	2.16	773
457.200	596.900	133.350	136.525	2 290	5 200	☆ **E-L770847D/L770810AG2+A**	478	567	1.5	3.3	97	0.47	1.43	2.12	1.40	96.7
	596.900	133.350	136.525	1 880	4 600	**E-L770849D/L770810+A**	478	567	1.5	3.3	97	0.47	1.43	2.12	1.40	96.7
479.425	679.450	238.125	238.125	5 400	13 000	☆ **T-E-M272749D/M272710G2+A**	510	633	3.3	6.4	1.5	0.33	2.03	3.02	1.98	293
482.600	615.950	158.750	158.750	2 580	6 700	☆ **E-LM272249D/LM272210G2+A**	504	585	3.3	6.4	35.5	0.33	2.03	3.02	1.98	115
	647.700	201.612	201.612	4 100	10 100	☆ **E-M272647D/M272610G2+A**	510	609	3.3	6.4	18	0.33	2.03	3.02	1.98	185
489.026	634.873	153.988	153.988	2 780	6 950	**E-LM772749D/LM772710A+A**	516	600	3.3	3.3	95	0.47	1.43	2.12	1.40	124
501.650	711.200	250.825	250.825	5 600	13 700	☆ **E-M274149D/M274110G2+A**	534	663	3.3	6.4	−1.5	0.33	2.03	3.02	1.98	314
514.350	673.100	203.200	203.200	3 850	10 200	**E-LM274449D/LM274410+A**	540	636	3.3	6.4	23	0.33	2.03	3.02	1.98	189
519.112	736.600	258.762	258.762	5 900	14 400	☆ **E-M275349D/M275310G2+A**	552	684	3.3	6.4	−1.5	0.33	2.03	3.02	1.98	348

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

2) When the value is negative "−", the load center is outside the inner ring.

Inch series





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

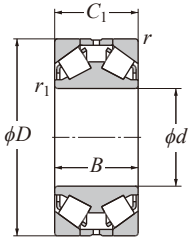
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 536.575-939.800 mm

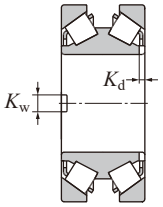
Boundary dimensions mm				Basic load rating kN		Bearing number [1]	Installation-related dimensions mm				Load center [2] mm	Constant	Axial load factors			Mass kg
d	D	B	C_1	dynamic C_r	static C_{0r}		d_a Min.	D_a Min.	r_{as} Max.	r_{1as} Max.	a	e	Y_1	Y_2	Y_0	(approx.)
536.575	761.873	269.875	269.875	6 550	15 200	☆ **E-M276448D/M276410G2+A**	564	711	3.3	6.4	1	0.33	2.03	3.02	1.98	389
	761.873	269.875	269.875	6 550	15 200	☆ **E-M276449D/M276410G2+A**	564	711	3.3	6.4	1	0.33	2.03	3.02	1.98	389
558.800	736.600	155.575	155.575	2 770	6 750	**E-EE843220D/843290+A**	585	699	3.3	6.4	64.5	0.34	1.98	2.94	1.93	177
	736.600	196.850	196.850	3 950	10 300	☆ **E-LM377449D/LM377410G2+A**	588	696	3.3	6.4	43	0.35	1.95	2.90	1.91	223
571.500	812.800	285.750	285.750	7 700	18 300	☆ **E-M278749D/M278710AG2+A**	609	756	3.3	6.4	0	0.33	2.03	3.02	1.98	470
584.200	762.000	188.912	193.675	4 250	11 200	☆ **E-LM778549D/LM778510G2+A**	615	717	3.3	6.4	108	0.47	1.43	2.14	1.40	223
595.312	844.550	296.862	296.862	8 150	20 200	☆ **E-M280049D/M280010G2+A**	633	786	3.3	6.4	1	0.33	2.03	3.02	1.98	525
609.600	787.400	171.450	171.450	3 900	9 950	☆ **T-E-EE649241D/649310G2+A**	636	747	3.3	6.4	79	0.37	1.82	2.71	1.78	210
	863.600	317.500	317.500	8 750	21 100	☆ **E-M280349D/M280310G2+A**	648	807	3.3	6.4	−4.5	0.33	2.03	3.02	1.98	585
657.225	933.450	328.612	328.612	9 900	24 000	☆ **E-M281649D/M281610G2+A**	699	870	3.3	6.4	6	0.33	2.03	3.02	1.98	711
660.400	812.800	176.212	176.212	4 000	11 600	☆ **E-L281149D/L281110G2+A**	684	777	3.3	6.4	89	0.37	1.80	2.69	1.76	195
679.450	901.700	265.112	265.112	7 200	19 000	☆ **E-LM281849D/LM281810G2+A**	714	852	3.3	6.4	31.5	0.33	2.03	3.02	1.98	459
685.800	876.300	168.275	171.450	3 900	10 900	☆ **E-EE655271D/655345G2+A**	717	831	3.3	6.4	129	0.42	1.61	2.40	1.58	247
708.025	930.275	273.050	273.050	7 500	20 400	☆ **E-LM282549D/LM282510G2+A**	741	879	3.3	6.4	33	0.33	2.03	3.02	1.98	490
711.200	914.400	149.225	149.225	3 450	8 950	☆ **E-EE755281D/755360G2+A**	744	873	3.3	6.4	127	0.38	1.77	2.64	1.73	243
749.300	990.600	293.000	293.000	8 200	22 700	☆ **E-LM283649D/LM283610G2+A**	786	936	3.3	6.4	34.5	0.33	2.03	3.02	1.98	606
762.000	1 066.800	352.425	365.125	11 400	29 300	☆ **E-M284148D/M284111G2+A**	819	996	Special chamfer	12.7	14	0.33	2.03	3.02	1.98	968
	1 079.500	381.000	381.000	12 300	32 000	☆ **E-M284249D/M284210G2+A**	810	1 005	4.8	12.7	0	0.33	2.03	3.02	1.98	1 097
863.600	1 130.300	323.850	323.850	10 200	29 600	☆ **E-LM286249D/LM286210G2+A**	906	1 065	4.8	12.7	49.5	0.33	2.03	3.02	1.98	848
	1 219.200	425.450	438.150	15 600	41 500	☆ **E-EE547341D/547480G2+A**	918	1 135	4.8	12.7	1.5	0.33	2.03	3.02	1.98	1 552
938.212	1 270.000	400.050	400.050	14 600	40 000	☆ **E-LM287649D/LM287610G2+A**	990	1 190	4.8	12.7	30.5	0.33	2.03	3.02	1.98	1 444
939.800	1 333.500	349.250	463.550	18 700	48 500	☆ **E-LM287849D/LM287810G2+A**	999	1 240	4.8	12.7	3.5	0.33	2.03	3.02	1.98	1 540

1) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: Chamfer dimensions of the inner and outer rings of the bearing are larger than the maximum values of installation-related dimensions r_{as} and r_{1as}.

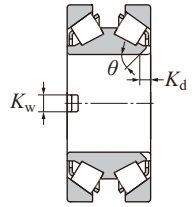
2) When the value is negative "−", the load center is outside the inner ring.
Note: For details on special chamfer, please contact **NTN** Engineering.



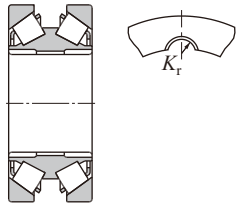
Drawing 1



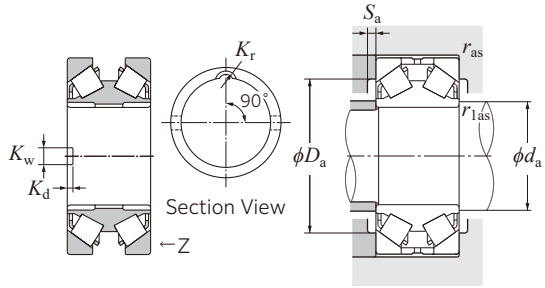
Drawing 2



Drawing 3



Drawing 4



Drawing 5

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

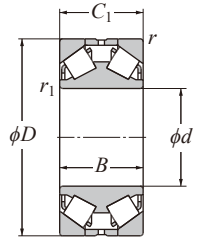
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 100-305.000 mm

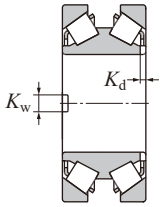
Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN		Bearing number[2) 3)]	Drawing No.	Groove dimensions mm					Installation-related dimensions mm					Constant	Axial load factors			Mass kg
												Width	Depth	Angle	Qty. × Side face	Key groove										
d	D	B	C_1	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)			K_w	K_d	$\theta°$		K_r	d_a Min.	D_a Min.	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
100	215	105	110	3	1	650	825	88.0		**CRD-2005**	1	—	—	—	—	—	117.5	201	3.7	2.5	3	0.81	0.83	1.23	0.81	19.7
120	260	130	130	3	1	920	1 200	120		**CRD-2410**	1	—	—	—	—	—	147.5	246	3.1	2.5	3	0.81	0.83	1.23	0.81	34.2
125	305	180	180	3	3	1 560	2 250	215		**CRD-2503**	2	30.2	11	90	1-2	—	160.5	291	1.5	2.5	3	0.73	0.93	1.38	0.91	68.9
140	305	160	160	5	1.5	1 460	2 080	198		**CRD-2819**	1	—	—	—	—	—	168.5	283	7.5	4	5	0.73	0.92	1.37	0.90	58.1
160	260	130	130	3	1.5	975	1 740	170		**CRD-3253**	1	—	—	—	—	—	177	246	3.5	2.5	3	0.62	1.09	1.62	1.06	27
170	300	100	100	3	2.5	935	1 450	137		**CRD-3423**	1	—	—	—	—	—	195	286	5.4	2.5	3	0.70	0.97	1.44	0.94	30.2
	360	144	160	4	1.5	1 590	2 300	209		**CRD-3416**	1	—	—	—	—	—	197	342	1.5	3	4	1.10	0.61	0.91	0.60	79.7
180	380	158	158	3	4	1 530	1 980	177		**CRD-3623**	1	—	—	—	—	—	208.5	366	3.4	2.5	3	0.81	0.83	1.23	0.81	87.6
	400	232	232	4	4	2 320	3 600	315		**CRD-3622**	1	—	—	—	—	—	211.5	382	6.8	3	4	0.81	0.83	1.23	0.81	146.5
190	320	104	104	3	3	900	1 460	133		**CRD-3801**	1	—	—	—	—	—	216.5	306	5.5	2.5	3	0.73	0.92	1.37	0.90	34.1
	320	104	104	3	4	940	1 540	141		**CRD-3813**	1	—	—	—	—	—	214	306	4.6	2.5	3	0.80	0.85	1.26	0.83	34.1
	350	135	135	3	3	1 260	1 950	176		**CRD-3811**	1	—	—	—	—	—	216	336	5.5	2.5	3	0.81	0.83	1.23	0.81	57.7
210	480	230	230	6	6	2 980	4 300	360		**CRD-4209**	1	—	—	—	—	—	253	367	5.9	5	5	0.81	0.83	1.23	0.81	212
228.600	431.800	177.800	177.800	5	5	1 810	3 100	262	◎	**CRD-4604**	1	—	—	—	—	—	278	410	1.5	4	5	1.01	0.67	0.99	0.65	118
240	460	140	140	5	5	1 530	2 510	210	☆	**CRD-4808**	2	50	15	90	2-2	—	296	438	1.5	4	5	0.87	0.78	1.16	0.76	107
254	585	260	285	4	4	4 100	6 450	510	☆	**CRD-5102**	1	—	—	—	—	—	301	567	4.5	3	4	1.17	0.58	0.86	0.56	392
260	458	155	155	5	5	1 930	3 150	261	☆	**CRD-5214**	2	32	15	90	2-2	—	304	436	1.5	4	5	0.87	0.78	1.16	0.76	109
	459	155	155	5	5	1 930	3 150	261	☆	**CRD-5216**	1	—	—	—	—	—	304	437	1.5	4	5	0.87	0.78	1.16	0.76	110
280	280	92	92	4	1.5	785	1 660	141		**CRD-5621**	1	—	—	—	—	—	294.5	331	3.8	3	1.5	1.05	0.64	0.96	0.63	28.9
	410	110	110	2.5	2.5	1 100	1 960	165		**CRD-5616**	1	—	—	—	—	—	300	398	5	2	2.5	1.05	0.64	0.96	0.63	49
285	380	92	92	2.5	1	805	1 770	150		**CRD-5705**	3	32	13	45	1-2	—	299.5	368	6.5	2	2.5	0.87	0.78	1.16	0.76	27
300	440	105	105	4	4	1 110	2 150	176		**CRD-6025**	3	32.13	22.225	45	1-2	—	325	422	4.5	3	4	0.81	0.83	1.23	0.81	54
	500	200	200	5	5	2 730	5 300	420	☆	**CRD-6028**	3	50.8	34.925	45	2-2	—	342	478	1.5	4	5	0.76	0.88	1.31	0.86	158
305.000	500.000	200.000	200.000	5	5	2 730	5 300	420	◎ ☆	**CRD-6161**	1	—	—	—	—	—	342	413.5	1.5	4	5	0.76	0.88	1.31	0.86	155

1) Smallest allowable dimension for chamfer dimension r or r_1. For details on special chamfer, please contact **NTN** Engineering.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

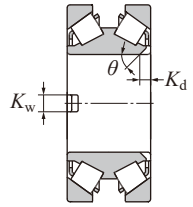
Double Row Steep Slope Face-to-Face Tapered Roller Bearings NTN



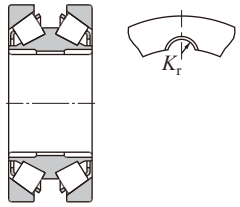
Drawing 1



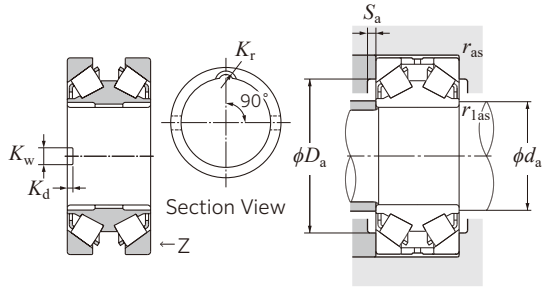
Drawing 2



Drawing 3



Drawing 4



Drawing 5

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

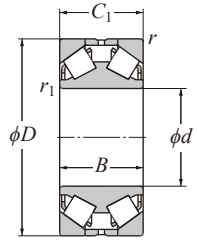
For values of e, Y_1, Y_2 and Y_0 see the table below.

d 305.000-482 mm

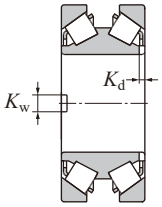
Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number[2) 3)]	Drawing No.	Groove dimensions mm			Qty. × Side face	mm Key groove	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)		Width K_w	Depth K_d	Angle $\theta°$			d_a Min.	D_a Min.	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
	500.000	200.000	200.000	Special chamfer	5	2 730	5 300	420	◎ ☆ **CRD-6148**	3	50.9	35	45	2-2	—	342	478	1.5	4	5	0.76	0.88	1.31	0.86	155
305.000	500.000	200.000	200.000	5	5	2 410	5 050	400	◎ **CRD-6151**	3	40.5	35	45	2-2	—	347	478	1.5	4	5	0.70	0.97	1.44	0.94	155
	560.000	200.000	200.000	20	6.4	2 600	4 700	365	◎ ☆ **CRD-6154**	2	50	19	90	2-2	—	369	468	1.5	19	5	1.09	0.62	0.92	0.61	218
305.069	559.999	200.000	200.000	9.5	6	2 520	4 500	350	◎ **CRD-6152**	3	50.8	39.69	45	2-2	—	372	516	1.5	8	5	1.09	0.62	0.92	0.61	218
305.105	559.867	169.977	200.000	3	4	2 390	4 300	340	◎ **CRD-6104**	1	—	—	—	—	—	355	546	1.5	3	2.5	1.09	0.62	0.92	0.61	217
330	458	120	120	3	3	1 100	2 220	178	**CRD-6604**	2	32	12	90	2-2	—	355.5	444	8	2.5	2.5	1.05	0.64	0.96	0.63	59.7
	590	192	192	3	3	3 300	6 400	490	☆ **CRD-7017**	2	32	12	90	2-2	—	409.5	576	6.5	2.5	2.5	0.55	1.24	1.84	1.21	209
350	590	192	192	3	3	3 100	5 850	445	☆ **CRD-7023**	2	32	12	90	2-2	—	308.5	479	6.5	2.5	2.5	0.87	0.78	1.16	0.76	204
	618	200	200	6	6	3 350	5 700	430	☆ **CRD-7004**	1	50	20	90	2-2	—	410	510	1.5	5	5	0.87	0.78	1.16	0.76	252
360	540	200	200	5	5	2 760	6 150	475	**CRD-7201**	2	40	12	90	2-2	—	389.5	518	4.7	4	4	0.70	0.97	1.44	0.94	160
	650	240	240	6	3	4 000	7 950	590	☆ **CRD-7623**	3	50.8	40	45	2-2	—	435	622	1.5	2.5	5	1.05	0.64	0.96	0.63	329
380	650	240	240	6	3	4 000	7 950	590	☆ **CRD-7612**	2	50	15	90	2-2	—	430	622	8	2.5	5	1.05	0.64	0.96	0.63	338.2
381	695	280	280	6	6	5 300	9 950	730	☆ **CRD-7634**	3	50	45	45	2-2	—	448	550	4.2	5	5	0.87	0.78	1.16	0.76	476
	650	240	240	6	4	4 000	8 450	625	☆ **CRD-8026**	3	63.6	32	45	1-2	—	456	535	2.5	3	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	4	4 000	8 450	625	☆ **CRD-8032**	3	64.3	32	45	1-2	—	454	622	2.5	3	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8034**	3	64.3	32	45	1-2	—	454	622	1.5	5	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8035**	3	64.3	32	45	1-2	—	454	622	8	5	5	0.80	0.85	1.26	0.83	303
400	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8042**	3	64.3	32	45	1-2	—	454	622	2	5	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	5	3 700	7 450	550	☆ **CRD-8044**	3	64.3	32	45	1-2	—	437	525	8	4	5	1.05	0.64	0.96	0.63	292
	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8048**	3	64.3	32	45	2-2	—	456	628.5	1.5	5	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8049**	5	63.6	32	45	1-2	11.25	456	628.5	1.5	5	5	0.80	0.85	1.26	0.83	303
	650	240	240	6	6	4 000	8 450	625	☆ **CRD-8067**	3	64.3	41.3	45	1-2	—	456	628.5	1.5	5	5	0.80	0.85	1.26	0.83	302
460	720	250	250	6	2.5	4 950	10 100	720	☆ **CRD-9214**	3	50.8	35	45	2-2	—	500	692	4.8	2	5	0.80	0.85	1.26	0.83	388
482	655	160	170	3.3	3.3	2 520	6 200	410	**CRD-9618**	3	40	20	45	2-2	—	507	535	1.5	2.5	2.5	0.67	1.01	1.50	0.95	161

1) Smallest allowable dimension for chamfer dimension r or r_1. For details on special chamfer, please contact **NTN** Engineering.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.
Note: **CRD-7017** and **CRD-7004** have slots at the side face of inner ring.

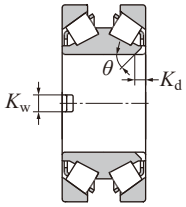
Double Row Steep Slope Face-to-Face Tapered Roller Bearings NTN



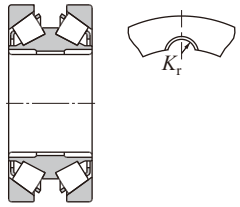
Drawing 1



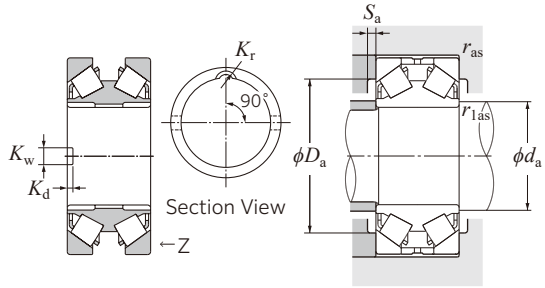
Drawing 2



Drawing 3



Drawing 4



Drawing 5

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

d 482.600-685.800 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number[2) 3)]	Drawing No.	Groove dimensions mm			Qty. × Side face	mm Key groove	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B	C_1	$r_{s\,min}$ [1)]	$r_{1s\,min}$ [1)]	C_r	C_{0r}	C_u	2) 3)		Width K_w	Depth K_d	Angle $\theta°$		K_r	d_a Min.	D_a Min.	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
482.600	733.500	200.000	200.000	Special chamfer	5	3 050	6 550	460	◎ ☆ **CRD-9717**	1	—	—	—	—	—	538	630	1.5	—	4	1.09	0.62	0.92	0.61	320
500	820	256	256	7.5	7.5	6 250	12 300	850	**CRD-10011**	1	—	—	—	—	—	562	696	7.8	6	6	0.61	1.11	1.66	1.09	543
509.948	733.425	200.020	200.020	5	5	3 600	8 350	580	◎ ☆ **CRD-10208**	3	50.8	38.1	45	2-2	—	560	711.5	8	4	4	0.87	0.78	1.16	0.76	256
	733.425	200.020	200.020	5	5	3 550	8 600	600	◎ ☆ **CRD-10211**	3	50.8	38.1	45	2-2	—	561.7	628	1.5	4	4	1.01	0.67	0.99	0.65	273
560	820	242	242	12	8	5 100	11 600	790	☆ **CRD-11219**	1	—	—	—	—	—	601	710	6.7	11	7	0.73	0.92	1.37	0.90	432
600	955	330	330	12	5	6 800	14 900	980	☆ **CRD-12012**	3	71.5	48	45	1-2	—	660.2	791	7.2	11	4	0.83	0.81	1.21	0.79	810
635.000	939.800	304.800	304.800	6.4	3.3	6 850	16 000	1 050	◎ ☆ **CRD-12705**	3	70.3	50.8	45	2-2	—	694	792	1.5	5	2.5	0.87	0.78	1.16	0.76	737
660.000	814.000	176.212	176.212	6.4	3.3	2 890	8 200	545	◎ ☆ **CRD-13210**	3	50	20	40	1-2	—	685	765	8	5	2.5	0.70	0.97	1.44	0.94	202
685.800	939.800	234.950	227.810	6.4	3.3	3 800	14 400	875	◎ ☆ **CRD-13705**	3	63.5	38.1	45	2-2	—	743	829	1.5	5	2.5	0.70	0.97	1.44	0.94	482
	939.800	234.950	227.813	6.4	3.3	5 500	13 500	875	◎ ☆ **CRD-13704**	3	63.5	38.1	45	2-2	—	743	829	1.5	5	2.5	0.70	0.97	1.44	0.94	464

1) Smallest allowable dimension for chamfer dimension r or r_1. For details on special chamfer, please contact **NTN** Engineering.
2) Bearing numbers marked "◎" designate inch series bearings.
3) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Double Row Steep Slope Face-to-Face Tapered Roller Bearings NTN

Spherical Roller Bearings

1. Types, design features, and characteristics

Spherical roller bearings consist of an outer ring having a continuous spherical raceway and two rows of barrel-shaped rollers guided by an inner ring with two raceways (see **Fig. 1**). This bearing has self-aligning properties, and therefore is suited for use where misalignment between the inner and outer rings occurs from housing installation error or shaft bending.

Spherical roller bearings have a large capacity for radial loads, axial loads in either direction, and combined loads. They are also suited for applications where vibration and shock loads are encountered. When spherical roller bearings are used with a vertical shaft or under a large axial load, the load on the rollers of the row that is not subject to the axial load becomes small, and the resulting skidding on the rollers may result in wear. If the ratio of the radial load exceeds the factor e in the dimension table ($F_a/F_r > e$), consult **NTN** Engineering.

In addition to spherical roller bearings with cylindrical bores, spherical roller bearings with tapered bores are also available. Bearings with tapered bores are specified by the suffix "K" at the end of the spherical roller bearing part number. The standard taper ratio is 1:12 for bearings with a "K" suffix; for bearings in series 240 and 241, the suffix "K30" indicates the taper ratio for a bearing is 1:30. Most tapered bore bearings incorporate the use of adapters and withdrawal sleeves for shaft mounting.

Table 1 shows the types of the spherical roller bearings.

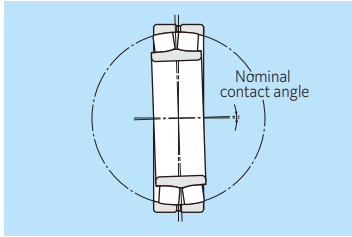


Fig. 1

2. Dimensional and rotational accuracy

Refer to **Table 3.3** (pages A-18 and A-19).

3. Recommended fits

For fits recommended for ULTAGE™ series, refer to **Table 2** and **Table 3**.

For fits recommended for non-ULTAGE™ series bearings, refer to **Table 4.2** (pages A-33 and A-34).

4. Bearing internal clearance

Refer to **Table 5.9** (pages A-46 and A-47).

5. Allowable misalignment

Spherical roller bearings have self-aligning properties. The allowable misalignment varies according to dimension series and load conditions, but the general allowable misalignment angles are listed below:

- Normal load or more:·····1/115
- Light load:·····1/30

* Misalignment beyond the above limits may cause the roller to protrude from the outer ring, causing interference with the peripheral components.

Table 1 Types of spherical roller bearings

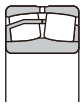
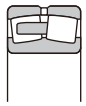
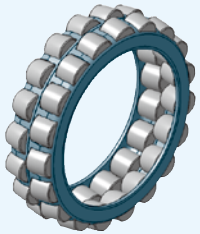
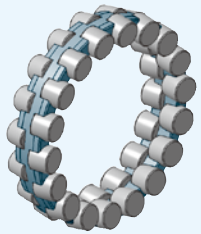
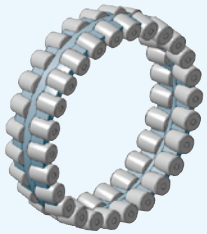
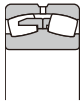
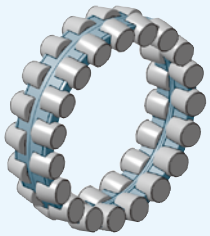
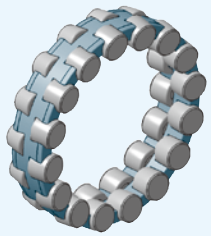
Type	ULTAGE™ series		
	Type EA	Type EM	Type EM (large size)
Design			
Bearing size	Series other than 213 type with outside diameter of 420 mm or smaller		Series with outside diameter of 440 to 580 mm
Roller	Symmetrical		
Cage type	Pressed cage	Machined cage	Machined cage
Cage shape			
Max. operating temperature	200 °C		
Type	Type B	Type 213	
Design			
Bearing size	Other than ULTAGE™ series (outside diameter of 600 mm or larger)	Series with bore diameter of 55 mm or larger	
Roller	Asymmetrical	Asymmetrical	
Cage type	Machined cage	Machined cage	
Cage shape			
Max. operating temperature	120 °C (instantaneous) 100 °C (continuous)		

Table 2 Shaft tolerance class in common use (ULTAGE™ series)

Conditions		Shaft diameter (mm) Over	Incl.	Shaft tolerance class	Remarks
Cylindrical bore bearing (Class 0)					
Inner ring rotational load or load of undetermined direction	Light load [1] or Normal load [1] or Fluctuating load	60	100	n6	
		100	200	p6	
		200	500	r6	
	Heavy load [1] or Impact load	70	140	p6	Use bearings with larger internal clearances than CN clearance bearings.
		140	200[2]	r6	
Static inner ring load	Inner ring must move easily over shaft	Overall shaft diameter		g6	For large bearings, f6 will suffice to facilitate movement.
	Inner ring does not have to move easily over shaft	Overall shaft diameter		h6	
Tapered bore bearing (Class 0) (with adapter or withdrawal sleeve)					
Full load		Overall shaft diameter		h9/IT5 [3]	h10/IT7 [3] will suffice for power transmitting shafts.

1) Standards for light loads, normal loads, and heavy loads
- Light loads: dynamic equivalent radial load ≤ $0.05C_r$
- Normal loads: $0.05C_r$ < dynamic equivalent radial load ≤ $0.10C_r$
- Heavy loads: $0.10C_r$ < dynamic equivalent radial load

2) When the shaft diameter exceeds 200 mm and the bearing is to be used under heavy load or impact load conditions, please consult **NTN** Engineering.

3) The shaft shape error (roundness, cylindricity, etc.) must be within the tolerance range of IT5 and IT7.

Note: 1. All values and fits listed in the above tables are for solid steel shafts.

2. Use the formula below to calculate necessary interference. The upper limit value should not exceed 1/1 000 of the shaft diameter.
- When $F_r \leq 0.3C_{0r}$, necessary interference Δ_{dF} (μm) is $\Delta_{dF} = 0.08\,(d \cdot F_r/B)^{1/2}$
- When $F_r > 0.3C_{0r}$, $\Delta_{dF} = 0.02(F_r/B)$

[d: bearing bore diameter (mm), B: inner ring width (mm), F_r: radial load, (N), C_{0r}: basic static load rating (N)]

When the difference between the bearing temperature and the ambient temperature during bearing operation is to be considered, consider the effective interference Δ_{dT} (μm) by the temperature difference as the necessary interference.

$\Delta_{dT} = 0.0015 \cdot d \cdot \Delta T$

(ΔT: Difference between bearing temperature and ambient temperature °C)

Table 3 Housing bore tolerance class in common use (ULTAGE™ series)

Conditions				Housing bore tolerance class	Remarks
Housing	Load type, etc.		Outer ring axial direction movement		
Single housing or split housing	Static outer ring load	All types of loads	Yes	H7	G7 can be used for large bearings or bearings with large temperature differential between the outer ring and housing.
		Light [1] or normal load [1]	Yes	H8	—
		Shaft and inner ring become hot	Easily	G7	F7 can be used for large bearings or bearings with a large temperature differential between the outer ring and housing.
Single housing		Requires precise rotation under light or normal loads	As a rule, it cannot move.	K6	—
			Yes	JS6	—
		Requires low noise operation	Yes	H6	—
	Indeterminate load	Light or normal load	Yes	JS7	—
		Normal or heavy load [1]	As a rule, it cannot move.	K7	—
		High impact load	No	M7	—
	Rotating outer ring load	Light or fluctuating load	No	M7	—
		Normal or heavy load	No	N7	—
		Heavy load or large impact load with thin wall housing	No	P7	—

1) Standards for light loads, normal loads, and heavy loads
- Light loads: dynamic equivalent radial load ≤ $0.05C_r$
- Normal loads: $0.05C_r$ < dynamic equivalent radial load ≤ $0.10C_r$
- Heavy loads: $0.10C_r$ < dynamic equivalent radial load

Note: All values and fits listed in the above tables are for cast iron or steel housings.

6. Oil inlet and groove for outer ring

Both ULTAGE™ series and type B spherical roller bearings are provided with oil inlets and an oil groove (see **Fig. 2** and **Table 4**).

Type 213 does not have oil inlets and grooves. However, they can be made based on customer requests. Contact **NTN** Engineering with the bearing numbers and supplementary suffix code "D1".

If a pin to prevent outer ring rotation is necessary, contact **NTN** Engineering.

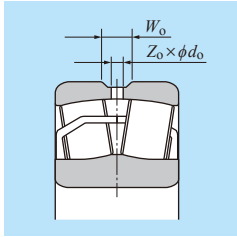


Fig. 2

Table 4 Oil inlet number

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
—	320	4
320	1 010	8
1 010	—	12

Note: For oil groove width W_o and diameter of oil inlet d_o, see the dimension table.

7. Installation of tapered bore bearings

For tapered bore spherical roller bearings, the measurement method shown in **Fig. 3** is used, and the predetermined interference is obtained when the bearing has been driven onto the shaft until the radial internal clearance reduction amount shown in **Table 5.1** [applied to ULTAGE™ series][1] and **Table 5.2** [applied to non-ULTAGE™ series] is reached.

Please treat the axial displacement drive up amounts in **Table 5.1** and **Table 5.2** as reference values only.

For conditions such as heavy loads, high speeds, or when there is a large temperature differential between inner and outer rings, etc., which require large interference fits, bearings with a minimum radial internal clearance of C3 or greater should be used and the reduction of radial internal clearance should be the maximum value shown in **Table 5.1** or **Table 5.2**. In addition, the reduction of radial internal clearance at this time must be greater than or equal to the minimum residual radial internal clearance shown in **Table 5.1** or **Table 5.2**.

Note: 1) Does not apply to ULTAGE™ series sealed spherical roller bearings [EMLLX Type]. This bearing, refer to **Table 1** (page C-15) in section "Special Application Bearings".

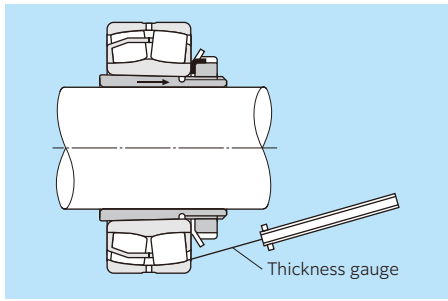


Fig. 3 Internal clearance measurement method for spherical roller bearings

Table 5.1 Installing tapered bore spherical roller bearings [ULTAGE™ series][1)] Unit: mm

Nominal bearing bore diameter d		Reduction of radial internal clearance		Axial displacement drive up				Nut rotation angle[2)] ° (approx.)				Minimum residual radial internal clearance[3)]		
				Taper, 1:12		Taper, 1:30		Taper, 1:12		Taper, 1:30				
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	CN	C3	C4
80	100	0.040	0.050	0.60	0.70	—	—	108	126	—	—	0.030	0.060	0.090
100	120	0.055	0.065	0.80	0.90	1.80	2.30	144	162	324	414	0.035	0.070	0.105
120	140	0.065	0.075	0.90	1.00	1.95	2.70	162	180	351	486	0.045	0.085	0.125
140	150	0.075	0.090	1.00	1.20	2.35	3.10	180	216	423	558	0.040	0.090	0.140
150	160	0.075	0.090	1.00	1.20	2.35	3.10	120	144	282	372	0.040	0.090	0.140
160	180	0.080	0.100	1.10	1.40	2.80	3.55	132	168	336	426	0.040	0.100	0.160
180	200	0.090	0.110	1.20	1.50	3.20	3.95	144	180	384	474	0.050	0.110	0.180
200	225	0.110	0.130	1.50	1.80	3.85	4.60	135	162	347	414	0.050	0.120	0.190
225	250	0.120	0.140	1.60	1.90	4.20	4.95	144	171	378	446	0.060	0.130	0.210
250	280	0.130	0.160	1.60	2.10	4.25	5.40	144	189	383	486	0.060	0.140	0.230
280	305	0.150	0.180	1.90	2.40	4.45	5.70	171	216	401	513	0.060	0.150	0.250
305	315	0.150	0.180	1.90	2.40	4.45	5.70	137	173	320	410	0.060	0.150	0.250
315	355	0.160	0.190	2.10	2.50	5.10	6.10	151	180	367	439	0.080	0.170	0.280
355	400	0.180	0.220	2.30	3.00	5.75	7.50	166	216	414	540	0.080	0.180	0.300
400	450	0.210	0.250	3.00	3.60	—	—	216	259	—	—	0.080	0.190	0.320

1) For EMLLX type, refer to **Table 1** (page C-15) in section "Special Application Bearings".
2) The nut rotation angle may only be applied when a nut having the same bore diameter code as the bearing is used.
3) Minimum residual radial internal clearance: Standard value of radial internal clearance (min.) - reduction in radial internal clearance (max.)

Table 5.2 Installing tapered bore spherical roller bearings [non-ULTAGE™ series] Unit: mm

Nominal bearing bore diameter d		Reduction of radial internal clearance		Axial displacement drive up				Nut rotation angle[4)] ° (approx.)				Minimum residual radial internal clearance[5)]		
				Taper, 1:12		Taper, 1:30		Taper, 1:12		Taper, 1:30				
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	CN	C3	C4
80	100	0.045	0.055	0.70	0.80	1.75	2.25	126	144	315	405	0.025	0.055	0.085
100	120	0.050	0.060	0.75	0.90	1.90	2.25	135	162	342	405	0.040	0.075	0.110
120	140	0.065	0.075	1.10	1.20	2.75	3.00	198	216	495	540	0.045	0.085	0.130
140	150	0.075	0.090	1.20	1.40	3.00	3.75	216	252	540	675	0.040	0.090	0.140
150	160	0.075	0.090	1.20	1.40	3.00	3.75	144	168	360	450	0.040	0.090	0.140
160	180	0.080	0.100	1.30	1.60	3.25	4.00	156	192	390	480	0.040	0.100	0.160
180	200	0.090	0.110	1.40	1.70	3.50	4.25	168	204	420	510	0.050	0.110	0.180
200	225	0.100	0.120	1.60	1.90	4.00	4.75	144	171	360	428	0.060	0.130	0.200
225	250	0.110	0.130	1.70	2.00	4.25	5.00	153	180	383	450	0.070	0.140	0.220
250	280	0.120	0.150	1.90	2.40	4.75	6.00	171	216	428	540	0.070	0.150	0.240
280	305	0.130	0.160	2.00	2.50	5.00	6.25	180	225	450	563	0.080	0.170	0.270
305	315	0.130	0.160	2.00	2.50	5.00	6.25	144	180	360	450	0.080	0.170	0.270
315	355	0.150	0.180	2.40	2.80	6.00	7.00	173	202	432	504	0.090	0.180	0.290
355	400	0.170	0.210	2.60	3.30	6.50	8.25	187	238	468	594	0.090	0.190	0.310
400	450	0.200	0.240	3.10	3.70	7.75	9.25	223	266	558	666	0.090	0.200	0.330
450	500	0.210	0.260	3.30	4.00	8.25	10.0	238	288	594	720	0.110	0.230	0.370
500	560	0.240	0.300	3.70	4.60	9.25	11.5	222	276	555	690	0.110	0.240	0.380
560	630	0.260	0.330	4.00	5.10	10.0	12.5	240	306	600	750	0.130	0.270	0.430
630	670	0.300	0.370	4.60	5.70	11.5	14.5	276	342	690	870	0.140	0.300	0.480
670	710	0.300	0.370	4.60	5.70	11.5	14.5	237	293	591	746	0.140	0.300	0.480
710	800	0.340	0.430	5.30	6.70	13.3	16.5	273	345	684	849	0.140	0.320	0.530
800	900	0.370	0.470	5.70	7.30	14.3	18.5	293	375	735	951	0.170	0.370	0.600
900	1 000	0.410	0.530	6.30	8.20	15.8	20.5	284	369	711	923	0.180	0.400	0.660
1 000	1 120	0.450	0.580	6.80	8.70	17.0	22.5	306	392	765	1 013	0.190	0.450	0.720
1 120	1 250	0.490	0.630	7.40	9.40	18.5	24.5	—	—	—	—	0.200	0.490	0.790

4) The nut rotation angle may only be applied when a nut having the same bore diameter code as the bearing is used.
5) Minimum residual radial internal clearance: Standard value of rad ial internal clearance (min.) - reduction in radial internal clearance (max.)

8. Adapters and withdrawal sleeves

Adapters are used for installation of bearings with tapered bores on cylindrical shafts (see **Fig. 4**). Withdrawal sleeves are also used to install and disassemble bearings with tapered bores onto and off of cylindrical shafts (see **Fig. 5**). In disassembling the bearing from the shaft, the nut is turned against the side face of the inner ring utilizing the bolt provided on the withdrawal sleeve, and then the sleeve is drawn away from the bearing's bore (Precision and dimensions of adapter and withdrawal sleeve are defined in JIS B 1552 and JIS B 1556).

For bearings with a bore diameter of 200 mm or more, high pressure oil (hydraulic) type adapters and withdrawal sleeves can be made to make installation and disassembly easier. As shown in **Fig. 6** construction is designed to reduce friction by injecting high pressure oil between the surfaces of the adapter sleeve and bearing inner bore by means of a pressure fitting.

If the oil supply inlet is attached in the nut side of the adapter, the supplementary suffix "HF" is added to the bearing number; if the oil supply inlet is attached on the opposite side, the suffix "HB" is added to the bearing number. For adapter sleeves, the supplementary suffix "H" is added to the bearing's number for both cases. The hydraulic sleeve nut is equipped with holes for bolts used for mounting and dismounting and holes for hydraulic piping. The suffix SP (with screw holes) or SPB (with bolts) is added to the bearing number of the nut.

For information on the hydraulic adapters and withdrawal sleeves, see the special catalog "**Adapters, Withdrawal Sleeves, Locknuts, Lockwashers & Lockplates, Hydraulic Nuts (CAT. No. 4201/E)**".

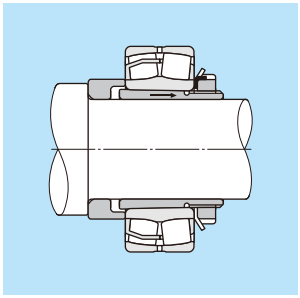


Fig. 4

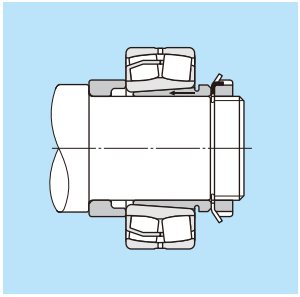


Fig. 5

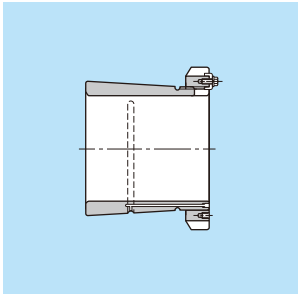
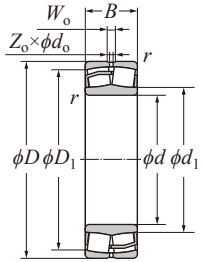
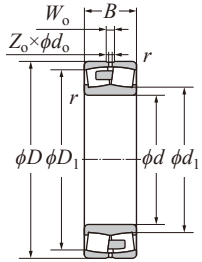


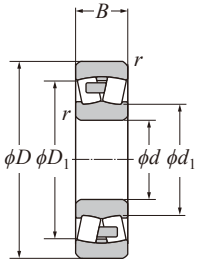
Fig. 6



Cylindrical bore [Type EA]

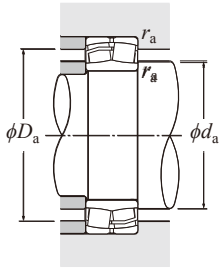


Cylindrical bore [Type EM]



Cylindrical bore [Type 213]

Tapered bore



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

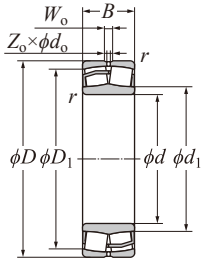
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
—	320	4

d 100-120 mm

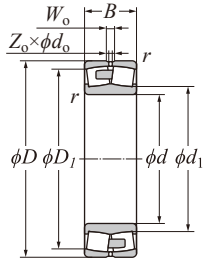
Boundary dimensions mm						Basic load rating kN		Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
						dynamic	static														
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
100	165	52	2	8	4	464	563	30.7	* 23120EAD1	* 23120EAKD1	114	147	111	154	2	0.28	2.39	3.56	2.34	4.37	4.24
	165	52	2	8	4	480	590	32.1	* 23120EMD1	* 23120EMKD1	114	147	111	154	2	0.28	2.39	3.56	2.34	4.45	4.32
	180	46	2.1	11	5	472	495	36.9	* 22220EAD1	* 22220EAKD1	118	161	112	168	2.1	0.24	2.84	4.23	2.78	4.9	4.8
	180	46	2.1	11	5	472	495	36.9	* 22220EMD1	* 22220EMKD1	118	161	112	168	2.1	0.24	2.84	4.23	2.78	5.02	4.93
	180	60.3	2.1	9	4.5	586	661	36.3	* 23220EMD1	* 23220EMKD1	118	159	112	168	2.1	0.31	2.18	3.24	2.13	6.51	6.33
	215	47	3	9	5	410	465	42.5	21320	21320K	133	179	114	201	2.5	0.22	3.01	4.48	2.94	8.88	8.79
	215	73	3	13	6	827	844	50.1	* 22320EAD1	* 22320EAKD1	127	187	114	201	3	0.34	1.98	2.94	1.93	12.6	12.3
	215	73	3	13	6	827	844	50.1	* 22320EMD1	* 22320EMKD1	127	187	114	201	3	0.34	1.98	2.94	1.93	12.6	12.3
110	170	45	2	8	3.5	417	517	32.1	* 23022EAD1	* 23022EAKD1	123	155	119	161	2	0.23	2.95	4.40	2.89	3.66	3.55
	170	45	2	8	3.5	417	517	32.1	* 23022EMD1	* 23022EMKD1	123	155	119	161	2	0.23	2.95	4.40	2.89	3.66	3.55
	180	56	2	9	4	547	669	36.2	* 23122EAD1	* 23122EAKD1	125	161	121	169	2	0.28	2.43	3.61	2.37	5.66	5.49
	180	56	2	9	4	547	669	36.2	* 23122EMD1	* 23122EMKD1	125	161	121	169	2	0.28	2.43	3.61	2.37	5.53	5.36
	180	69	2	8	4	622	769	35.7	* 24122EMD1	* 24122EMK30D1	121	158	121	169	2	0.36	1.90	2.83	1.86	6.75	6.65
	200	53	2.1	12	6	602	643	45	* 22222EAD1	* 22222EAKD1	130	179	122	188	2.1	0.25	2.69	4.00	2.63	7.1	6.95
	200	53	2.1	12	6	602	643	45	* 22222EMD1	* 22222EMKD1	130	179	122	188	2.1	0.25	2.69	4.00	2.63	7.3	7.15
	200	69.8	2.1	11	5	752	869	43.9	* 23222EMD1	* 23222EMKD1	130	176	122	188	2.1	0.32	2.12	3.15	2.07	9.41	9.14
	240	50	3	9	5	550	615	61.5	21322	21322K	146	203	124	226	2.5	0.21	3.20	4.77	3.13	11.9	11.8
	240	80	3	16	7	975	972	59	* 22322EAD1	* 22322EAKD1	139	209	124	226	3	0.32	2.09	3.11	2.04	17	16.6
	240	80	3	16	7	975	972	59	* 22322EMD1	* 22322EMKD1	139	209	124	226	3	0.32	2.09	3.11	2.04	17.4	17.1
120	180	46	2	8	3.5	446	577	35.8	* 23024EAD1	* 23024EAKD1	134	165	129	171	2	0.22	3.14	4.67	3.07	4.02	3.9
	180	46	2	8	3.5	446	577	35.8	* 23024EMD1	* 23024EMKD1	134	165	129	171	2	0.22	3.14	4.67	3.07	4.02	3.9
	180	60	2	8	3.5	526	726	34.4	* 24024EMD1	* 24024EMK30D1	132	161	129	171	2	0.29	2.32	3.45	2.26	5.28	5.21
	200	62	2	10	4.5	663	820	43.4	* 23124EAD1	* 23124EAKD1	138	179	131	189	2	0.28	2.43	3.61	2.37	7.72	7.49
	200	62	2	10	4.5	663	820	43.4	* 23124EMD1	* 23124EMKD1	138	179	131	189	2	0.28	2.43	3.61	2.37	7.77	7.54

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "*" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Note: For type 213 bearings, outer rings with oil inlets and oil grooves can also be made based on your request.
In this case, supplementary suffix "**D1**" is added after a bearing number. Example: **21322D1**



Cylindrical bore
[Type EA]



Cylindrical bore
[Type EM]

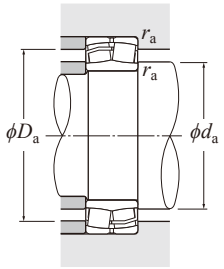
Tapered bore

d 120-140 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
120	200	80	2	10	4.5	756	991	41.3	∗ **24124EMD1**	∗ **24124EMK30D1**	136	173	131	189	2	0.37	1.84	2.74	1.80	10	9.87
	215	58	2.1	12	6	688	753	49.9	∗ **22224EAD1**	∗ **22224EAKD1**	141	193	132	203	2	0.25	2.74	4.08	2.68	8.88	8.68
	215	58	2.1	12	6	688	753	49.9	∗ **22224EMD1**	∗ **22224EMKD1**	141	193	132	203	2	0.25	2.74	4.08	2.68	9.01	8.82
	215	76	2.1	11	5	857	998	49.8	∗ **23224EMD1**	∗ **23224EMKD1**	139	190	132	203	2	0.32	2.09	3.11	2.04	11.7	11.3
	260	86	3	18	8	1 170	1 280	68.4	∗ **22324EAD1**	∗ **22324EAKD1**	156	225	134	246	3	0.32	2.09	3.11	2.04	22.3	21.9
	260	86	3	18	8	1 170	1 280	68.4	∗ **22324EMD1**	∗ **22324EMKD1**	156	225	134	246	3	0.32	2.09	3.11	2.04	22.7	22.2
130	200	52	2	9	4	565	721	44.2	∗ **23026EAD1**	∗ **23026EAKD1**	145	183	139	191	2	0.22	3.01	4.48	2.94	5.88	5.71
	200	52	2	9	4	565	721	44.2	∗ **23026EMD1**	∗ **23026EMKD1**	145	183	139	191	2	0.22	3.01	4.48	2.94	5.9	5.73
	200	69	2	9	4	682	936	42.2	∗ **24026EMD1**	∗ **24026EMK30D1**	143	178	139	191	2	0.31	2.20	3.27	2.15	7.82	7.71
	210	64	2	10	4.5	710	906	47.1	∗ **23126EAD1**	∗ **23126EAKD1**	148	189	141	199	2	0.27	2.51	3.74	2.45	8.45	8.19
	210	64	2	10	4.5	710	906	47.1	∗ **23126EMD1**	∗ **23126EMKD1**	148	189	141	199	2	0.27	2.51	3.74	2.45	8.51	8.25
	210	80	2	10	4.5	803	1 080	45	∗ **24126EMD1**	∗ **24126EMK30D1**	146	183	141	199	2	0.34	1.96	2.92	1.92	10.7	10.5
	230	64	3	13	6	808	898	56.6	∗ **22226EAD1**	∗ **22226EAKD1**	151	206	144	216	3	0.25	2.69	4.00	2.63	11	10.7
	230	64	3	13	6	808	898	56.6	∗ **22226EMD1**	∗ **22226EMKD1**	151	206	144	216	3	0.25	2.69	4.00	2.63	11.1	10.9
	230	80	3	12	5	958	1 130	55.4	∗ **23226EMD1**	∗ **23226EMKD1**	150	203	144	216	3	0.32	2.12	3.15	2.07	13.8	13.4
	280	93	4	19	9	1 330	1 400	77.8	∗ **22326EAD1**	∗ **22326EAKD1**	164	243	147	263	4	0.33	2.06	3.06	2.01	27.2	26.6
	280	93	4	19	9	1 330	1 400	77.8	∗ **22326EMD1**	∗ **22326EMKD1**	164	243	147	263	4	0.33	2.06	3.06	2.01	28	27.5
140	210	53	2	9	4	597	783	47.5	∗ **23028EAD1**	∗ **23028EAKD1**	155	193	149	201	2	0.22	3.14	4.67	3.07	6.32	6.13
	210	53	2	9	4	597	783	47.5	∗ **23028EMD1**	∗ **23028EMKD1**	155	193	149	201	2	0.22	3.14	4.67	3.07	6.37	6.18
	210	69	2	9	4	709	990	46	∗ **24028EMD1**	∗ **24028EMK30D1**	153	188	149	201	2	0.28	2.37	3.53	2.32	8.27	8.15
	225	68	2.1	11	5	802	1 030	53.1	∗ **23128EAD1**	∗ **23128EAKD1**	159	203	152	213	2.1	0.26	2.55	3.80	2.50	10.3	9.94
	225	68	2.1	11	5	802	1 030	53.1	∗ **23128EMD1**	∗ **23128EMKD1**	159	203	152	213	2.1	0.26	2.55	3.80	2.50	10.3	10
	225	85	2.1	10	4.5	951	1 280	53.3	∗ **24128EMD1**	∗ **24128EMK30D1**	156	198	152	213	2.1	0.34	1.98	2.94	1.93	12.9	12.8
	250	68	3	14	7	912	1 010	65.8	∗ **22228EAD1**	∗ **22228EAKD1**	163	224	154	236	3	0.25	2.74	4.08	2.68	13.9	13.6

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "∗" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



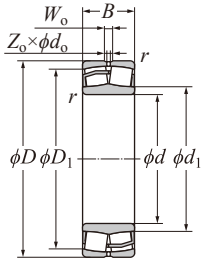
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

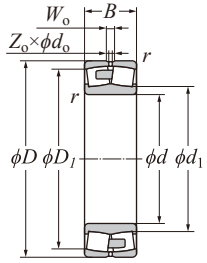
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
—	320	4



Cylindrical bore
[Type EA]



Cylindrical bore
[Type EM]

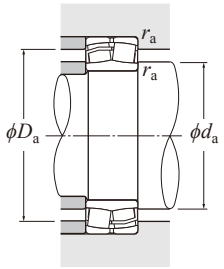
Tapered bore

d 140-160 mm

Boundary dimensions mm						Basic load rating kN dynamic	Basic load rating kN static	Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
140	250	68	3	14	7	912	1 010	65.8	* **22228EMD1**	* **22228EMKD1**	163	224	154	236	3	0.25	2.74	4.08	2.68	14.2	13.9
	250	88	3	13	6	1 140	1 370	64.2	* **23228EMD1**	* **23228EMKD1**	162	220	154	236	3	0.33	2.06	3.06	2.01	18.2	17.7
	300	102	4	19	9	1 540	1 720	88.8	* **22328EAD1**	* **22328EAKD1**	181	261	157	283	4	0.33	2.03	3.02	1.98	34.4	33.7
	300	102	4	19	9	1 540	1 720	88.8	* **22328EMD1**	* **22328EMKD1**	181	261	157	283	4	0.33	2.03	3.02	1.98	35.4	34.7
150	225	56	2.1	10	4.5	660	893	52.9	* **23030EAD1**	* **23030EAKD1**	167	207	161	214	2.1	0.21	3.20	4.70	3.13	7.68	7.45
	225	56	2.1	10	4.5	660	893	52.9	* **23030EMD1**	* **23030EMKD1**	167	207	161	214	2.1	0.21	3.20	4.70	3.13	7.73	7.5
	225	75	2.1	10	4.5	789	1 140	51.2	* **24030EMD1**	* **24030EMK30D1**	165	202	161	214	2.1	0.29	2.32	3.45	2.26	10.4	10.3
	250	80	2.1	13	6	1 060	1 350	65.1	* **23130EAD1**	* **23130EAKD1**	171	223	162	238	2.1	0.29	2.35	3.50	2.30	15.7	15.2
	250	80	2.1	13	6	1 060	1 350	65.1	* **23130EMD1**	* **23130EMKD1**	171	223	162	238	2.1	0.29	2.35	3.50	2.30	15.8	15.3
	250	100	2.1	12	6	1 180	1 590	62.8	* **24130EMD1**	* **24130EMK30D1**	168	216	162	238	2.1	0.36	1.85	2.76	1.81	19.7	19.4
	270	73	3	15	7	1 080	1 220	74.4	* **22230EAD1**	* **22230EAKD1**	177	242	164	256	3	0.25	2.74	4.08	2.68	17.6	17.3
	270	73	3	15	7	1 080	1 220	74.4	* **22230EMD1**	* **22230EMKD1**	177	242	164	256	3	0.25	2.74	4.08	2.68	18	17.7
	270	96	3	14	6	1 340	1 620	74	* **23230EMD1**	* **23230EMKD1**	174	237	164	256	3	0.33	2.03	3.02	1.98	23.6	22.9
	320	108	4	20	9	1 740	1 890	98.9	* **22330EMD1**	* **22330EMKD1**	188	279	167	303	4	0.34	2.00	2.98	1.96	42.2	41.3
160	220	45	2	9	4	455	683	45.6	* **23932EMD1**	* **23932EMKD1**	175	205	169	211	2	0.17	3.90	5.81	3.81	5.09	4.94
	240	60	2.1	11	5	748	1 000	59.1	* **23032EAD1**	* **23032EAKD1**	177	221	171	229	2.1	0.21	3.20	4.77	3.13	9.32	9.03
	240	60	2.1	11	5	748	1 000	59.1	* **23032EMD1**	* **23032EMKD1**	177	221	171	229	2.1	0.21	3.20	4.77	3.13	9.37	9.09
	240	80	2.1	10	5	901	1 290	56.8	* **24032EMD1**	* **24032EMK30D1**	175	215	171	229	2.1	0.29	2.32	3.45	2.26	12.6	12.4
	270	86	2.1	14	6	1 220	1 580	73.6	* **23132EAD1**	* **23132EAKD1**	185	240	172	258	2.1	0.29	2.35	3.50	2.30	20.1	19.5
	270	86	2.1	14	6	1 220	1 580	73.6	* **23132EMD1**	* **23132EMKD1**	185	240	172	258	2.1	0.29	2.35	3.50	2.30	20.2	19.6
	270	109	2.1	14	6	1 360	1 860	70.6	* **24132EMD1**	* **24132EMK30D1**	181	232	172	258	2	0.37	1.83	2.72	1.79	25.4	25.1
	290	80	3	17	8	1 220	1 390	84.1	* **22232EAD1**	* **22232EAKD1**	190	260	174	276	3	0.25	2.69	4.00	2.63	22.3	21.8
	290	80	3	17	8	1 220	1 390	84.1	* **22232EMD1**	* **22232EMKD1**	190	260	174	276	3	0.25	2.69	4.00	2.63	22.9	22.4
	290	104	3	15	7	1 550	1 890	83.8	* **23232EMD1**	* **23232EMKD1**	187	254	174	276	3	0.33	2.03	3.02	1.98	29.6	28.8

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "*" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



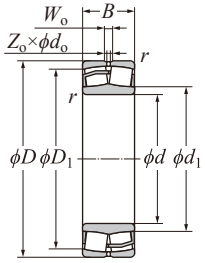
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

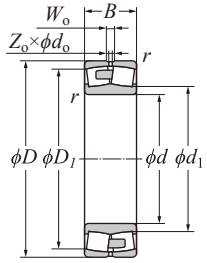
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
—	320	4
320	1 010	8



Cylindrical bore
[Type EA]



Cylindrical bore
[Type EM]

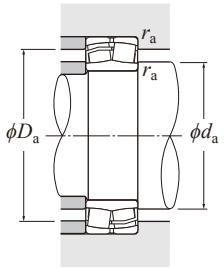
Tapered bore

d 160-190 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
160	340	114	4	20	10	1 950	2 210	109	＊ **22332EMD1**	＊ **22332EMKD1**	205	296	177	323	4	0.33	2.03	3.02	1.98	50.5	49.5
	230	45	2	9	4.5	468	723	48.8	＊ **23934EMD1**	＊ **23934EMKD1**	185	215	179	221	2	0.16	4.11	6.12	4.02	5.39	5.23
	260	67	2.1	12	5	914	1 240	68.8	＊ **23034EAD1**	＊ **23034EAKD1**	190	238	181	249	2.1	0.22	3.07	4.57	3.00	12.7	12.3
	260	67	2.1	12	5	914	1 240	68.8	＊ **23034EMD1**	＊ **23034EMKD1**	190	238	181	249	2.1	0.22	3.07	4.57	3.00	12.8	12.4
	260	90	2.1	11	5	1 100	1 600	66.3	＊ **24034EMD1**	＊ **24034EMK30D1**	186	231	181	249	2.1	0.30	2.23	3.32	2.18	17.2	16.9
170	280	88	2.1	14	6	1 270	1 700	77.3	＊ **23134EAD1**	＊ **23134EAKD1**	195	250	182	268	2.1	0.28	2.39	3.56	2.34	21.5	20.9
	280	88	2.1	14	6	1 270	1 700	77.3	＊ **23134EMD1**	＊ **23134EMKD1**	195	250	182	268	2.1	0.28	2.39	3.56	2.34	21.6	20.9
	280	109	2.1	14	6	1 410	1 990	74.4	＊ **24134EMD1**	＊ **24134EMK30D1**	193	243	182	268	2	0.35	1.91	2.85	1.87	26.7	26.3
	310	86	4	18	8	1 400	1 610	94.7	＊ **22234EMD1**	＊ **22234EMKD1**	201	277	187	293	4	0.26	2.60	3.87	2.54	28.3	27.7
	310	110	4	16	8	1 700	2 070	94.6	＊ **23234EMD1**	＊ **23234EMKD1**	199	272	187	293	4	0.33	2.03	3.02	1.98	35.8	34.8
	360	120	4	20	10	2 200	2 630	121	＊ **22334EMD1**	＊ **22334EMKD1**	223	313	187	343	4	0.32	2.09	3.11	2.04	60.3	59.1
180	250	52	2	10	5	573	869	57.2	＊ **23936EMD1**	＊ **23936EMKD1**	199	232	189	241	2	0.17	3.90	5.81	3.81	7.79	7.56
	280	74	2.1	13	6	1 080	1 450	78.6	＊ **23036EAD1**	＊ **23036EAKD1**	201	255	191	269	2.1	0.23	2.95	4.40	2.89	16.8	16.3
	280	74	2.1	13	6	1 080	1 450	78.6	＊ **23036EMD1**	＊ **23036EMKD1**	201	255	191	269	2.1	0.23	2.95	4.40	2.89	16.9	16.4
	280	100	2.1	13	6	1 310	1 880	76	＊ **24036EMD1**	＊ **24036EMK30D1**	199	248	191	269	2	0.31	2.15	3.20	2.10	22.8	22.4
	300	96	3	15	7	1 490	1 960	88.7	＊ **23136EAD1**	＊ **23136EAKD1**	205	267	194	286	3	0.29	2.32	3.45	2.26	27.2	26.4
	300	96	3	15	7	1 490	1 960	88.7	＊ **23136EMD1**	＊ **23136EMKD1**	205	267	194	286	3	0.29	2.32	3.45	2.26	27.4	26.5
	300	118	3	15	7	1 660	2 290	85.5	＊ **24136EMD1**	＊ **24136EMK30D1**	202	259	194	286	3	0.36	1.87	2.79	1.83	33.5	33
	320	86	4	18	8	1 450	1 660	101	＊ **22236EMD1**	＊ **22236EMKD1**	209	287	197	303	4	0.25	2.74	4.08	2.68	29.3	28.7
	320	112	4	16	8	1 880	2 270	101	＊ **23236EMD1**	＊ **23236EMKD1**	210	282	197	303	4	0.33	2.06	3.06	2.01	38.2	37.1
	380	126	4	21	10	2 420	2 810	132	＊ **22336EMD1**	＊ **22336EMKD1**	229	329	197	363	4	0.32	2.09	3.11	2.04	70.2	68.7
190	260	52	2	10	5	603	935	62.8	＊ **23938EMD1**	＊ **23938EMKD1**	209	243	199	251	2	0.17	4.05	6.04	3.96	8.2	7.96
	290	75	2.1	13	6	1 140	1 570	83.5	＊ **23038EAD1**	＊ **23038EAKD1**	213	266	201	279	2.1	0.22	3.01	4.48	2.94	17.8	17.3
	290	75	2.1	13	6	1 140	1 570	83.5	＊ **23038EMD1**	＊ **23038EMKD1**	213	266	201	279	2.1	0.22	3.01	4.48	2.94	17.9	17.4

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "＊" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



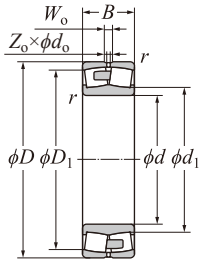
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

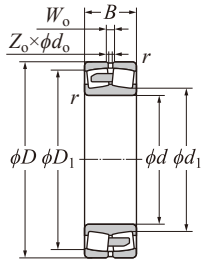
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

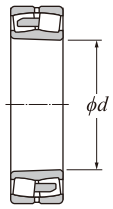
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
—	320	4
320	1 010	8



Cylindrical bore
[Type EM]



Cylindrical bore
[Type EM (large size)]

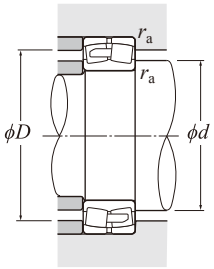


Tapered bore

d 190-240 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
190	290	100	2.1	13	6	1 360	2 000	80.7	* **24038EMD1**	* **24038EMK30D1**	209	258	201	279	2.1	0.30	2.23	3.32	2.18	23.8	23.4
	320	104	3	17	8	1 670	2 250	100	* **23138EMD1**	* **23138EMKD1**	221	284	204	306	3	0.29	2.32	3.45	2.26	34.3	33.2
	320	128	3	16	8	1 900	2 700	96.8	* **24138EMD1**	* **24138EMK30D1**	216	275	204	306	3	0.37	1.84	2.74	1.80	42.1	41.5
	340	92	4	20	9	1 620	1 870	112	* **22238EMD1**	* **22238EMKD1**	222	305	207	323	4	0.25	2.74	4.08	2.68	35.6	34.9
	340	120	4	18	8	1 990	2 480	109	* **23238EMD1**	* **23238EMKD1**	220	299	207	323	4	0.33	2.03	3.02	1.98	46.1	44.7
	400	132	5	21	10	2 600	3 120	145	* **22338EMD1**	* **22338EMKD1**	247	346	210	380	5	0.32	2.12	3.15	2.07	81.5	79.9
200	280	60	2.1	12	6	766	1 190	71.8	* **23940EMD1**	* **23940EMKD1**	221	260	211	269	2.1	0.18	3.76	5.59	3.67	12	11.6
	310	82	2.1	15	7	1 310	1 790	94.1	* **23040EMD1**	* **23040EMKD1**	223	283	211	299	2.1	0.23	2.95	4.40	2.89	22.8	22.1
	310	109	2.1	14	7	1 570	2 280	91.1	* **24040EMD1**	* **24040EMK30D1**	221	275	211	299	2.1	0.31	2.18	3.24	2.13	30.2	29.7
	340	112	3	18	8	1 890	2 510	110	* **23140EMD1**	* **23140EMKD1**	231	301	214	326	3	0.30	2.25	3.34	2.20	41.9	40.6
	340	140	3	17	8	2 130	2 930	105	* **24140EMD1**	* **24140EMK30D1**	224	291	214	326	3	0.39	1.74	2.59	1.70	51.5	50.7
	360	98	4	20	10	1 810	2 100	124	* **22240EMD1**	* **22240EMKD1**	234	323	217	343	4	0.25	2.74	4.08	2.68	42.7	41.8
	360	128	4	19	9	2 250	2 840	120	* **23240EMD1**	* **23240EMKD1**	232	315	217	343	4	0.34	1.98	2.94	1.93	55.2	53.6
	420	138	5	21	10	2 830	3 530	158	* **22340EMD1**	* **22340EMKD1**	265	364	220	400	5	0.31	2.15	3.20	2.10	94.6	92.7
220	300	60	2.1	12	6	789	1 260	79.4	* **23944EMD1**	* **23944EMKD1**	241	280	231	289	2.1	0.17	4.05	6.04	3.96	12.5	12.1
	340	90	3	15	7	1 530	2 110	109	* **23040EMD1**	* **23040EMKD1**	246	310	233	327	3	0.23	2.95	4.40	2.89	29.9	29.1
	340	118	3	15	7	1 850	2 720	106	* **24044EMD1**	* **24044EMK30D1**	243	302	233	327	3	0.31	2.20	3.27	2.15	39.2	38.6
	370	120	4	19	9	2 190	2 940	128	* **23144EMD1**	* **23144EMKD1**	252	328	237	353	4	0.30	2.28	3.39	2.23	52.3	50.7
	370	150	4	19	9	2 540	3 620	124	* **24144EMD1**	* **24144EMK30D1**	247	317	237	353	4	0.38	1.78	2.65	1.74	65.2	64.3
	400	108	4	21	11	2 210	2 690	149	* **22244EMD1**	* **22244EMKD1**	264	358	237	383	4	0.25	2.74	4.08	2.68	59.6	58.4
	400	144	4	20	10	2 890	3 830	147	* **23244EMD1**	* **23244EMKD1**	261	349	237	383	4	0.34	2.00	2.98	1.96	79.4	77.1
	460	145	5	20	12	3 010	3 560	143	* **22344EMD1**	* **22344EMKD1**	277	388	240	440	5	0.32	2.10	3.13	2.06	119	116
240	320	60	2.1	12	6	815	1 350	87.7	* **23948EMD1**	* **23948EMKD1**	262	301	251	309	2.1	0.15	4.40	6.56	4.31	14	13.1
	360	92	3	16	8	1 630	2 350	120	* **23048EMD1**	* **23048EMKD1**	267	329	253	347	3	0.22	3.07	4.57	3.00	32	31.7

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "*" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.



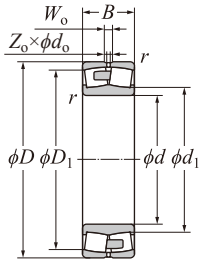
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

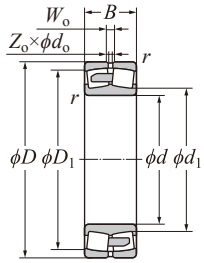
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

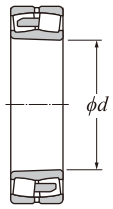
Nominal bearing outside diameter D mm Incl.	Below	Number of oil inlets Z_o
—	320	4
320	1 010	8



Cylindrical bore
[Type EM]



Cylindrical bore
[Type EM (large size)]



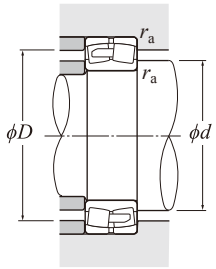
Tapered bore

d 240-300 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
240	360	118	3	16	8	1 940	2 980	116	＊ **24048EMD1**	＊ **24048EMK30D1**	264	322	253	347	3	0.28	2.37	3.53	2.32	42.2	41.6
	400	128	4	20	9	2 510	3 500	147	＊ **23148EMD1**	＊ **23148EMKD1**	276	356	257	383	4	0.29	2.32	3.45	2.26	65.1	63.1
	400	160	4	19	9	2 910	4 290	142	＊ **24148EMD1**	＊ **24148EMK30D1**	270	344	257	383	4	0.37	1.82	2.70	1.78	81	79.8
	440	120	4	16	10	2 470	3 110	159	＊ **22248EMD1**	＊ **22248EMKD1**	288	383	257	423	4	0.27	2.53	3.77	2.47	82.6	80.9
	440	160	4	20	12	3 140	4 260	156	＊ **23248EMD1**	＊ **23248EMKD1**	284	372	257	423	4	0.36	1.86	2.77	1.82	108	105
	500	155	5	20	12	3 500	4 170	193	＊ **22348EMD1**	＊ **22348EMKD1**	299	421	260	480	5	0.32	2.12	3.15	2.07	149	146
260	360	75	2.1	14	7	1 130	1 940	105	＊ **23952EMD1**	＊ **23952EMKD1**	292	335	271	349	2	0.17	3.90	5.81	3.81	23.9	23.1
	400	104	4	18	8	2 060	2 910	144	＊ **23052EMD1**	＊ **23052EMKD1**	291	366	275	385	4	0.23	2.95	4.40	2.89	47.8	46.3
	400	140	4	18	8	2 520	3 820	139	＊ **24052EMD1**	＊ **24052EMK30D1**	286	354	275	385	4	0.31	2.16	3.22	2.12	63.6	62.6
	440	144	4	20	12	2 780	4 020	160	＊ **23152EMD1**	＊ **23152EMKD1**	302	380	277	423	4	0.31	2.15	3.20	2.10	92.2	89.5
	440	180	4	27	16	3 290	4 880	147	＊ **24152EMD1**	＊ **24152EMK30D1**	295	371	277	423	4	0.40	1.69	2.52	1.65	111	109
	480	130	5	20	12	2 890	3 680	183	＊ **22252EMD1**	＊ **22252EMKD1**	312	415	280	460	5	0.27	2.53	3.77	2.47	108	105
	480	174	5	27	16	3 650	5 050	180	＊ **23252EMD1**	＊ **23252EMKD1**	310	405	280	460	5	0.36	1.87	2.79	1.83	143	139
	540	165	6	27	16	4 020	4 830	221	＊ **22352EMD1**	＊ **22352EMKD1**	324	456	286	514	6	0.31	2.16	3.22	2.12	186	183
280	380	75	2.1	14	7	1 180	2 050	115	＊ **23956EMD1**	＊ **23956EMKD1**	310	356	291	369	2	0.16	4.16	6.20	4.07	25.2	24.4
	420	106	4	18	8	2 170	3 150	155	＊ **23056EMD1**	＊ **23056EMKD1**	310	386	295	405	4	0.22	3.07	4.57	3.00	51.3	49.7
	420	140	4	18	8	2 620	4 060	150	＊ **24056EMD1**	＊ **24056EMK30D1**	306	376	295	405	4	0.29	2.30	3.42	2.25	67.3	66.3
	460	146	5	20	12	2 980	4 400	182	＊ **23156EMD1**	＊ **23156EMKD1**	322	403	300	440	5	0.30	2.23	3.32	2.18	98.4	95.3
	460	180	5	27	16	3 550	5 450	167	＊ **24156EMD1**	＊ **24156EMK30D1**	316	394	300	440	5	0.38	1.78	2.65	1.74	118	117
	500	130	5	20	12	3 010	3 920	198	＊ **22256EMD1**	＊ **22256EMKD1**	333	437	300	480	5	0.25	2.69	4.00	2.63	113	111
	500	176	5	27	16	3 770	5 340	193	＊ **23256EMD1**	＊ **23256EMKD1**	331	426	300	480	5	0.35	1.95	2.90	1.91	152	148
	580	175	6	27	16	4 490	5 450	249	＊ **22356EMD1**	＊ **22356EMKD1**	349	489	306	554	6	0.31	2.18	3.24	2.13	228	223
300	420	90	3	14	8	1 600	2 620	145	＊ **23960EMD1**	＊ **23960EMKD1**	329	387	313	407	3	0.20	3.42	5.09	3.34	40.1	39.2
	460	118	4	16	10	2 400	3 610	176	＊ **23060EMD1**	＊ **23060EMKD1**	338	413	315	445	4	0.24	2.81	4.19	2.75	72.9	70.9

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "＊" designate **ULTAGE™ series**.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



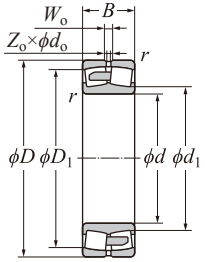
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

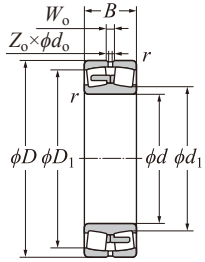
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

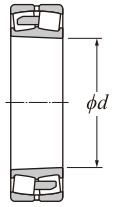
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8



Cylindrical bore
[Type EM (large size)]



Cylindrical bore



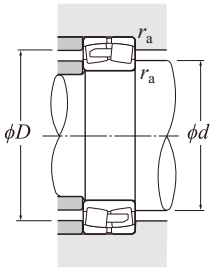
Tapered bore

d 300-360 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load kN	Bearing number [2) 3)]		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1)]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [4)]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
300	460	160	4	20	12	3 150	5 190	166	✻ 24060EMD1	✻ 24060EMK30D1	332	401	315	445	4	0.03	2.04	3.04	2.00	98	96.9
	500	160	5	20	12	3 540	5 170	205	✻ 23160EMD1	✻ 23160EMKD1	345	436	320	480	5	0.31	2.20	3.27	2.15	129	125
	500	200	5	27	16	4 270	6 610	198	✻ 24160EMD1	✻ 24160EMK30D1	340	425	320	480	5	0.39	1.74	2.59	1.70	159	157
	540	140	5	20	12	3 470	4 590	232	✻ 22260EMD1	✻ 22260EMKD1	358	469	320	520	5	0.25	3.69	4.00	2.63	134	131
	540	192	5	27	16	4 520	6 280	228	✻ 23260EMD1	✻ 23260EMKD1	352	461	320	520	5	0.35	1.92	2.86	1.88	194	188
	620	185	7.5	27	16	4 000	5 400	490	22360B	22360BK	381	522	336	584	6	0.32	2.13	3.17	2.08	274	269
320	440	90	3	14	8	1 670	2 820	154	✻ 23964EMD1	✻ 23964EMKD1	350	407	333	427	3	0.19	3.62	5.39	3.54	42.1	40.8
	480	121	4	20	12	2 540	4 020	191	✻ 23064EMD1	✻ 23064EMKD1	360	433	335	465	4	0.23	2.92	4.35	2.86	78.9	76.6
	480	160	4	20	12	3 250	5 400	184	✻ 24064EMD1	✻ 24064EMK30D1	352	423	335	465	4	0.31	2.15	3.20	2.10	104	102
	540	176	5	27	16	4 020	6 020	227	✻ 23164EMD1	✻ 23164EMKD1	373	468	340	520	5	0.31	2.15	3.20	2.10	169	164
	540	218	5	33	20	5 010	7 720	225	✻ 24164EMD1	✻ 24164EMK30D1	363	457	340	520	5	0.39	1.71	2.54	1.67	204	201
	580	150	5	20	12	3 950	5 100	261	✻ 22264EMD1	✻ 22264EMKD1	383	510	340	560	5	0.25	2.69	4.00	2.63	177	174
	580	208	5	33	20	5 230	7 370	259	✻ 23264EMD1	✻ 23264EMKD1	376	493	340	560	5	0.35	1.91	2.85	1.87	245	238
340	460	90	3	14	8	1 710	2 980	162	✻ 23968EMD1	✻ 23968EMKD1	370	427	353	447	3	0.18	3.80	5.66	3.72	44.5	43.1
	520	133	5	20	12	2 990	4 690	219	✻ 23068EMD1	✻ 23068EMKD1	384	466	358	502	5	0.24	2.87	4.27	2.80	98.5	95.5
	520	180	5	27	16	3 910	6 510	206	✻ 24068EMD1	✻ 24068EMK30D1	377	456	358	502	5	0.33	2.06	3.06	2.01	140	137
	580	190	5	27	16	4 670	6 870	257	✻ 23168EMD1	✻ 23168EMKD1	393	500	360	560	5	0.32	2.12	3.15	2.07	213	206
	580	243	5	33	20	5 980	9 340	254	✻ 24168EMD1	✻ 24168EMK30D1	385	486	360	560	5	0.41	1.65	2.46	1.61	266	262
	620	224	6	33	20	4 950	8 000	585	23268B	23268BK	410	598	368	592	5	0.37	1.84	2.75	1.80	303	294
	710	212	7.5	33	20	5 150	7 050	625	22368B	22368BK	435	598	304	674	6	0.32	2.14	3.19	2.09	415	408
	620	229	6	33	20	4 950	8 000	585	☆ 2P6802	☆ 2P6802K	432	524	368	592	5	0.37	1.84	2.75	1.80	309	300
360	480	90	3	14	8	1 750	3 090	171	✻ 23972EMD1	✻ 23972EMKD1	390	447	373	467	3	0.17	4.00	5.96	3.91	46.2	44.8
	540	134	5	20	12	3 070	4 910	232	✻ 23072EMD1	✻ 23072EMKD1	405	488	378	522	5	0.23	2.98	4.44	2.92	111	108
	540	180	5	27	16	4 040	6 840	220	✻ 24072EMD1	✻ 24072EMK30D1	398	478	378	522	5	0.31	2.16	3.22	2.12	147	145

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "✻" designate **ULTAGE™ series**.
3) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
4) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



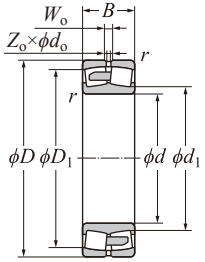
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

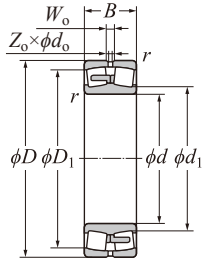
Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

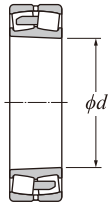
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8



Cylindrical bore
[Type EM (large size)]



Cylindrical bore

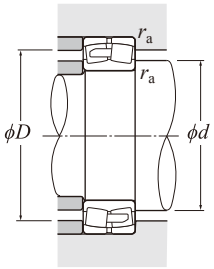


Tapered bore

d 360-420 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load kN	Bearing number [2) 3)] Cylindrical bore	Bearing number [2) 3)] Tapered bore [4)]	Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1)]	W_o	d_o	C_r	C_{0r}	C_u			d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
360	600	192	5	27	16	4 200	7 050	530	**23172B**	**23172BK**	417	520	382	578	4	0.32	2.11	3.15	2.07	224	217
	600	243	5	33	20	5 100	9 150	470	**24172B**	**24172BK30**	414	507	382	578	4	0.40	1.67	2.48	1.63	277	273
	650	170	6	27	16	4 250	6 350	550	**22272B**	**22272BK**	433	567	388	622	5	0.27	2.53	3.77	2.48	250	245
	650	232	6	33	20	5 400	8 700	620	**23272B**	**23272BK**	429	551	388	622	5	0.36	1.87	2.78	1.83	341	331
	750	224	7.5	33	20	5 850	8 300	665	**22372B**	**22372BK**	461	628	398	714	6	0.32	2.08	3.10	2.04	489	480
380	520	106	4	16	10	2 340	4 000	205	✻ **23976EMD1**	✻ **23976EMKD1**	412	481	395	505	4	0.18	3.66	5.46	3.58	68	65.9
	560	135	5	20	12	3 230	5 270	247	✻ **23076EMD1**	✻ **23076EMKD1**	425	509	398	542	5	0.22	3.07	4.57	3.00	117	113
	560	180	5	27	16	4 140	7 280	240	✻ **24076EMD1**	✻ **24076EMK30D1**	420	499	398	542	5	0.30	2.25	3.34	2.20	154	151
	620	194	5	27	16	4 350	7 500	560	**23176B**	**23176BK**	436	540	402	598	4	0.31	2.16	3.22	2.12	236	229
	620	243	5	33	20	5 350	9 650	570	**24176B**	**24176BK30**	431	529	402	598	4	0.39	1.73	2.58	1.69	289	284
	680	240	6	33	20	5 800	9 650	665	**23276B**	**23276BK**	453	575	408	652	5	0.36	1.89	2.82	1.85	388	377
	680	245	6	33	20	5 800	9 650	665	☆ **2P7603**	☆ **2P7603K**	453	573	408	652	5	0.36	1.89	2.82	1.85	396	384
400	540	106	4	16	10	2 370	4 170	215	✻ **23980EMD1**	✻ **23980EMKD1**	433	501	415	525	4	0.18	3.80	5.66	3.72	71.4	69.2
	600	148	5	20	12	3 300	6 050	450	**23080B**	**23080BK**	451	542	422	578	4	0.24	2.80	4.16	2.73	151	147
	600	200	5	27	16	4 250	8 400	485	**24080B**	**24080BK30**	446	528	422	578	4	0.32	2.09	3.11	2.04	202	199
	650	200	6	27	16	4 650	8 050	630	**23180B**	**23180BK**	458	567	428	622	5	0.31	2.21	3.28	2.16	265	258
	650	250	6	33	20	5 650	10 300	585	**24180B**	**24180BK30**	453	552	428	622	5	0.38	1.77	2.63	1.73	328	323
	720	256	6	33	20	6 500	10 600	740	**23280B**	**23280BK**	473	612	428	692	5	0.37	1.81	2.69	1.77	464	450
	820	243	7.5	33	20	6 950	9 950	805	**22380B**	**22380BK**	506	691	436	784	6	0.31	2.16	3.22	2.12	634	623
	720	260	6	33	20	6 500	10 600	740	☆ **2P8002**	☆ **2P8002K**	473	610	428	692	5	0.37	1.81	2.69	1.77	470	456
420	560	106	4	16	10	2 390	4 320	230	✻ **23984EMD1**	✻ **23984EMKD1**	454	522	435	545	4	0.17	3.95	5.88	3.86	74.9	72.6
	620	150	5	20	12	3 450	6 400	475	**23084B**	**23084BK**	471	562	442	598	4	0.24	2.85	4.24	2.78	160	155
	620	200	5	27	16	4 300	8 450	470	**24084B**	**24084BK30**	465	551	442	598	4	0.32	2.13	3.18	2.09	210	207
	700	224	6	33	20	5 800	9 950	410	**23184B**	**23184BK**	488	611	448	672	5	0.32	2.11	3.15	2.07	356	345

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "✻" designate **ULTAGE™ series**.
3) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
4) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.



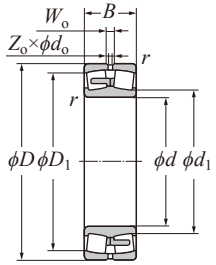
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

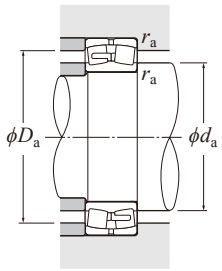
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8



Cylindrical bore

Tapered bore

Spherical Roller Bearings NTN



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

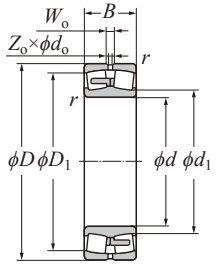
Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8

d 420-480 mm

Boundary dimensions mm						Basic load rating kN dynamic	static	Fatigue load limit kN	Bearing number 2)		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ 1)	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore 3)	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
420	700	280	6	33	20	6 850	12 200	755	**24184B**	**24184BK30**	477	592	448	672	5	0.40	1.69	2.51	1.65	434	428
	760	272	7.5	33	20	7 300	12 000	820	**23284B**	**23284BK**	501	643	456	724	6	0.36	1.86	2.77	1.82	550	535
	850	250	9.5	33	20	7 350	10 600	855	**22384B**	**22384BK**	527	718	464	806	8	0.31	2.15	3.20	2.12	693	680
440	600	118	4	16	10	2 260	4 700	325	**23988**	**23988K**	483	551	458	582	3	0.18	3.66	5.46	3.58	100	97.4
	650	157	6	20	12	3 650	6 850	530	**23088B**	**23088BK**	490	585	468	622	5	0.24	2.85	4.24	2.78	184	179
	650	212	6	33	20	4 800	9 450	530	**24088B**	**24088BK30**	486	576	468	622	5	0.32	2.11	3.15	2.07	244	240
	720	226	6	33	20	5 800	10 100	685	**23188B**	**23188BK**	504	627	468	692	5	0.31	2.15	3.21	2.11	369	357
	720	280	6	33	20	7 200	13 100	715	**24188B**	**24188BK30**	498	614	468	692	5	0.39	1.75	2.61	1.71	452	445
	790	280	7.5	33	20	7 700	12 800	870	**23288B**	**23288BK**	525	671	476	754	6	0.36	1.88	2.80	1.84	606	589
	790	285	7.5	—	—	7 750	12 900	870	☆ **2P8802**	☆ **2P8802K**	525	669	476	754	6	0.36	1.88	2.80	1.84	619	601
450	620	190	3	—	—	3 400	7 400	425	☆ **2P9002**	☆ **2P9002K**	491	559	464	606	2.5	0.27	2.49	3.71	2.43	178	170
460	620	118	4	16	10	2 340	4 950	325	**23992**	**23992K**	503	572	478	602	3	0.17	3.95	5.88	3.86	105	102
	680	163	6	27	16	4 000	7 450	560	**23092B**	**23092BK**	512	613	488	652	5	0.23	2.88	4.29	2.82	208	202
	680	218	6	33	20	5 100	10 200	590	**24092B**	**24092BK30**	509	604	488	652	5	0.31	2.15	3.21	2.11	274	270
	760	240	7.5	33	20	6 350	11 400	775	**23192B**	**23192BK**	534	660	496	724	6	0.31	2.14	3.19	2.10	447	434
	760	300	7.5	33	20	7 900	14 500	805	**24192B**	**24192BK30**	523	645	496	724	6	0.39	1.71	2.55	1.67	546	538
	830	296	7.5	33	20	8 650	14 500	925	**23292B**	**23292BK**	547	703	496	794	6	0.36	1.87	2.78	1.83	714	693
	950	280	9.5	33	20	9 200	13 500	1 040	**22392B**	**22392BK**	584	799	504	906	8	0.31	2.17	3.23	2.12	986	968
480	650	128	5	20	12	2 590	5 500	365	**23996**	**23996K**	527	599	502	628	4	0.18	3.85	5.73	3.76	126	122
	660	200	3	—	—	3 950	8 350	500	☆ **2P9602**	☆ **2P9602K**	520	596	494	646	2.5	0.27	2.52	3.75	2.46	209	199
	700	165	6	27	16	4 050	7 700	570	**23096B**	**23096BK**	532	633	508	672	5	0.23	2.94	4.38	2.88	218	212
	700	218	6	33	20	5 200	10 500	610	**24096B**	**24096BK30**	530	625	508	672	5	0.30	2.22	3.30	2.17	285	281
	790	248	7.5	33	20	6 900	12 300	860	**23196B**	**23196BK**	554	687	516	754	6	0.31	2.15	3.21	2.11	498	483
	790	308	7.5	33	20	8 250	15 300	860	**24196B**	**24196BK30**	546	671	516	754	6	0.39	1.74	2.59	1.70	604	595

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.



Cylindrical bore

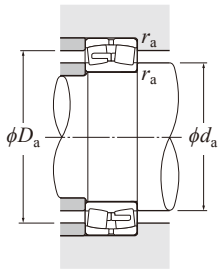
Tapered bore

d 480-600 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number 2)		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ 1)	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore 3)	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
480	870	310	7.5	33	20	9 200	15 500	1 000	**23296B**	**23296BK**	574	737	516	834	6	0.36	1.87	2.78	1.83	825	801
	620	90	3	14	8	1 720	3 950	330	**238/500**	**238/500K**	532	589	514	606	2.5	0.13	5.38	8.02	5.26	61.3	59.3
	670	128	5	20	12	2 640	5 600	460	**239/500**	**239/500K**	547	621	522	648	4	0.17	4.02	5.98	3.93	129	125
	720	167	6	27	16	4 250	8 300	645	**230/500B**	**230/500BK**	552	653	528	692	5	0.23	2.98	4.44	2.91	229	223
500	720	218	6	33	20	5 300	10 900	640	**240/500B**	**240/500BK30**	550	646	528	692	5	0.30	2.28	3.40	2.23	296	291
	830	264	7.5	33	20	7 700	13 700	875	**231/500B**	**231/500BK**	580	724	536	794	6	0.32	2.12	3.16	2.08	587	570
	830	325	7.5	42	25	9 000	16 700	870	**241/500B**	**241/500BK30**	572	703	536	794	6	0.39	1.72	2.57	1.69	710	699
	920	336	7.5	42	25	10 500	17 800	1 100	**232/500B**	**232/500BK**	600	773	536	884	6	0.39	1.74	2.59	1.70	1 020	991
	710	136	5	20	12	2 940	6 450	400	**239/530**	**239/530K**	579	654	552	688	4	0.17	3.94	5.87	3.86	156	151
	780	185	6	27	16	4 850	9 350	710	**230/530B**	**230/530BK**	594	704	558	752	5	0.22	3.03	4.52	2.97	311	302
530	780	250	6	33	20	6 200	12 700	700	**240/530B**	**240/530BK30**	586	689	558	752	5	0.30	2.24	3.33	2.19	411	405
	870	272	7.5	33	20	7 800	14 200	920	**231/530B**	**231/530BK**	617	757	566	834	6	0.30	2.22	3.30	2.17	652	633
	870	335	7.5	42	25	9 250	17 400	910	**241/530B**	**241/530BK30**	605	737	566	834	6	0.38	1.79	2.67	1.75	787	775
	980	355	9.5	42	25	11 500	19 800	1 210	**232/530B**	**232/530BK**	600	723	574	936	8	0.39	1.74	2.59	1.70	1 220	1 180
545	755	230	4	—	—	5 050	10 800	615	☆ **2P10901**	☆ **2P10901K**	589	679	563	737	3	0.28	2.45	3.65	2.40	322	317
	680	90	3	14	8	1 830	4 450	340	**238/560**	**238/560K**	590	647	574	666	2.5	0.11	5.97	8.88	5.83	67.9	65.8
	750	140	5	20	12	3 200	6 700	525	**239/560**	**239/560K**	547	621	582	728	4	0.16	4.09	6.09	4.00	177	172
	820	195	6	27	16	5 350	10 500	800	**230/560B**	**230/560BK**	627	741	588	792	5	0.22	3.03	4.51	2.96	361	350
560	820	258	6	33	20	6 750	14 100	750	**240/560B**	**240/560BK30**	620	726	588	792	5	0.30	2.29	3.40	2.24	467	460
	920	280	7.5	33	20	8 550	15 500	1 000	**231/560B**	**231/560BK**	650	801	596	884	6	0.30	2.27	3.38	2.22	756	734
	920	355	7.5	42	25	11 100	20 800	1 030	**241/560B**	**241/560BK30**	638	787	596	884	6	0.39	1.75	2.61	1.71	943	929
	1 030	365	9.5	42	25	12 300	21 100	1 320	**232/560B**	**232/560BK**	677	867	604	986	8	0.36	1.88	2.80	1.84	1 380	1 340
600	800	150	5	20	12	3 600	7 800	490	**239/600**	**239/600K**	654	739	622	778	4	0.18	3.85	5.73	3.76	217	210
	870	200	6	27	16	5 800	12 000	835	**230/600B**	**230/600BK**	672	785	628	842	5	0.21	3.17	4.72	3.10	410	398

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Spherical Roller Bearings NTN



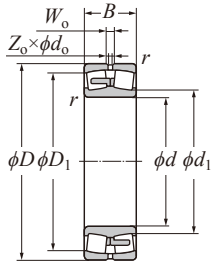
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8
1 010	—	12



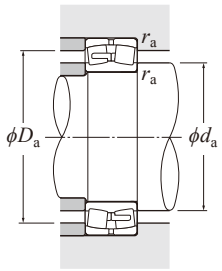
Cylindrical bore

Tapered bore

d 600-750 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number 2)		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ 1)	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore 3)	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
600	870	272	6	33	20	7 150	15 600	750	**240/600B**	**240/600BK30**	667	770	628	842	5	0.29	2.33	3.47	2.28	547	539
	980	300	7.5	33	20	10 000	18 400	1 160	**231/600B**	**231/600BK**	694	860	636	944	6	0.30	2.22	3.30	2.17	912	885
	980	375	7.5	42	25	11 900	23 200	1 130	**241/600B**	**241/600BK30**	685	832	636	944	6	0.37	1.81	2.70	1.77	1 120	1 110
	1 090	388	9.5	42	25	13 600	23 700	930	**232/600B**	**232/600BK**	722	919	644	1 046	8	0.36	1.86	2.77	1.82	1 600	1 550
630	850	165	6	27	16	4 100	9 250	545	**239/630**	**239/630K**	690	781	658	822	5	0.18	3.66	5.45	3.58	279	270
	920	212	7.5	33	20	6 550	13 000	950	**230/630B**	**230/630BK**	704	834	666	884	6	0.22	3.14	4.67	3.07	491	477
	920	290	7.5	33	20	8 400	17 900	915	**240/630B**	**240/630BK30**	697	815	666	884	6	0.30	2.28	3.40	2.23	659	649
	1 030	315	7.5	33	20	10 700	19 900	1 190	**231/630B**	**231/630BK**	731	899	666	994	6	0.30	2.27	3.38	2.22	1 060	1 030
	1 030	400	7.5	42	25	12 900	25 000	1 200	**241/630B**	**241/630BK30**	718	872	666	994	6	0.38	1.78	2.66	1.74	1 310	1 290
	1 150	412	12	42	25	15 200	26 800	1 540	**232/630B**	**232/630BK**	760	969	684	1 096	10	0.36	1.87	2.78	1.83	1 900	1 850
670	900	170	6	27	16	4 550	10 300	795	**239/670**	**239/670K**	733	830	698	872	5	0.18	3.76	5.59	3.67	322	313
	980	230	7.5	33	20	7 300	14 600	1 000	**230/670B**	**230/670BK**	750	886	706	944	6	0.22	3.07	4.57	3.00	600	583
	980	308	7.5	33	20	9 650	20 600	1 040	**240/670B**	**240/670BK30**	741	870	706	944	6	0.29	2.29	3.41	2.24	798	785
	1 090	336	7.5	42	25	12 500	22 800	1 400	**231/670B**	**231/670BK**	773	956	706	1 054	6	0.30	2.22	3.30	2.17	1 260	1 220
	1 090	412	7.5	42	25	14 100	28 000	1 340	**241/670B**	**241/670BK30**	764	926	706	1 054	6	0.37	1.83	2.73	1.79	1 520	1 500
	1 220	438	12	42	25	17 900	32 000	1 770	**232/670B**	**232/670BK**	807	1 034	724	1 166	10	0.36	1.89	2.81	1.85	2 270	2 210
710	950	180	6	27	16	4 950	11 500	665	**239/710**	**239/710K**	778	876	738	922	5	0.18	3.85	5.73	3.76	374	363
	1 030	236	7.5	33	20	8 000	16 200	1 140	**230/710B**	**230/710BK**	792	937	746	994	6	0.22	3.02	4.50	2.96	667	648
	1 030	315	7.5	33	20	10 300	22 500	1 150	**240/710B**	**240/710BK30**	783	916	746	994	6	0.29	2.36	3.51	2.31	894	881
	1 150	345	9.5	42	25	13 000	24 900	1 470	**231/710B**	**231/710BK**	822	1 005	754	1 106	8	0.29	2.32	3.45	2.27	1 440	1 390
	1 150	438	9.5	42	25	16 100	32 000	1 190	**241/710B**	**241/710BK30**	805	979	754	1 106	8	0.37	1.80	2.69	1.76	1 790	1 760
	1 280	450	12	42	25	18 100	32 500	1 200	**232/710B**	**232/710BK**	851	1 081	764	1 226	10	0.35	1.91	2.84	1.87	2 540	2 470
750	920	128	5	20	12	3 450	8 450	595	**238/750**	**238/750K**	794	876	772	898	4	0.12	5.72	8.51	5.59	185	179
	1 000	185	6	27	16	5 600	13 000	990	**239/750**	**239/750K**	818	924	778	972	5	0.17	3.90	5.81	3.81	428	415

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.



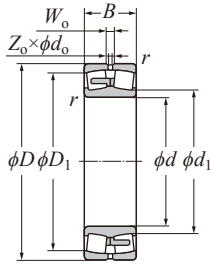
Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

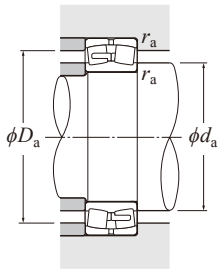
Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
320	1 010	8
1 010	—	12



Cylindrical bore

Tapered bore

Spherical Roller Bearings NTN



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

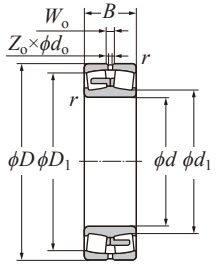
Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
1 010	—	12

d 750-950 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]		Dimension (Reference) mm		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [3]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
750	1 090	250	7.5	33	20	9 100	18 300	1 290	**230/750B**	**230/750BK**	834	991	786	1 054	6	0.21	3.20	4.76	3.13	805	782
	1 090	335	7.5	42	25	11 300	24 600	1 230	**240/750B**	**240/750BK30**	828	969	786	1 054	6	0.29	2.35	3.49	2.29	1 060	1 040
	1 220	365	9.5	42	25	14 300	27 200	1 130	**231/750B**	**231/750BK**	868	1 066	794	1 176	8	0.29	2.32	3.45	2.27	1 710	1 660
	1 360	475	15	42	25	20 300	36 500	1 980	**232/750B**	**232/750BK**	903	1 149	814	1 296	12	0.35	1.92	2.86	1.88	3 050	2 960
760	1 140	325	7.5	42	25	11 400	23 800	1 030	☆ **2P15203**	☆ **2P15203K**	862	1 017	796	1 104	6	0.24	2.79	4.15	2.73	1 150	1 110
790	1 100	310	7.5	—	—	9 600	21 000	1 170	☆ **2P15802**	☆ **2P15802K**	863	1 001	826	1 064	6	0.24	2.76	4.11	2.70	947	909
800	1 060	195	6	27	16	6 000	13 700	1 040	**239/800**	**239/800K**	868	983	828	1 032	5	0.17	4.05	6.04	3.96	489	474
	1 150	258	7.5	33	20	9 350	19 500	1 340	**230/800B**	**230/800BK**	893	1 049	836	1 114	6	0.21	3.15	4.69	3.08	894	868
	1 150	345	7.5	42	25	12 400	27 800	1 360	**240/800B**	**240/800BK30**	881	1 026	836	1 114	6	0.28	2.41	3.59	2.36	1 200	1 180
	1 280	375	9.5	42	25	16 000	31 000	1 780	**231/800B**	**231/800BK**	912	1 122	844	1 236	8	0.29	2.32	3.45	2.27	1 910	1 860
	1 280	475	9.5	42	25	19 200	39 500	1 740	**241/800B**	**241/800BK30**	907	1 095	844	1 236	8	0.36	1.86	2.77	1.82	2 380	2 350
850	1 030	136	5	20	12	4 000	10 500	735	**238/850**	**238/850K**	899	982	872	1 008	4	0.11	6.01	8.94	5.87	241	233
	1 120	200	6	27	16	6 500	15 100	1 080	**239/850**	**239/850K**	924	1 043	878	1 092	5	0.16	4.25	6.32	4.15	542	525
	1 220	272	7.5	33	20	10 900	22 700	1 510	**230/850B**	**230/850BK**	945	1 114	886	1 184	6	0.20	3.32	4.95	3.25	1 070	1 040
	1 220	330	7.5	42	25	12 300	26 800	1 020	☆ **2P17012**	☆ **2P17012K**	940	1 099	886	1 184	6	0.23	2.90	4.31	2.83	1 230	1 190
	1 220	365	7.5	42	25	13 900	31 500	1 490	**240/850B**	**240/850BK30**	936	1 089	886	1 184	6	0.28	2.42	3.61	2.37	1 430	1 410
	1 360	400	12	42	25	17 300	34 000	1 380	**231/850B**	**231/850BK**	979	1 194	904	1 306	10	0.28	2.37	3.54	2.32	2 290	2 220
	1 500	515	15	42	25	24 800	47 500	2 380	**232/850B**	**232/850BK**	1 018	1 277	914	1 436	12	0.35	1.94	2.89	1.90	4 040	3 920
900	1 180	206	6	33	20	7 400	17 300	1 230	**239/900**	**239/900K**	974	1 101	928	1 152	5	0.16	4.32	6.44	4.23	623	605
	1 280	280	7.5	33	20	11 400	24 700	1 580	**230/900B**	**230/900BK**	999	1 167	936	1 244	6	0.20	3.32	4.95	3.25	1 210	1 170
	1 280	375	7.5	42	25	14 700	33 500	1 580	**240/900B**	**240/900BK30**	988	1 147	936	1 244	6	0.27	2.48	3.70	2.43	1 580	1 560
	1 420	412	12	42	25	18 700	38 000	2 030	**231/900B**	**231/900BK**	1 031	1 251	954	1 366	10	0.28	2.42	3.60	2.36	2 530	2 460
950	1 250	224	7.5	33	20	8 650	20 500	1 390	**239/950**	**239/950K**	1 029	1 165	986	1 214	6	0.16	4.20	6.26	4.11	771	747
	1 360	300	7.5	33	20	12 800	28 400	1 750	**230/950B**	**230/950BK**	1 063	1 239	986	1 324	6	0.21	3.26	4.85	3.18	1 480	1 440

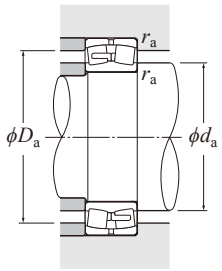
1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.



Cylindrical bore

Tapered bore

Spherical Roller Bearings NTN



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2 and Y_0 see the table below.

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets Z_o
Incl.	Below	
1 010	—	12

d 950-1 400 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number 2)		Dimension mm (Reference)		Installation-related dimensions mm			Constant	Axial load factors			Mass kg (approx.)	
d	D	B	$r_{s\,min}$ 1)	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore 3)	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
	1 360	320	7.5	42	25	12 800	28 000	1 080	☆ **2P19022**	☆ **2P19022K**	1 059	1 234	986	1 324	6	0.20	3.33	4.96	3.25	1 510	1 470
950	1 360	412	7.5	42	25	17 200	40 000	1 780	**240/950B**	**240/950BK30**	1 044	1 213	986	1 324	6	0.28	2.39	3.56	2.34	1 990	1 960
	1 400	380	7.5	28	15	15 700	33 500	1 630	☆ **2P19019**	☆ **2P19019K**	1 060	1 251	986	1 364	6	0.24	2.77	4.13	2.71	2 040	1 970
	1 320	236	7.5	33	20	9 550	22 700	1 520	**239/1000**	**239/1000K**	1 084	1 230	1 036	1 284	6	0.16	4.21	6.26	4.11	913	885
1 000	1 420	308	7.5	33	20	13 800	30 000	1 460	**230/1000B**	**230/1000BK**	1 107	1 294	1 036	1 384	6	0.20	3.37	5.02	3.29	1 630	1 580
	1 420	412	7.5	42	25	17 800	42 000	1 890	**240/1000B**	**240/1000BK30**	1 097	1 272	1 036	1 384	6	0.27	2.51	3.73	2.45	2 150	2 120
1 050	1 500	412	9.5	42	25	17 600	42 500	1 780	☆ **2P21001**	☆ **2P21001K**	1 171	1 344	1 094	1 456	8	0.24	2.85	4.25	2.79	2 410	2 320
	1 400	250	7.5	33	20	10 400	24 700	1 670	**239/1060**	**239/1060K**	1 153	1 400	1 096	1 364	6	0.16	4.28	6.37	4.19	1 080	1 050
1 060	1 500	325	9.5	42	25	15 100	33 500	1 610	**230/1060B**	**230/1060BK**	1 172	1 368	1 104	1 456	8	0.20	3.36	5.00	3.28	1 890	1 840
	1 500	438	9.5	42	25	19 800	47 000	2 060	**240/1060B**	**240/1060BK30**	1 160	1 343	1 104	1 456	8	0.27	2.49	3.71	2.44	2 530	2 490
	1 360	180	6	27	16	6 900	18 700	1 190	**238/1120**	**238/1120K**	1 183	1 295	1 148	1 332	5	0.11	5.97	8.89	5.84	559	542
1 120	1 460	250	7.5	33	20	10 900	26 700	1 470	**239/1120**	**239/1120K**	1 208	1 362	1 156	1 424	6	0.15	4.42	6.58	4.32	1 150	1 110
	1 580	345	9.5	42	25	17 400	39 000	2 310	**230/1120B**	**230/1120BK**	1 234	1 442	1 164	1 536	8	0.21	3.29	4.80	3.21	2 220	2 150
	1 580	462	9.5	42	25	21 700	52 500	2 230	**240/1120B**	**240/1120BK30**	1 227	1 418	1 164	1 536	8	0.27	2.50	3.72	2.44	2 940	2 890
	1 420	180	6	27	16	7 100	19 700	1 210	**238/1180**	**238/1180K**	1 243	1 356	1 208	1 392	5	0.11	6.27	9.34	6.13	577	558
1 180	1 540	272	7.5	33	20	12 200	29 800	1 650	**239/1180**	**239/1180K**	1 271	1 504	1 216	1 504	6	0.15	4.40	6.55	4.30	1 340	1 300
	1 540	355	7.5	42	25	15 200	40 500	1 940	**249/1180**	**249/1180K30**	1 275	1 425	1 216	1 504	6	0.21	3.28	4.88	3.21	1 790	1 760
	1 660	475	9.5	42	25	23 000	55 500	2 300	**240/1180B**	**240/1180BK30**	1 288	1 489	1 224	1 616	8	0.27	2.54	3.78	2.48	3 310	3 260
1 250	1 500	185	6	27	16	7 400	20 700	1 240	**238/1250**	**238/1250**	1 315	1 432	1 278	1 472	5	0.10	6.44	9.58	6.29	649	628
	1 630	280	7.5	33	20	13 400	33 500	1 810	**239/1250**	**239/1250K**	1 352	1 525	1 286	1 594	6	0.15	4.42	6.58	4.32	1 600	1 550
1 320	1 720	300	7.5	33	20	15 100	38 000	1 930	**239/1320**	**239/1320K**	1 423	1 605	1 356	1 684	6	0.16	4.34	6.46	4.24	1 910	1 850
	1 850	530	12	42	25	28 100	67 500	3 050	**240/1320B**	**240/1320BK30**	1 443	1 671	1 374	1 796	10	0.25	2.65	3.94	2.59	4 510	4 440
1 400	1 820	315	9.5	33	20	16 800	43 000	2 570	**239/1400**	**239/1400K**	1 513	1 703	1 444	1 776	8	0.15	4.39	6.54	4.29	2 200	2 130

1) Smallest allowable dimension for chamfer dimension r.
2) Bearing numbers marked "☆" designate special bearings. For details, please contact **NTN** Engineering.
3) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio of 1:30.

Thrust Bearings

1. Classification and Features

1.1 Thrust ball bearings

As shown in **Fig. 1**, balls of thrust ball bearings are arranged between a pair of raceway washers (shaft raceway washer and housing raceway washer) with a typical contact angle of 90°.

Axial loads can be supported in only one direction, and radial loads cannot be accommodated. These bearings are not suitable for high speed operation.

Table 1 shows the standard cage types.

Table 1 Standard cage types

Bearing series	511	512	513	514
Pressed cage	51120 to 51152	51220 to 51224	51320	–
Machined cage	51156 to 511/750	51226 to 51292	51322 to 51340	51420

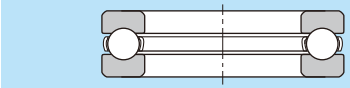


Fig. 1 Thrust ball bearing (example of pressed cage)

1.2 Thrust cylindrical roller bearings

Thrust bearings incorporating cylindrical rollers are available in single row, double row, and triple row (see **Fig. 2**).

While thrust cylindrical roller bearings are only able to receive axial loads, the axial loads can be heavy due to the high axial rigidity of the bearing.

Machined cages are used.

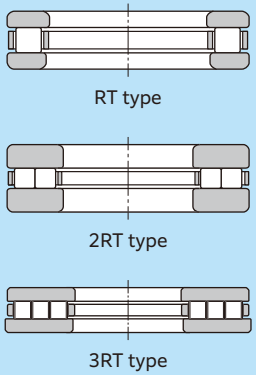


Fig. 2 Thrust cylindrical roller bearings (examples of machined cage)

1.3 Thrust tapered roller bearings

Thrust tapered roller bearings are thrust bearings using tapered rollers. Among them, the single direction type includes a ribbed housing raceway washer type [see **Fig. 3(a)**] and a ribless housing raceway washer type [see **Fig. 3(b)**], as well as a full complement roller type [see **Fig. 3(c)**]. The double direction type is mainly used to support axial loads on the roll neck of the rolling mill.

Machined cages are used.

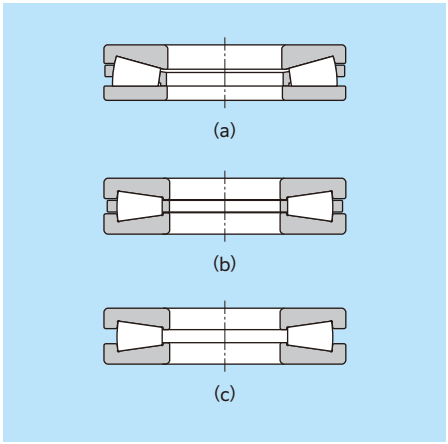


Fig. 3 Thrust tapered roller bearing (single direction type)

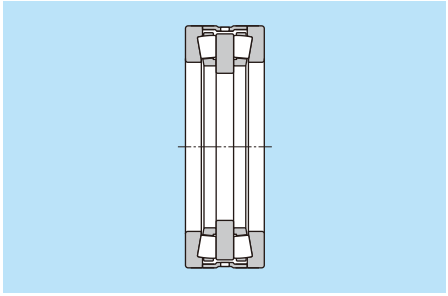


Fig. 4 Thrust tapered roller bearing (double direction type)

1.4 Thrust spherical roller bearings

Just like spherical roller bearings, the center of the spherical surface for thrust spherical roller bearings is the point where the raceway surface of the housing raceway washer meets the center axis of the bearing. Since thrust spherical roller bearings incorporate barrel-shaped rollers as rolling elements, they also have self-aligning properties (see **Fig. 5**). Under normal load conditions, allowable misalignment is 1/60 to 1/30, although this will vary depending upon the bearing's dimension series.

These bearings use machined cages. A guide sleeve for the cage is attached to the shaft raceway washer. These bearings have a high axial load capacity and, when an axial load F_a is applied, they can support a radial load F_r of a certain magnitude under the condition that $F_r/F_a \leq 0.55$.

The design for spherical thrust bearings is such that lubricant cannot enter the gap between the roller end face and the shaft raceway washer rib, between the cage and the guide sleeve, etc. Therefore, oil lubrication should be used, even in low speed operation.

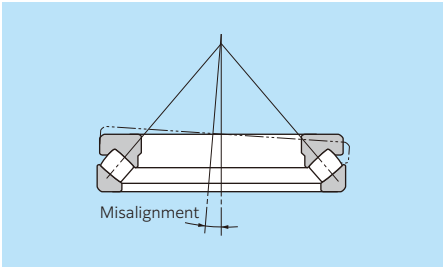


Fig. 5 Thrust spherical roller bearing

2. Dimensional and rotational accuracy

For accuracy of the thrust bearings, refer to the table (page) which provides detailed information for each bearing.

Thrust ball bearings ··· **Table 3.7** (page A-25)
Thrust cylindrical roller bearings
····· **Table 3.7** (page A-25)
Thrust tapered roller bearings
(Metric series) ····· **Table 3.9** (page A-27)
(Inch series) ····· **Table 3.10** (page A-27)
Thrust spherical roller bearing
····· **Table 3.8** (page A-26)

3. Recommended fits

For fits recommended for thrust bearings, refer to **Table 4.3** (page A-35).

4. Precautions

Thrust bearings must have a certain amount of axial load applied to them to prevent slipping between the rolling elements and axial housing raceway. Please contact **NTN** Engineering for details.

5. ULTAGE™ series thrust spherical roller bearings

ULTAGE™ series thrust spherical roller bearings are the products developed to meet the demands for "long operating life", "higher speed", and "Improved handling" required for various industrial machinery.

By adopting the simple window-type pressed steel cage, the bearings can be used with oil and grease lubrication, expanding the range of use.

For details, see the special catalog "**ULTAGE™ series Thrust Spherical Roller Bearings (CAT. No. 3034/E)**".

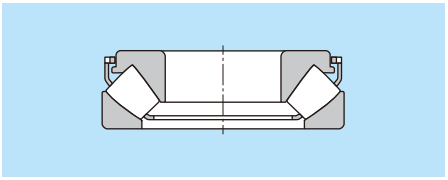
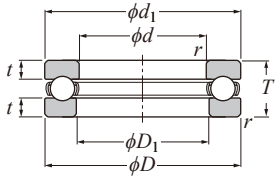
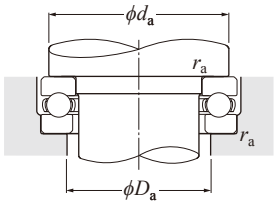


Fig. 6 ULTAGE™ series thrust spherical roller bearing





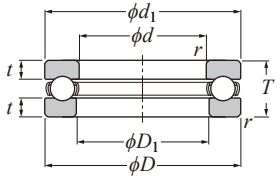
Dynamic equivalent axial load
$P_a = F_a$

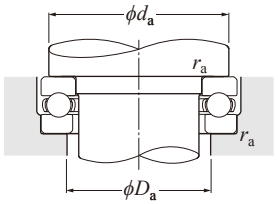
Static equivalent axial load
$P_{0a} = F_a$

d 100-180 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number 4)	Dimension mm		Thickness mm	Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ 1)	C_a	C_{0a}	C_u		$d_{1s\,max}$ 2)	$D_{1s\,min}$ 3)	t	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
100	135	25	1	85.0	268	11.2	**51120**	135	102	7.5	121	114	1	0.987
	150	38	1.1	147	410	16.6	**51220**	150	103	11.7	130	120	1	2.29
	170	55	1.5	237	595	23.1	**51320**	170	103	17.3	142	128	1.5	4.88
	210	85	3	370	970	35.0	***51420**	205	103	26.6	165	145	2.5	14.7
110	145	25	1	87.0	288	11.5	**51122**	145	112	7.5	131	124	1	1.07
	160	38	1.1	153	450	17.5	**51222**	160	113	11.7	140	130	1	2.46
	190	63	2	267	705	25.9	***51322**	187	113	20	158	142	2	7.67
120	155	25	1	89.0	310	11.8	**51124**	155	122	7.5	141	134	1	1.11
	170	39	1.1	154	470	17.7	**51224**	170	123	12.2	150	140	1	2.71
	210	70	2.1	296	805	28.3	***51324**	205	123	22.3	173	157	2	10.8
130	170	30	1	104	350	13.0	**51126**	170	132	9	154	146	1	1.73
	190	45	1.5	191	565	20.2	***51226**	187	133	13.9	166	154	1.5	4.22
	225	75	2.1	330	960	32.5	***51326**	220	134	24.2	186	169	2	12.7
140	180	31	1	107	375	13.4	***51128**	178	142	9.5	164	156	1	1.9
	200	46	1.5	193	595	20.6	***51228**	197	143	14.4	176	164	1.5	4.77
	240	80	2.1	350	1 050	34.5	***51328**	235	144	26	199	181	2	15.3
150	190	31	1	109	400	13.9	***51130**	188	152	10	174	166	1	2
	215	50	1.5	220	685	24.0	***51230**	212	153	15.8	189	176	1.5	5.87
	250	80	2.1	360	1 130	36.0	***51330**	245	154	26	209	191	2	16.1
160	200	31	1	112	425	14.4	***51132**	198	162	10	184	176	1	2.1
	225	51	1.5	223	720	23.3	***51232**	222	163	16.3	199	186	1.5	6.32
	270	87	3	450	1 470	45.0	***51332**	265	164	27	225	205	2.5	20.7
170	215	34	1.1	134	510	16.7	***51134**	213	172	10.5	197	188	1	2.77
	240	55	1.5	261	835	26.3	***51234**	237	173	17.3	212	198	1.5	7.81
	280	87	3	465	1 570	47.5	***51334**	275	174	27	235	215	2.5	21.6
180	225	34	1.1	135	525	16.7	***51136**	222	183	10.5	207	198	1	2.92

1) Smallest allowable dimension for chamfer dimension r.
2) Maximum allowable dimension for shaft raceway washer outside dimension d_1.
3) Smallest allowable dimension for housing raceway washer bore dimension D_1.
4) Bearing number marked "*" signify where the shaft raceway washer outside diameter is smaller than the housing raceway washer outside diameter. Therefore, when using these bearings, it is possible to use the housing bore as is, without providing a ground undercut on the outside diameter section of the shaft raceway washer as shown in the drawing.





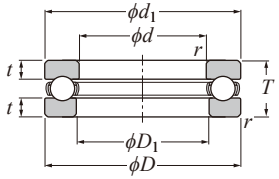
Dynamic equivalent axial load
$P_a = F_a$

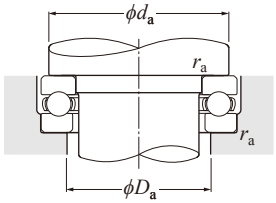
Static equivalent axial load
$P_{0a} = F_a$

d 180-380 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number 4)	Dimension mm		Thickness mm	Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ 1)	C_a	C_{0a}	C_u		$d_{1s\,max}$ 2)	$D_{1s\,min}$ 3)	t	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
180	250	56	1.5	266	875	26.9	***51236**	247	183	17.8	222	208	1.5	8.34
	300	95	3	490	1 700	49.5	***51336**	295	184	29.7	251	229	2.5	27.5
190	240	37	1.1	170	655	20.2	***51138**	237	193	11	220	210	1	3.75
	270	62	2	310	1 060	31.5	***51238**	267	194	19.6	238	222	2	11.3
	320	105	4	545	1 950	55.0	***51338**	315	195	33.5	266	244	3	35
200	250	37	1.1	172	675	20.4	***51140**	247	203	11.5	230	220	1	3.92
	280	62	2	315	1 110	32.0	***51240**	277	204	19.6	248	232	2	11.8
	340	110	4	595	2 220	61.0	***51340**	335	205	34.7	282	258	3	41.8
220	270	37	1.1	177	740	21.3	***51144**	267	223	11.5	250	240	1	4.27
	300	63	2	325	1 210	34.0	***51244**	297	224	20.1	268	252	2	13
240	300	45	1.5	228	935	25.6	***51148**	297	243	14	276	264	1.5	6.87
	340	78	2.1	415	1 650	44.0	***51248**	335	244	25	299	281	2	22.4
260	320	45	1.5	232	990	26.2	***51152**	317	263	14	296	284	1.5	7.38
	360	79	2.1	440	1 810	46.5	***51252**	355	264	24.9	319	301	2	24.2
280	350	53	1.5	305	1 270	32.5	***51156**	347	283	16	322	308	1.5	11.8
	380	80	2.1	460	1 970	49.0	***51256**	375	284	25.4	339	321	2	26.1
300	380	62	2	355	1 560	38.0	***51160**	376	304	19.5	348	332	2	17.2
	420	95	3	590	2 680	63.5	***51260**	415	304	29.7	371	349	2.5	40.6
320	400	63	2	365	1 660	39.5	***51164**	396	324	20	368	352	2	18.4
	440	95	3	595	2 800	65.0	***51264**	435	325	29.7	392	368	2.5	44.9
340	420	64	2	375	1 760	40.5	***51168**	416	344	20.5	388	372	2	19.7
	460	96	3	605	2 920	66.0	***51268**	455	345	30.2	412	388	2.5	47.8
360	440	65	2	380	1 860	42.0	***51172**	436	364	21	408	392	2	21.1
	500	110	4	720	3 650	79.5	***51272**	495	365	34.7	444	416	3	69
380	460	65	2	380	1 910	42.0	***51176**	456	384	21	428	412	2	22.3
	520	112	4	735	3 800	77.5	***51276**	515	385	35	464	436	3	73.7

1) Smallest allowable dimension for chamfer dimension r.
2) Maximum allowable dimension for shaft raceway washer outside dimension d_1.
3) Smallest allowable dimension for housing raceway washer bore dimension D_1.
4) Bearing number marked "*" signify where the shaft raceway washer outside diameter is smaller than the housing raceway washer outside diameter. Therefore, when using these bearings, it is possible to use the housing bore as is, without providing a ground undercut on the outside diameter section of the shaft raceway washer as shown in the drawing.





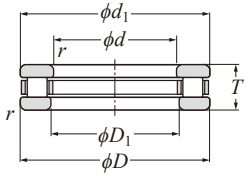
Dynamic equivalent axial load
$P_a = F_a$
Static equivalent axial load
$P_{0a} = F_a$

d 400-750 mm

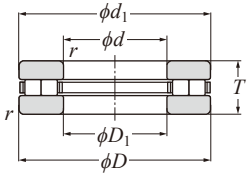
Boundary dimensions				Basic load rating		Fatigue load limit	Bearing number [4]	Dimension		Thickness	Installation-related dimensions			Mass
				dynamic	static									
mm				kN		kN		mm		mm	mm			kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		$d_{1s\,max}$ [2]	$D_{1s\,min}$ [3]	t	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
400	480	65	2	390	2 010	43.5	∗**51180**	476	404	21	448	432	2	23.3
	540	112	4	745	3 950	82.5	∗**51280**	535	405	35.7	484	456	3	76.9
420	500	65	2	395	2 110	44.5	∗**51184**	495	424	21	468	452	2	24.4
	580	130	5	865	4 850	97.5	∗**51284**	575	425	42.1	516	484	4	109
440	540	80	2.1	515	2 850	58.0	∗**51188**	535	444	26	499	481	2	40
	600	130	5	855	4 850	95.5	∗**51288**	595	445	42.1	536	504	4	113
460	560	80	2.1	525	3 000	60.0	∗**51192**	555	464	26	519	501	2	41.6
	620	130	5	895	5 250	102	∗**51292**	615	465	42.2	556	524	4	118
480	580	80	2.1	525	3 100	60.5	∗**51196**	575	484	26	539	521	2	43.3
500	600	80	2.1	575	3 400	65.5	∗**511/500**	595	504	25	559	541	2	45
530	640	85	3	645	4 000	74.5	∗**511/530**	635	534	26	595	575	2.5	55.8
560	670	85	3	595	3 750	68.5	∗**511/560**	665	564	27	625	605	2.5	59.4
600	710	85	3	645	4 200	74.0	∗**511/600**	705	604	26	666	644	2.5	62.6
630	750	95	3	720	4 850	83.5	∗**511/630**	745	634	30	702	678	2.5	82.5
670	800	105	4	825	5 850	97.5	∗**511/670**	795	674	33.5	748	722	3	105
710	850	112	4	875	6 350	103	∗**511/710**	845	714	36	794	766	3	129
750	900	120	4	1 010	7 650	120	∗**511/750**	895	755	37	841	809	3	155

1) Smallest allowable dimension for chamfer dimension r.
2) Maximum allowable dimension for shaft raceway washer outside dimension d_1.
3) Smallest allowable dimension for housing raceway washer bore dimension D_1.
4) Bearing number marked "∗" signify where the shaft raceway washer outside diameter is smaller than the housing raceway washer outside diameter. Therefore, when using these bearings, it is possible to use the housing bore as is, without providing a ground undercut on the outside diameter section of the shaft raceway washer as shown in the drawing.

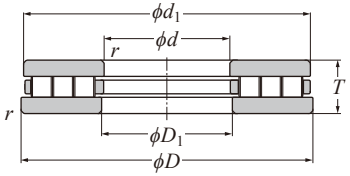
Thrust Ball Bearings
NTN



RT type

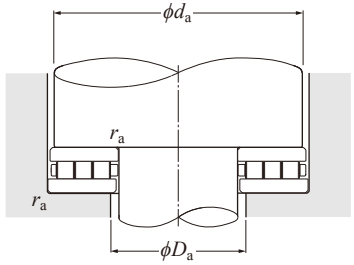


2RT type



3RT type

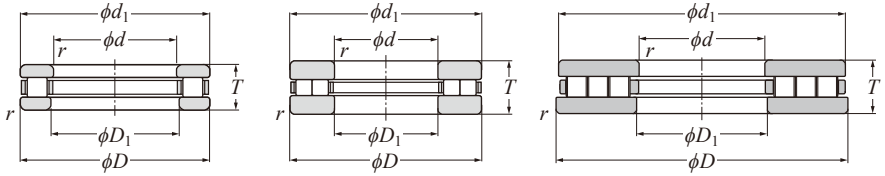
Thrust Cylindrical Roller Bearings NTN



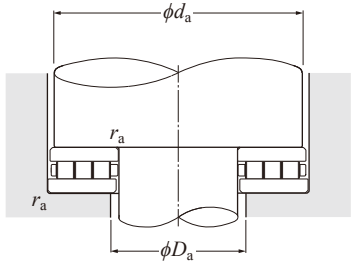
d 180-320 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
180	220	22	1	183	715	73.5	**RT3615**	219	181	213	187	1	1.77
	300	73	3	1 210	4 900	455	**2RT3618**	300	184	298	188	2.5	23.3
190	270	62	2.5	825	2 780	264	**RT3812**	270	195	264	196	2	11.9
	330	70	4	1 420	5 900	535	**2RT3811**	329.5	190.5	327	200	3	27.9
200	340	75	5	1 460	6 150	560	**2RT4028**	340	201	335	204	4	31.4
	340	85	5	1 400	4 950	450	**2RT4030**	340	202	332	212	4	35
	370	85	4	1 950	7 400	660	**2RT4024**	370	200.5	362	210	3	44.3
	400	122	5	2 470	8 250	725	**2RT4032**	396	204	388	216	4	80.3
203.2	406.4	76.2	6	1 700	7 850	685	**3RT4101**	404.038	205.562	389	214	5	52.1
210	250	25	1.5	148	635	60.0	**RT4206**	250	210	243	217	1.5	2.51
220	270	25	1	241	1 060	99.0	**RT4411**	269	221	262	234	1	3.16
	360	85	Outside 4 Inside 2	1 530	5 950	530	**2RT4416**	359	221	349	233	Outside 3 Inside 2	38.1
	400	80	2	1 870	7 750	655	**2RT4425**	399	221	382	244	2	48.5
	430	88	5	2 080	9 100	780	**3RT4406**	430	222	418	230	4	64.6
222.25	520.7	114.3	4	5 650	20 500	1 680	**2RT4426**	514.7	228	511	231	3	135
	520.7	165	4	5 650	20 500	1 680	**2RT4427**	514.7	228	511	231	3	203
240	320	45	2	740	3 350	299	**2RT4814**	316	244	313	247	2	10.4
	425	90	2	2 020	8 850	755	**2RT4803**	425	241	408	254	2	61.6
254	457.2	95.25	6	2 610	12 100	1 010	**3RT5107**	456	256	453	261	5	76
260	340	55	1.5	875	3 350	295	**RT5211**	339.5	260.4	328	270	1.5	13.9
270	540	105	5	3 450	15 800	1 270	**3RT5404**	530	277	530	282	4	125
280	380	55	2.5	720	2 900	249	**RT5606**	375	285	358	302	2	18
	520	109	4	3 200	13 200	1 060	**2RT5610**	520	280	501	309	3	113
290	350	35	1.5	380	1 760	152	**RT5805**	350	290	338	302	1.5	6.92
304.8	457.2	95.25	6	1 960	8 250	675	**2RT6108**	454.8	307.2	450	318	5	60
320	380	30	1.5	305	1 510	126	**RT6405**	379	321	368	336	1.5	6.64

1) Smallest allowable dimension for chamfer dimension r.
2) **RT**: single row, **2RT**: double row, **3RT**: triple row



RT type 2RT type 3RT type



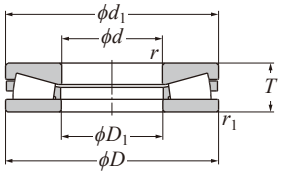
d 320-560 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number [2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
320	440	95	3	1 860	7 100	580	**RT6406**	435	325	428	334	2.5	44
	600	115	5	4 500	20 600	1 590	**3RT6404**	600	321	584	336	4	162
360	610	120	5	4 250	18 200	1 380	**2RT7205**	605	365	598	378	4	157
380	520	112	4	2 110	7 850	610	**RT7607**	515	385	500	404	3	73.8
400	500	63	4	1 440	6 400	495	**RT8009**	495	405	488	412	3	27.9
	540	85	4	2 180	10 100	775	**RT8005**	540	403	526	414	3	59.2
425	650	110	4	3 900	19 200	1 410	**2RT8502**	650	430	635	443	3	145
440	540	45	2.5	840	5 300	400	**2RT8807**	539	441	532	460	2	24.2
540	705	100	5	2 480	11 700	820	**RT10802**	695	565	682	582	4	99.5
560	660	50	3	1 150	7 850	555	**2RT11207**	659	561	653	571	2.5	32.9
	670	85	3	2 050	10 200	720	**RT11204**	660	570	657	575	2.5	58.1
	820	113	5	4 800	26 000	1 770	**2RT11208**	810	570	790	590	4	210

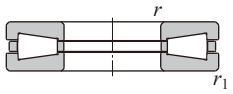
1) Smallest allowable dimension for chamfer dimension r.
2) **RT**: single row, **2RT**: double row, **3RT**: triple row

Thrust Cylindrical Roller Bearings NTN

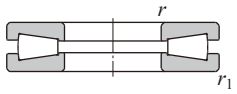
Thrust Tapered Roller Bearings (Single Direction Type) NTN



Drawing 1



Drawing 2



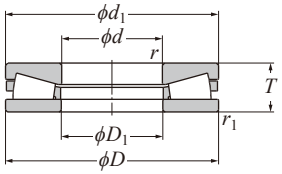
Drawing 3

d 101.600-340 mm

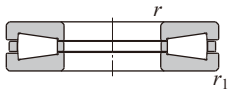
Boundary dimensions mm					Basic load rating kN		Bearing number 2)	Drawing No.	Dimension mm		Mass kg
					dynamic	static					
d	D	T	$r_{s\ min}$ 1)	$r_{1s\ min}$ 1)	C_a	C_{0a}			D_1	d_1	(approx.)
101.600	215.900	46.038	3.3	3.3	765	2 690	◎ **CRT2010**	2	101.6	215.9	9.06
114.300	250.000	53.975	4	4	1 090	3 650	◎ **CRT2303**	2	114.3	250	13.7
115	280	70	4	4	1 240	4 600	**CRT2305**	2	117	280	25.1
127.000	266.700	58.738	4	4	1 240	4 600	◎ **CRT2503**	2	128.6	265.1	17.7
152.400	317.500	69.850	6.4	6.4	1 680	6 250	◎ **CRT3018**	2	152.4	317.5	28.5
168.275	304.800	69.850	6.4	6.4	1 380	4 950	◎ **CRT3407**	2	168.275	304.8	24.6
170	320	100	6	6	1 800	6 400	**CRT3410**	1	170.5	320	39.4
174.625	358.775	82.550	6.4	6.4	1 890	7 000	◎ **CRT3503**	2	174.625	358.775	39.9
177.800	368.300	82.550	8	8	1 950	7 250	◎ **CRT3614**	2	177.8	368.3	42.3
	368.300	82.550	8	8	2 430	8 900	◎ **CRT3617**	2	177.8	368.3	45
203.200	419.100	92.075	9.5	9.5	2 490	9 450	◎ **CRT4109**	2	205.6	416.7	64
	419.100	92.075	9.7	9.7	2 490	9 450	◎ **CRT4107**	2	203.2	419.1	60.9
	419.100	92.075	9.7	9.7	2 760	10 600	◎ **CRT4112**	2	203.2	419.1	64.9
	419.100	92.075	9.7	9.7	3 550	14 800	◎ **CRT4111V**	3	203.2	419.1	64.3
220	370	90	4	4	1 870	7 250	**CRT4405**	1	221	369	39.2
228.600	482.600	104.775	11.2	11.2	3 800	15 500	◎ **CRT4604**	2	230.6	480.6	101
	482.600	104.775	11.2	11.2	3 600	14 300	◎ **CRT4605**	1	230.6	480.6	93.2
234.950	546.100	127.000	16	16	5 100	20 900	◎ **CRT4707**	2	234.95	546.1	164
254.000	539.750	117.475	11.2	11.2	4 300	17 100	◎ **CRT5103**	1	254	539.75	140
260	360	75	2.5	2.5	1 240	4 250	**CRT5201**	1	260.3	360	26.3
279.400	603.250	136.525	11.2	11.2	5 650	23 300	◎ **CRT5613**	2	279.4	603.25	203
	603.250	136.525	11.2	11.2	5 650	23 300	◎ **CRT5617**	2	279.7	603.25	205
290	395	80	4	4	1 500	5 250	**CRT5804**	1	291	395	27.8
320	580	155	7.5	7.5	5 300	18 900	**CRT6408**	2	320.5	580	194
	710	235	10	10	9 600	31 500	**CRT6401**	1	320	708	465

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch size bearings.

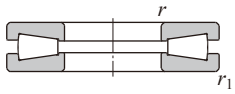
Thrust Tapered Roller Bearings (Single Direction Type) NTN



Drawing 1



Drawing 2

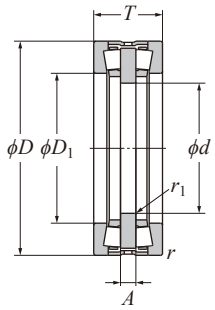


Drawing 3

d 350-920 mm

Boundary dimensions mm					Basic load rating kN		Bearing number [2]	Drawing No.	Dimension mm		Mass kg
					dynamic	static					
d	D	T	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_a	C_{0a}			D_1	d_1	(approx.)
340	460	96	3	3	1 840	7 450	**CRT6803**	1	340	460	49.9
350	460	85	4	4	1 540	5 850	**CRT7014**	1	350.5	460	37.5
360	620	120	6	6	4 200	17 500	**CRT7207**	1	366	600	150
368.300	603.250	120.650	9.7	9.7	4 250	18 000	◎ **CRT7402**	2	368.3	603.25	143
380	500	90	4	4	1 880	7 300	**CRT7610**	1	380.5	500	50.2
406.400	711.200	166.500	7.5	9.5	9 150	33 500	◎ **CRT8104**	1	409	709	275
440	600	105	4	4	2 550	11 700	**CRT8801**	1	440	600	94.2
450	570	100	4	4	1 700	7 550	**CRT9002**	1	452	570	64.8
457.200	733.425	133.350	3	12.7	5 600	24 500	◎ **CRT9102**	2	457.454	733.044	208
508.000	990.600	196.850	12.7	12.7	13 500	62 500	◎ **CRT10202**	2	508	990.6	701
749.3	955.68	127	5	2.5	6 100	29 300	**CRT15003**	1	761.24	952.5	229
	958	127	5	2.5	6 100	29 300	**CRT15001**	1	749.5	952.5	245
920	1 120	150	7.5	7.5	6 100	32 500	**CRT18401**	1	922	1 118	295

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch size bearings.

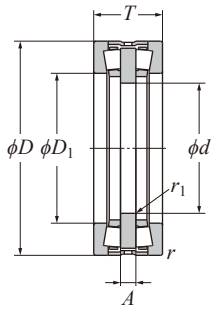


d 152-351 mm

Boundary dimensions mm					Basic dynamic kN	Bearing number 2)	Dimension mm		Mass kg
d	D	T	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_a		D_1	A	(approx.)
152	400	120	3	3	1 020	**CRTD3010**	290	25	72.2
170	240	84	2.5	1	405	**CRTD3401**	184	20	12
180	280	90	2	1	715	**CRTD3618**	196	20	20
	280	90	2	1	730	**CRTD3620**	210	20	17.4
200	280	96	2.1	1	505	**CRTD4015**	216	26	18
	280	96	2.1	1	450	**CRTD4018**	216	22	16.9
	560	138	3	4	1 800	**CRTD4013**	430	40	105
220	300	96	2.5	2	480	**CRTD4406**	236	26	19
	300	96	2.5	2	480	**CRTD4408**	236	22	18.5
	340	130	2	1.5	955	**CRTD4401**	250	39	42.1
240	320	96	2	1	455	**CRTD4807**	258	22	19.5
	320	96	2	0.6	655	**CRTD4804**	256	22	20.1
	320	115	2.1	0.6	570	**CRTD4809**	258	41	24.3
	380	105	2	2	1 050	**CRTD4808**	275	27	39.1
250	360	96	2.1	2	755	**CRTD5011**	285	24	27.1
	380	100	2	1.1	960	**CRTD5010**	275	22	40
	380	128	2	1.1	960	**CRTD5012**	275	50	52.7
260	360	92	2	1	645	**CRTD5216**	285	20	26
	400	120	3	1.5	1 020	**CRTD5217**	290	25	51.5
291.150	520.000	266.000	12	3	2 240	◎ **CRTD5807**	349	118	239
300	420	100	2	2	975	**CRTD6001**	330	23	38
320	440	108	3	2	1 090	**CRTD6406**	355	20	43
	470	130	3	2	1 540	**CRTD6404**	350	30	73
350	490	130	3	1.1	1 280	**CRTD7012**	390	30	72
	540	164	3	3	2 010	**CRTD7002**	400	65	135

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch size bearings.
Note: C_a does not mean allowable load ratings. For details, please contact **NTN** Engineering.

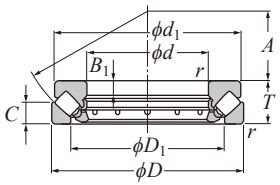
Thrust Tapered Roller Bearings (Double Direction Type)



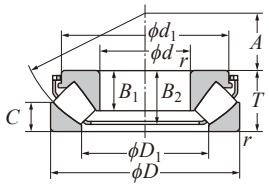
d 351.150-550 mm

Boundary dimensions mm					Basic dynamic kN	Bearing number 2)	Dimension mm		Mass kg
d	D	T	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_a		D_1	A	(approx.)
351	670	308	12	4	3 700	**CRTD7003**	435	120	474
351.150	670.000	319.000	12	4	3 700	◎ **CRTD7001**	435	131	494
380	560	130	3	2	1 800	**CRTD7612**	430	32	102
420	620	170	3	1.1	2 420	**CRTD8403**	465	35	155
440	645	167	5	2	2 300	**CRTD8802**	500	50	176
460	680	155	5	3	2 640	**CRTD9201**	510	30	171
550	760	230	4	2	3 200	**CRTD11002**	610	50	296

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch size bearings.
Note: C_a does not mean allowable load ratings. For details, please contact **NTN** Engineering.

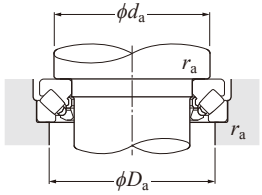


Non-ULTAGE ™ series

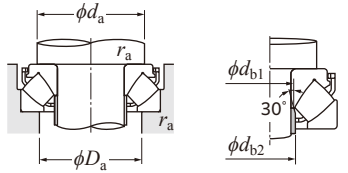


ULTAGE ™ series

Thrust Spherical Roller Bearings NTN



Non-ULTAGE ™ series



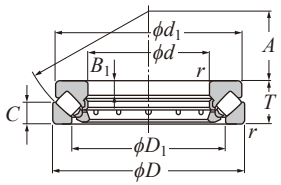
ULTAGE ™ series

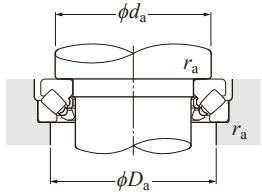
Dynamic equivalent axial load
$P_a = F_a + 1.2F_r$
Static equivalent axial load
$P_{0a} = F_a + 2.7F_r$
Provided that $\frac{F_r}{F_a} \leq 0.55$ only.

d 100-160 mm

Boundary dimensions mm				Basic load rating kN		Fatigue load limit kN	Bearing number	Dimension mm						Installation-related dimensions mm					Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a dynamic	C_{0a} static	C_u		D_1	d_1	B_1	B_2	C	A	d_a Min.	d_{b1} Max.	d_{b2} Min.	D_a Max.	r_{as} Max.	(approx.)
100	170	42	1.5	385	1 160	96	**29320**	129	163	14	—	20.8	58	130	—	—	150	1.5	3.94
	210	67	3	760	2 130	156	**29420**	146	200	24	—	32	62	150	—	—	175	2.5	11.5
	210	67	3	1 130	2 500	130	**29420E**	141	185	44	58.9	32	62	150	107	114	175	2.5	10.3
110	190	48	2	495	1 500	120	**29322**	143	182	16	—	23	64	145	—	—	165	2	5.78
	230	73	3	940	2 620	193	**29422**	162	220	26	—	35	69	165	—	—	190	2.5	15
	230	73	3	1 350	3 040	144	**29422E**	156	199	48.5	65	35	69	165	118	125	190	2.5	13.1
120	210	54	2.1	595	1 770	151	**29324**	159	200	18	—	26	70	160	—	—	180	2	7.92
	250	78	4	1 080	3 050	212	**29424**	174	236	29	—	37	74	180	—	—	205	3	18.6
	250	78	4	1 470	3 470	170	**29424E**	171	218	52.7	71	35.9	74	180	128	135	205	3	16.7
130	225	58	2.1	685	2 100	168	**29326**	171	215	19	—	28	76	170	—	—	195	2	9.76
	270	85	4	1 200	3 550	232	**29426**	189	255	31	—	41	81	195	—	—	225	3	23.7
	270	85	4	1 740	4 220	200	**29426E**	180	238	58.5	74	39.6	81	195	138	146	225	3	21.4
140	240	60	2.1	760	2 360	182	**29328**	183	230	20	—	29	82	185	—	—	205	2	11.4
	280	85	4	1 240	3 750	252	**29428**	199	268	31	—	41	86	205	—	—	235	3	25.2
	280	85	4	1 760	4 210	209	**29428E**	196	244	56	74.5	42	86	205	149	158	235	3	22.3
150	215	39	1.5	380	1 340	122	**29230**	178	208	14	—	19	82	179	—	—	196	1.5	4.56
	250	60	2.1	750	2 390	191	**29330**	194	240	20	—	29	87	195	—	—	215	2	12
	300	90	4	1 430	4 350	280	**29430**	214	285	32	—	44	92	220	—	—	250	3	30.5
	300	90	4	2 120	5 120	235	**29430E**	204	264	60.5	81	43.2	92	220	158	168	250	3	27.4
160	225	39	1.5	400	1 460	126	**29232**	188	219	14	—	19	86	189	—	—	206	1.5	4.88
	270	67	3	915	2 860	223	**29332**	208	260	24	—	32	92	210	—	—	235	2.5	15.9
	320	95	5	1 670	5 150	320	**29432**	229	306	34	—	45	99	230	—	—	265	4	37
	320	95	5	2 330	5 630	263	**29432E**	221	280	63	84.9	45.5	99	230	170	182	265	4	32.5

1) Smallest allowable dimension for chamfer dimension r.
Note: "**E**" indicates **ULTAGE™ series**.





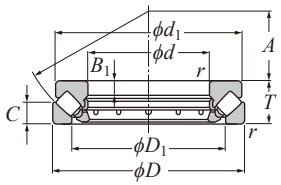
Dynamic equivalent axial load
$P_a = F_a + 1.2F_r$
Static equivalent axial load
$P_{0a} = F_a + 2.7F_r$
Provided that $\frac{F_r}{F_a} \leq 0.55$ only.

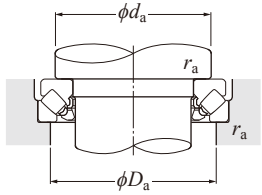
d 170-280 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number	Dimension mm					Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		D_1	d_1	B_1	C	A	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	240	42	1.5	475	1 770	146	**29234**	198	233	15	20	92	201	218	1.5	6.02
170	280	67	3	950	3 050	238	**29334**	216	270	23	32	96	220	245	2.5	16.6
	340	103	5	1 840	5 750	345	**29434**	243	324	37	50	104	245	285	4	45
	250	42	1.5	500	1 920	160	**29236**	208	243	15	20	97	211	228	1.5	6.27
180	300	73	3	1 110	3 600	272	**29336**	232	290	25	35	103	235	260	2.5	21.2
	360	109	5	2 050	6 200	400	**29436**	255	342	39	52	110	260	300	4	52.9
	270	48	2	585	2 230	184	**29238**	223	262	15	24	104	225	245	2	8.8
190	320	78	4	1 280	4 250	294	**29338**	246	308	27	38	110	250	275	3	26
	380	115	5	2 230	6 800	430	**29438**	271	360	41	55	117	275	320	4	62
	280	48	2	595	2 300	183	**29240**	236	271	15	24	108	235	255	2	9.14
200	340	85	4	1 420	4 600	330	**29340**	261	325	29	41	116	265	295	3	31.9
	400	122	5	2 490	7 650	465	**29440**	286	380	43	59	122	290	335	4	73.3
	300	48	2	620	2 480	198	**29244**	254	292	15	24	117	260	275	2	9.94
220	360	85	4	1 540	5 200	360	**29344**	280	345	29	41	125	285	315	3	34.5
	420	122	6	2 560	8 100	505	**29444**	308	400	43	58	432	310	355	5	77.8
	340	60	2.1	890	3 500	271	**29248**	283	330	19	30	130	285	305	2	17.5
240	380	85	4	1 530	5 250	390	**29348**	300	365	29	41	135	300	330	3	36.6
	440	122	6	2 680	8 700	530	**29448**	326	420	43	59	142	330	375	5	82.6
	360	60	2.1	960	3 950	296	**29252**	302	350	19	30	139	305	325	2	18.6
260	420	95	5	1 910	6 800	445	**29352**	329	405	32	45	148	330	365	4	52
	480	132	6	3 050	10 000	670	**29452**	357	460	48	64	154	360	405	5	108
	380	60	2.1	975	4 050	245	**29256**	323	370	19	30	150	325	345	2	19.8
280	440	95	5	2 010	7 250	480	**29356**	348	423	32	46	158	350	390	4	54.6
	520	145	6	3 700	12 400	710	**29456**	387	495	52	68	166	390	440	5	140

1) Smallest allowable dimension for chamfer dimension r.

Thrust Spherical Roller Bearings NTN



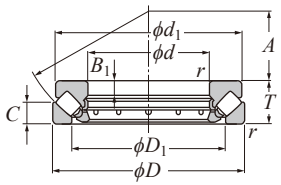


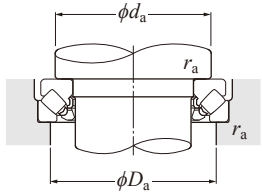
Dynamic equivalent axial load
$P_a = F_a + 1.2F_r$
Static equivalent axial load
$P_{0a} = F_a + 2.7F_r$
Provided that $\frac{F_r}{F_a} \leq 0.55$ only.

d 300-440 mm

Boundary dimensions mm				Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number	Dimension mm					Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		D_1	d_1	B_1	C	A	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
	420	73	3	1 330	5 350	385	**29260**	353	405	21	38	162	355	380	2.5	30.9
300	480	109	5	2 380	8 250	580	**29360**	379	460	37	50	168	380	420	4	75.8
	540	145	6	3 850	13 200	735	**29460**	402	515	52	70	175	410	460	5	147
	440	73	3	1 400	5 800	415	**29264**	372	430	21	38	172	375	400	2.5	33.5
320	500	109	5	2 470	8 800	605	**29364**	399	482	37	53	180	400	440	4	79.9
	580	155	7.5	4 100	14 200	820	**29464**	435	555	55	75	191	435	495	6	181
	460	73	3	1 380	5 800	395	**29268**	395	445	21	37	183	395	420	2.5	34.4
340	540	122	5	2 950	10 700	695	**29368**	428	520	41	59	192	430	470	4	107
	620	170	7.5	4 900	17 500	925	**29468**	462	590	61	82	201	465	530	6	230
	500	85	4	1 680	7 050	480	**29272**	423	485	25	44	194	420	455	3	50.5
360	560	122	5	3 000	11 100	915	**29372**	448	540	41	59	202	450	495	4	112
	640	170	7.5	5 000	18 500	950	**29472**	480	610	61	82	210	485	550	6	240
	520	85	4	1 770	7 650	505	**29276**	441	505	27	42	202	440	475	3	53.4
380	600	132	6	3 550	13 300	835	**29376**	477	580	44	63	216	480	525	5	143
	670	175	7.5	5 450	19 700	1 060	**29476**	504	640	63	85	230	510	575	6	267
	540	85	4	1 800	7 950	525	**29280**	460	526	27	42	212	460	490	3	55.8
400	620	132	6	3 750	14 500	865	**29380**	494	596	44	64	225	500	550	5	148
	710	185	7.5	6 050	22 100	1 140	**29480**	534	680	67	89	236	540	610	6	321
	580	95	5	2 330	10 400	670	**29284**	489	564	30	46	225	490	525	4	76.6
420	650	140	6	4 000	15 500	925	**29384**	520	626	48	68	235	525	575	5	172
	730	185	7.5	6 100	22 800	1 190	**29484**	556	700	67	89	244	560	630	6	333
	600	95	5	2 390	10 900	695	**29288**	508	585	30	49	235	510	545	4	79.6
440	680	145	6	4 200	16 400	965	**29388**	548	655	49	70	245	550	600	5	195
	780	206	9.5	7 100	26 200	1 340	**29488**	588	745	74	100	260	595	670	8	428

1) Smallest allowable dimension for chamfer dimension r.





Dynamic equivalent axial load
$P_a = F_a + 1.2F_r$
Static equivalent axial load
$P_{0a} = F_a + 2.7F_r$
Provided that $\frac{F_r}{F_a} \leq 0.55$ only.

d 460-900 mm

Boundary dimensions mm				Basic load rating kN dynamic	Basic load rating kN static	Fatigue load limit kN	Bearing number	Dimension mm					Installation-related dimensions mm			Mass kg
d	D	T	$r_{s\,min}$ [1]	C_a	C_{0a}	C_u		D_1	d_1	B_1	C	A	d_a Min.	D_a Max.	r_{as} Max.	(approx.)
460	620	95	5	2 390	11 000	900	**29292**	530	605	30	46	245	530	570	4	82.8
	710	150	6	4 700	18 500	1 060	**29392**	567	685	51	72	257	575	630	5	221
	800	206	9.5	7 350	27 900	1 390	**29492**	608	765	74	100	272	615	690	8	443
480	650	103	5	2 670	12 000	760	**29296**	556	635	33	55	259	555	595	4	98.6
	730	150	6	4 700	18 700	1 100	**29396**	590	705	51	72	270	595	650	5	228
	850	224	9.5	8 350	31 500	1 490	**29496**	638	810	81	108	280	645	730	8	552
500	670	103	5	2 830	13 000	810	**292/500**	574	654	33	55	268	575	615	4	102
	750	150	6	4 750	19 300	1 140	**293/500**	611	725	51	74	280	615	670	5	235
	870	224	9.5	8 750	33 000	1 610	**294/500**	661	830	81	107	290	670	750	8	569
530	710	109	5	3 050	14 000	840	**292/530**	610	692	39	55	288	610	650	4	122
	920	236	9.5	9 600	36 000	1 760	**294/530**	697	880	86	115	308	715	790	8	669
560	750	115	5	3 550	16 600	795	**292/560**	642	732	38	61	302	640	690	4	144
	980	250	12	10 300	40 500	1 880	**294/560**	743	938	90	121	321	755	835	10	815
600	800	122	5	3 900	18 300	1 090	**292/600**	686	780	40	63	321	690	735	4	171
	1 030	258	12	11 400	44 500	2 110	**294/600**	785	978	90	125	360	800	885	10	897
630	850	132	6	4 750	22 800	1 260	**292/630**	717	822	44	70	338	725	780	5	213
	1 090	280	12	12 900	51 000	2 290	**294/630**	830	1 040	100	136	365	845	935	10	1 110
670	900	140	6	4 750	23 300	1 320	**292/670**	765	880	49	68	360	775	820	5	257
	1 150	290	15	14 400	57 000	2 580	**294/670**	880	1 105	106	138	387	895	990	12	1 280
710	1 220	308	15	15 700	63 500	2 780	**294/710**	925	1 165	112	150	415	950	1 050	12	1 520
750	1 280	315	15	17 400	69 000	3 050	**294/750**	983	1 220	116	152	436	995	1 105	12	1 690
800	1 360	335	15	18 900	79 000	3 250	**294/800**	1 040	1 300	120	162	462	1 060	1 175	12	2 040
900	1 520	372	15	23 200	98 000	4 000	**294/900**	1 170	1 460	135	180	518	1 190	1 310	12	2 840

1) Smallest allowable dimension for chamfer dimension r.

Special Application Bearings

Special Application Bearings Contents

NTN New Generation Bearings (ULTAGE™ series)

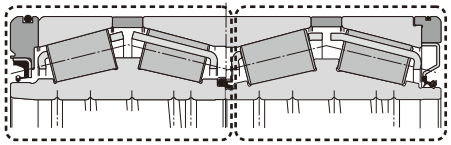
Other Bearings

The ULTAGE™ series sealed four-row tapered roller bearings [CROU-LL type] are designed to provide "high load capacity", "high load resistance performance", and "high sealing performance". These traits are required for rolling mill roll neck applications to improve reliability with a longer operating life.

1. Features

1) High load capacity

Higher load capacity and longer operating life are achieved by maximizing the size and number of rollers in the bearing.



Conventional **NTN** product | ULTAGE™ product

2) High load resistance performance

The load resistance performance has been greatly improved by making the contact stress distribution generated between the rolling elements and the raceway surface uniform.

3) High sealing performance

The ULTAGE™ series sealed four-row tapered roller bearing utilizes a specially designed fluorine rubber seal for high sealing performance, while minimizing the volume of the seal within the bearing.

Optimizing the tension force of the main seal lip and the overall design of the seal to minimize contamination ingress, reduces the internal water immersion by 50 % or more while preventing grease from flowing out from the sub lip.

Replacement of the seal on a regular basis is recommended. For details, please contact **NTN** Engineering.

4) Standard adoption of long-life grease

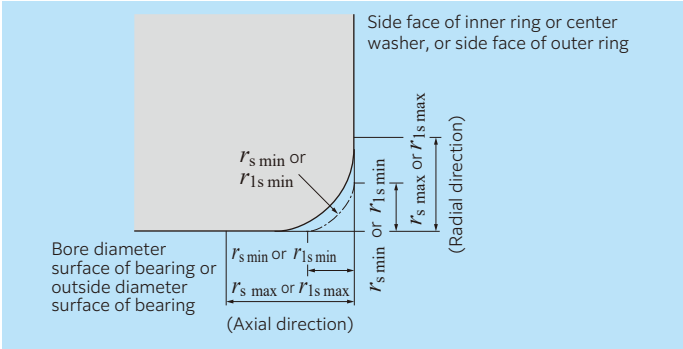
This bearing is filled with an ample amount of long-life grease to avoid the need for cleaning or filling the bearing with grease before assembling into the application.

2. Bearing number

2E- CROU- 6001 LLA1X PX1

- PX1: Tolerance code
- LLA1X: Seal code
- 6001: Bearing bore diameter code + serial code
- CROU-: Bearing type (ULTAGE™ series four-row tapered roller bearing)
- 2E-: Material code
  - 2E: Material of the inner and outer rings is carburizing (case hardened) steel. Material of the rolling elements is bearing steel.
  - E: Carburizing (case hardened) steel

3. Chamfer dimension



Unit: mm

$r_{s\,min}$ or $r_{1s\,min}$	Nominal bearing bore diameter d		$r_{s\,max}$ or $r_{1s\,max}$	
	Over	Incl.	Radial direction	Axial direction
1	50	—	1.9	3
1.5	120	250	2.8	3.5
	250	—	3.5	4
2.5	120	250	4	5.5
	250	—	4.5	6
3	120	250	4.5	6.5
	250	400	5	7
	400	—	5.5	7.5

4. Allowable temperature range

−20 to 120 °C

5. Bearing fits (recommended)

Metric series: Shaft d6/housing G7
Inch size: Contact **NTN** Engineering.

6. Standard grease fill

Grease brand: Palmax RBG (L373)
Grease amount: Space volume ratio 35 %

7. Allowable speed

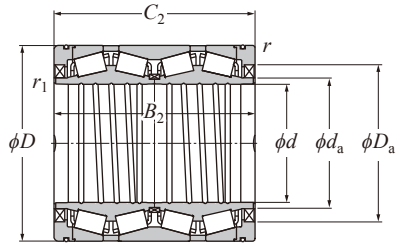
$d_m \cdot n$ value ≤ 30×10^4

d_m: Roller pitch diameter (mm) ≈ $(d + D)/2$
d : Bearing bore diameter, mm
D : Bearing outside diameter, mm
n : Rotational speed (min^{-1})

The above are approximate standard values and may not be appropriate depending on the usage condition. For details, please contact **NTN** Engineering.

8. Material

Inner and outer rings: Carburizing (case hardened) steel
Rolling elements: Bearing steel
* mark in the dimension table indicates carburizing (case hardened) steel.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

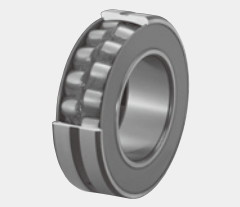
$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

Series	Boundary dimensions mm						(approx.) Standard radial clearance [2] mm	Standard axial clearance [2] mm	Basic load rating kN		Bearing number [3]	Installation-related dimensions mm		Constant	Axial load factors		
	d	D	B_2	C_2	$r_{1s\,min}$ [1]	$r_{s\,min}$ [1]			dynamic C_r	static C_{0r}		d_a	D_a	e	Y_1	Y_2	Y_0
Metric series	220	295	315	315	1	2.5	0.093-0.106	0.420-0.480	1 890	4 650	**2E-CROU-4401LLA1X**	235	267	0.33	2.03	3.02	1.98
	225	320	230	230	1	2.5	0.099-0.115	0.360-0.420	1 870	3 700	**2E-CROU-4501LLA1X**	241	294	0.41	1.64	2.44	1.60
	240	338	248	248	1	2.5	0.104-0.118	0.450-0.510	2 320	4 600	**2E-CROU-4801LLA1X**	257	309	0.35	1.95	2.90	1.91
	240	338	340	340	1	2.5	0.107-0.123	0.400-0.460	2 970	6 850	**2E-CROU-4802LLA1X**	257	309	0.40	1.68	2.50	1.64
	250	365	270	270	1	2.5	0.113-0.129	0.420-0.480	2 760	5 300	**2E-CROU-5001LLA1X**	272	333	0.40	1.68	2.50	1.64
	260	365	340	340	1	2.5	0.115-0.131	0.430-0.490	3 350	7 450	**2E-CROU-5201LLA1X**	275	327	0.40	1.68	2.50	1.64
	300	420	310	310	1	2.5	0.131-0.147	0.490-0.550	3 600	7 650	**2E-CROU-6001LLA1X**	318	382	0.40	1.68	2.50	1.64
	310	430	350	350	1	2.5	0.136-0.154	0.520-0.590	4 050	8 900	**2E-CROU-6201LLA1X**	329	388	0.39	1.72	2.56	1.68
	410	546	400	400	1.5	2.5	0.173-0.188	0.780-0.850	5 500	13 300	**2E-CROU-8201LLA1X**	434	504	0.33	2.03	3.02	1.98
	440	590	480	480	1.5	2.5	0.188-0.204	0.850-0.920	6 600	16 200	**2E-CROU-8801LLA1X**	462	540	0.33	2.03	3.02	1.98
	440	620	454	454	3	2.5	0.195-0.211	0.880-0.950	7 650	16 700	**2E-CROU-8802LLA1X**	473	570	0.33	2.03	3.02	1.98
	530	780	570	570	3	2.5	0.244-0.259	1.100-1.170	13 500	29 400	**E-CROU-10601LLA1X***	581	710	0.33	2.03	3.02	1.98
Inch size	220.662	314.325	239.712	239.712	1	2.5	0.098-0.111	0.450-0.510	2 240	4 350	**2E-CROU-4402LLA1X**	240	290	0.33	2.07	3.09	2.03
	254.000	358.775	269.875	269.875	1	2.5	0.111-0.127	0.430-0.490	2 770	5 700	**2E-CROU-5101LLA1X**	274	328	0.39	1.74	2.59	1.70
	304.902	412.648	266.700	266.700	1	2.5	0.130-0.150	0.450-0.520	2 810	5 850	**2E-CROU-6101LLA1X**	323	379	0.43	1.56	2.32	1.52
	343.052	457.098	254.000	254.000	1	2.5	0.136-0.158	0.430-0.500	2 830	5 950	**2E-CROU-6901LLA1X**	364	423	0.47	1.43	2.12	1.40
	343.052	457.098	299.000	299.000	1	2.5	0.143-0.163	0.500-0.570	3 500	8 150	**2E-CROU-6902LLA1X**	364	423	0.43	1.57	2.34	1.53
	501.650	711.200	520.700	520.700	3	2.5	0.206-0.226	0.730-0.800	10 100	23 900	**E-CROU-10001LLA1X***	542	642	0.42	1.60	2.38	1.56
	595.312	844.550	615.950	615.950	3	2.5	0.266-0.282	1.200-1.270	14 000	33 000	**2E-CROU-11901LLA1X**	638	770	0.33	2.03	3.02	1.98

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Consult with **NTN** Engineering because the appropriate value may change depending on the use conditions.

3) Bearing numbers marked "*" use rolling elements made of carburizing (case hardened) steel.



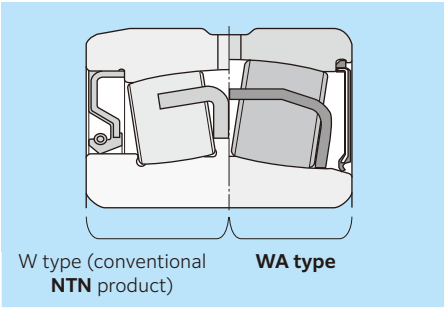
The ULTAGE™ series sealed spherical roller bearings [WA type] are designed to meet the demands of “long operating life”, “improved reliability”, and “improved handling” required for various types of industrial machinery.

1. Features

1) Long operating life
Increasing the roller diameter, maximizing the number of rollers, and industry-leading load ratings have led to higher load capacities and longer operating lives. Internal specifications are the same as the EA type.

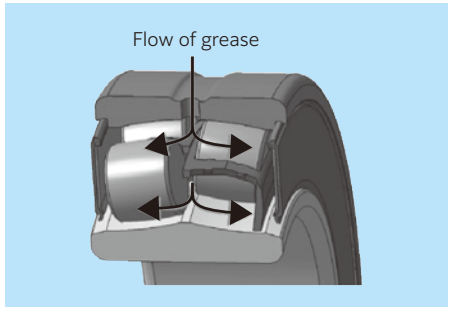
2) Improved reliability
The standard seal design is a “contact type” dust-resistant seal designed to minimize the volume of the seal within the bearing.

(1) Foreign matter intrusion is prevented by the adoption of the specially designed contact-type rubber seal.
(2) Consistent dust resistance is achieved without changing the contact surface pressure of the seal with respect to the bearing alignment.

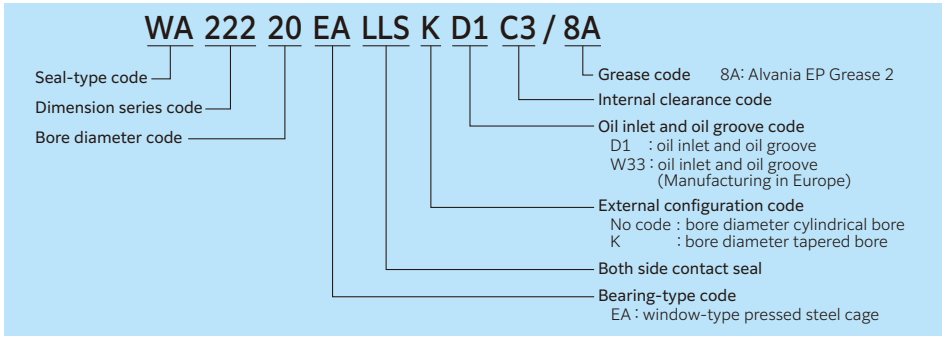


3) Improved handling
This bearing is filled with an ample amount of long-life grease to avoid the need for cleaning or filling the bearing with grease before assembling into the application.
(1) Grease brand: Alvania EP Grease 2 (8A) with extreme-pressure additive for heavy loads
(2) Grease amount: Space volume ratio 15 to 25 %

4) Standard adoption of oil inlet and groove
The bearing is able to be re-greased due to the oil inlet and oil groove that are standard in the outer ring.



2. Bearing number



3. Allowable speed

When grease is supplied : dn value ≤ 6×10^4
When no grease is supplied : dn value ≤ 8×10^4
* dn value:
dn = bearing bore diameter d (mm)× rotational speed n (min^{-1})

4. Allowable temperature range

Bearing temperature: −20 to 110 °C

5. Allowable misalignment angle

1/115

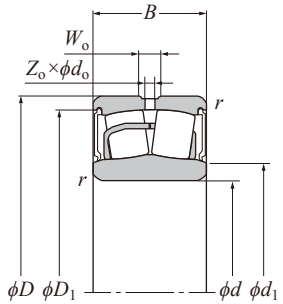
6. Allowable axial load

$F_a/F_r \leq e$
F_a : Axial load
F_r : Radial load
e : Constant (see dimension table)

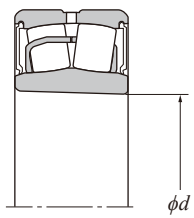
If this bearing type is used for a vertical shaft or under a large axial load, the load on the rollers of the row that is not subject to the axial load can become small. This small load on the rollers can result in skidding of the rollers, which can cause bearing damage. If the ratio of the radial load exceeds the factor e in the dimension table ($F_a/F_r > e$), consult **NTN** Engineering.

7. Handling precautions

1) The radial internal clearance on a sealed spherical roller bearing cannot be measured with a clearance (thickness) gauge. Please manage the clearance after assembly by measuring the movement in the axial direction shown in **Table 5.1** (page B-183) in section “Spherical Roller Bearings”.
2) When the bearing misalignment exceeds the allowable misalignment (1/115), the rollers may come in contact with seal and cause seal deformation. It should be noted that the seal may come off when a large force is applied in this state.
3) Use Li-based mineral grease when re-greasing. If other types of grease are to be used, please contact **NTN** Engineering.
4) When temperature mounting for assembly, the bearing temperature must be 100 °C or below. The method of immersing bearings in hot oil cannot be used for this bearing type.



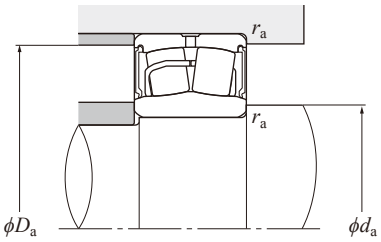
Cylindrical bore



Tapered bore

Number of oil inlets on outer ring
Number of oil inlets Z_o
4

ULTAGE Sealed Spherical Roller Bearings [WA Type] NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

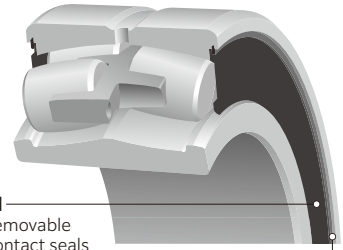
$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number		Dimension (Reference) mm		Installation-related dimensions mm			Constant	Axial load factors			Mass (approx.) kg		Amount of grease filled in (approx.) g
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [2]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore	
60	110	34	1.5	7	3	187	181	15.4	**WA22212EALLSD1/8A**	**WA22212EALLSKD1/8A**	70	102	69	102	1.5	0.24	2.84	4.23	2.78	1.29	1.26	6.6- 11.0
65	120	38	1.5	8	3.5	226	224	18.2	**WA22213EALLSD1/8A**	**WA22213EALLSKD1/8A**	76	110	74	111	1.5	0.24	2.79	4.15	2.73	1.73	1.68	8.5- 14.2
70	125	38	1.5	7	3.5	235	240	20.1	**WA22214EALLSD1/8A**	**WA22214EALLSKD1/8A**	82	116	79	116	1.5	0.22	3.01	4.48	2.94	1.86	1.81	9.6- 16.0
75	130	38	1.5	7	3.5	244	249	21.1	**WA22215EALLSD1/8A**	**WA22215EALLSKD1/8A**	86	121	84	121	1.5	0.22	3.14	4.67	3.07	1.93	1.88	9.9- 16.4
80	140	40	2	8	3.5	278	287	24	**WA22216EALLSD1/8A**	**WA22216EALLSKD1/8A**	93	131	91	131	2.0	0.22	3.14	4.67	3.07	2.38	2.32	12.0- 20.0
85	150	44	2	8	3.5	324	330	27.1	**WA22217EALLSD1/8A**	**WA22217EALLSKD1/8A**	98	140	96	140	2.0	0.22	3.07	4.57	3.00	2.97	2.89	16.9- 28.1
90	160	48	2	10	4.5	384	398	30.2	**WA22218EALLSD1/8A**	**WA22218EALLSKD1/8A**	103	149	101	149	2.0	0.23	2.90	4.31	2.83	3.75	3.66	20.0- 34.0
95	170	51	2.1	10	4.5	416	417	33.4	**WA22219EALLSD1/8A**	**WA22219EALLSKD1/8A**	108	158	107	158	2.1	0.23	2.95	4.40	2.89	4.44	4.32	25.9- 43.2
100	180	55	2.1	11	5	472	495	36.9	**WA22220EALLSD1/8A**	**WA22220EALLSKD1/8A**	115	168	112	168	2.1	0.24	2.84	4.23	2.78	5.53	5.39	28.8- 48.0
110	200	63	2.1	12	6	602	643	45	**WA22222EALLSD1/8A**	**WA22222EALLSKD1/8A**	127	188	122	188	2.1	0.25	2.69	4.00	2.63	7.98	7.76	41.6- 69.3
120	215	69	2.1	12	6	688	753	49.9	**WA22224EALLSD1/8A**	**WA22224EALLSKD1/8A**	138	203	132	203	2.1	0.25	2.74	4.08	2.68	9.96	9.67	52.8- 88.0
130	230	75	3	13	6	808	898	56.6	**WA22226EALLSD1/8A**	**WA22226EALLSKD1/8A**	148	216	144	216	3.0	0.25	2.69	4.00	2.63	12.2	11.8	62.6-104.4

1) Smallest allowable dimension for chamfer dimension *r*.
2) "**K**" indicates bearings having a tapered bore with a taper ratio of 1:12.

The ULTAGE™ series sealed spherical roller bearings [EMLLX type] are designed to meet the demands of "long operating life", "improved reliability", and "improved handling" required for various types of industrial machinery.



1. Specifications

1) Fully compatible with open bearings

The dimensions are the same as open bearings complying with ISO dimensions, so they can replace open bearings without changing the dimensions of the surrounding parts. The allowable misalignment, 1/115, is also the same as that of open bearings (see **Fig. 1**).

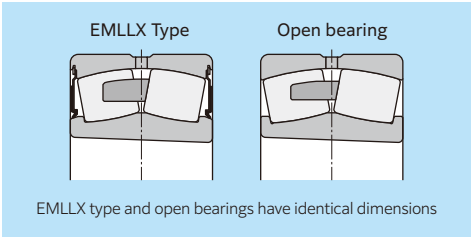


Fig. 1

2) Use of removable seals

Seals are installable, removable, and replaceable as they are held in place with a retaining ring (see **Fig. 2**).

- When installing the bearing, the radial internal clearance can be measured and adjusted accurately using a thickness gauge (see **Fig. 3**).
- The retaining rings can be installed without a special tool, and removed by inserting a flathead screwdriver or a like tool into the retaining ring notch (see **Fig. 4**).

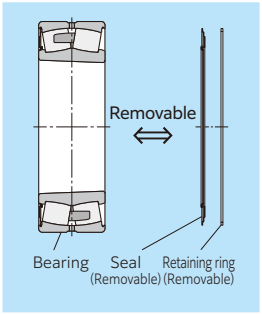


Fig. 2

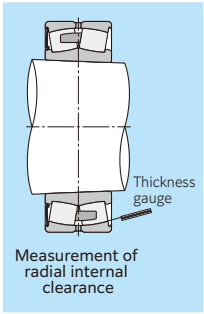


Fig. 3

3) Adoption of special thin seals

- Ensures uniform contact pressure of the seal lip during self-alignment of the bearing to prevent ingress of foreign matter and provide stable sealing.
- Provides sealed spherical roller bearings having the world's largest load capacity.

4) Lubrication spec. in accordance with requirements

Either grease-filled type or grease-free type is selectable.

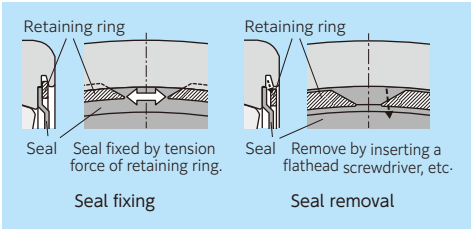


Fig. 4

2. Bearing number

231 36 EM LLX K D1 C3 / 0G V11

- V11 — Product specification code
  - V10: seals are attached on both sides.
  - V11: seal is attached on one side only. Seal is not attached on the opposite side (for tapered bore, on the smaller diameter side) but included with product.
- 0G — Lubrication code /8A : Alvania EP Grease2 /0G : No grease
- C3 — Internal clearance code
- D1 — Oil inlet and oil groove code D1: oil inlet and oil groove
- K — External configuration code No code: bore diameter cylindrical bore K : bore diameter tapered bore
- LLX — Both side contact seal
- EM — Bearing-type code EM : one-piece high strength, machined brass cage
- 36 — Bore diameter number
- 231 — Bearing series (type code + width series code + diameter series code)

* The lubricant code and the product specification code have the following combination: /8AV10 or /0GV11

3. Standard grease fill

Grease brand: Alvania EP Grease 2 (8A)
Grease with extreme-pressure additive for heavy loads is selected.

Grease amount: Space volume ratio 20 to 35 %

4. Allowable speed

dn value $\leq 6 \times 10^4$

* dn value:
dn = bearing bore diameter d (mm)× rotational speed n (min^{-1})

5. Allowable temperature range

Bearing temperature: −20 to 110 °C

6. Allowable misalignment angle

1/115

7. Allowable axial load

$F_a/F_r \leq e$
F_a : Axial load
F_r : Radial load
e : Constant (see dimension table)

If this bearing type is used for a vertical shaft or under a large axial load, the load on the rollers of the row that is not subject to the axial load can become small. This small load on the rollers can result in skidding of the rollers, which can cause bearing damage. If the ratio of the radial load exceeds the factor e in the dimension table ($F_a/F_r > e$), consult **NTN** Engineering.

8. Handling precautions

1. When assembling tapered bore bearings, maintain the reduction in radial internal clearance shown in **Table 1**.
   The reduction in radial internal clearance is the difference between the initial clearance and the clearance after assembly.
   Note that the axial displacement drive-ups in **Table 1** are for reference only.

2. When the bearing misalignment exceeds the allowable misalignment (±1/115) during handling, the rollers may come into contact with the seal and cause seal deformation. Furthermore, if additional force is applied in this state, the seal and retaining ring may come off from the bearing, so please exercise caution.

3. If a shrink fit is to be used for assembly, do not exceed a bearing temperature of 100 °C. However, the method of shrink fit by immersion in a hot oil bath cannot be used.

4. The retaining ring can be installed without special tools. Fit it in the groove in the outer ring sequentially from one end (see **Photo 1**).

5. There is a possibility that the seals or retaining rings will fall out during operation or handling of the bearing, confirm the seal and retaining ring are securely fit.

6. After assembling of the bearing, check that there is no slack in the retaining rings.

7. Remove the retaining ring by inserting a flathead screwdriver or a like tool into the retaining ring notch (see **Photo 2**).

8. When fitting or removing the seals or retaining rings, wear protective glasses for safety, and use caution when handling the retaining rings. Also, wear gloves when handling the retaining rings so as not to injure your hand or finger with the tip of the retaining ring.

9. When fitting or removing the seals or retaining rings, be careful not to damage the seals or retaining rings.

10. When supplying grease, the guideline for grease supply pressure is about 0.1 MPa. Sudden application of pressure may cause the seal or retaining ring to come off.

11. If the combination of the lubrication code and product spec. is "/8AV10", use lithium mineral grease when supplying grease. If other types of grease are to be used, please contact **NTN** Engineering.

*8A: Alvania EP Grease 2; V10: With seals already fitted on both sides

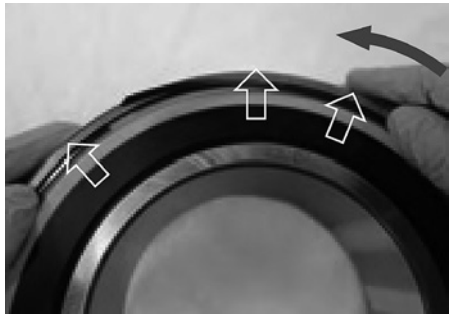


Photo 1

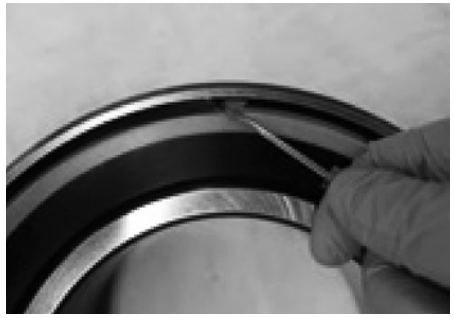
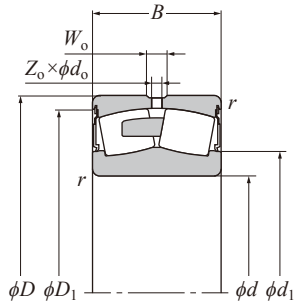


Photo 2

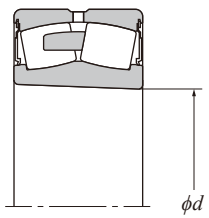
Table 1 Installation of tapered bore sealed spherical roller bearings (EMLLX type) Unit: mm

Nominal bearing bore diameter d	Bearing number	Reduction of radial internal clearance		Axial displacement drive up (approx.)		Minimum residual radial internal clearance 1)		
		Min.	Max.	Min.	Max.	CN	C3	C4
140	**22228EMLLXKD1**	0.065	0.075	1.0	1.1	0.045	0.085	0.125
150	**22230EMLLXKD1**	0.070	0.085	1.0	1.2	0.045	0.095	0.145
160	**22232EMLLXKD1**	0.065	0.085	1.0	1.2	0.045	0.095	0.145
170	**22234EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
170	**23134EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
180	**23136EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
190	**23138EMLLXKD1**	0.085	0.105	1.2	1.5	0.055	0.115	0.185
200	**23140EMLLXKD1**	0.085	0.105	1.2	1.5	0.055	0.115	0.185
220	**23144EMLLXKD1**	0.105	0.125	1.5	1.8	0.055	0.125	0.195
220	**22244EMLLXKD1**	0.100	0.120	1.5	1.8	0.060	0.130	0.200
240	**23048EMLLXKD1**	0.115	0.135	1.6	1.9	0.065	0.135	0.215
240	**23148EMLLXKD1**	0.110	0.130	1.6	1.9	0.070	0.140	0.220

1) Minimum residual radial internal clearance: Standard value of radial internal clearance (Min.) − Reduction of radial internal clearance (Max.)
Note: For models not listed in this table, please contact **NTN** Engineering.



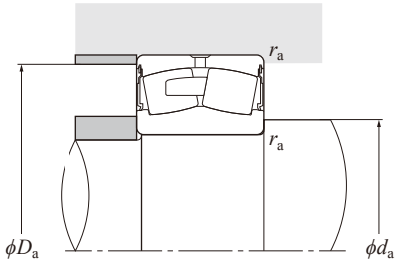
Cylindrical bore



Tapered bore

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm		Number of oil inlets
Min.	Below	Z_o
—	320	4
320	—	8



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number		Dimension (Reference) mm		Installation-related dimensions mm			Constant	Axial load factors			Mass (approx.) kg		Amount of grease filled in (approx.) g		Space volume (approx.) cm^3	Seal P/N	Snap ring P/N
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical bore	Tapered bore [2]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore	* For /8AV10 only				
140	250	68	3	14	7	866	944	65.9	**22228EMLLXD1**	**22228EMLLXKD1**	168	235	154	236	3	0.23	2.92	4.35	2.86	13.9	13.6	99.5-139		442	**F1#22228EMLX**	**HH#22228EMLX**
150	270	73	3	15	7	990	1 090	74.5	**22230EMLLXD1**	**22230EMLLXKD1**	181	254	164	256	3	0.23	2.90	4.31	2.83	17.6	17.2	126	-176	559	**F1#22230EMLX**	**HH#22230EMLX**
160	290	80	3	17	8	1 170	1 320	84.1	**22232EMLLXD1**	**22232EMLLXKD1**	194	271	174	276	3	0.24	2.81	4.19	2.75	22.5	22	158	-221	703	**F1#22232EMLX**	**HH#22232EMLX**
170	310	86	4	18	8	1 180	1 420	88.1	**22234EMLLXD1**	**22234EMLLXKD1**	211	281	187	293	4	0.25	2.69	4.00	2.63	28.4	27.9	171	-240	762	**F1#22234EMLX**	**HH#22234EMLX**
	280	88	2.1	14	6	1 170	1 540	77.6	**23134EMLLXD1**	**23134EMLLXKD1**	203	263	182	268	2.1	0.26	2.60	3.87	2.54	21.2	20.6	137	-192	610	**F1#23134EMLX**	**HH#23134EMLX**
180	300	96	3	15	7	1 390	1 800	88.9	**23136EMLLXD1**	**23136EMLLXKD1**	213	280	194	286	3	0.27	2.49	3.71	2.43	26.8	26	180	-252	800	**F1#23136EMLX**	**HH#23136EMLX**
190	320	104	3	17	8	1 590	2 120	100	**23138EMLLXD1**	**23138EMLLXKD1**	228	298	204	306	3	0.28	2.43	3.61	2.37	33.8	32.8	216	-302	960	**F1#23138EMLX**	**HH#23138EMLX**
200	340	112	3	18	8	1 800	2 380	111	**23140EMLLXD1**	**23140EMLLXKD1**	240	315	214	326	3	0.29	2.35	3.50	2.30	41.5	40.2	273	-382	1 214	**F1#23140EMLX**	**HH#23140EMLX**
220	370	120	4	19	9	2 070	2 730	128	**23144EMLLXD1**	**23144EMLLXKD1**	259	345	237	353	4	0.28	2.43	3.61	2.37	51.6	50.1	339	-474	1 506	**F1#23144EMLX**	**HH#23144EMLX**
	400	108	4	21	11	1 930	2 410	136	**22244EMLLXD1**	**22244EMLLXKD1**	271	365	237	383	4	0.24	2.84	4.23	2.78	59.7	58.5	342	-479	1 620	**F1#22244EMLX**	**HH#22244EMLX**
240	360	92	3	15	8	1 400	2 120	113	**23048EMLLXD1**	**23048EMLLXKD1**	276	342	253	347	3	0.20	3.34	4.98	3.27	33	32	182	-255	811	**F1#23048EMLX**	**HH#23048EMLX**
	400	128	4	20	9	2 360	3 240	148	**23148EMLLXD1**	**23148EMLLXKD1**	286	373	257	383	4	0.27	2.47	3.67	2.41	64.4	62.4	410	-574	1 823	**F1#23148EMLX**	**HH#23148EMLX**

1) Smallest allowable dimension for chamfer dimension r.
2) "**K**" indicates bearings having a tapered bore with a taper ratio of 1:12.
Note: For bearing numbers not shown on of the 231 series dimension table (bore diameter over 240 mm and 420 mm or less), contact **NTN** Engineering.

ULTAGE Sealed Spherical Roller Bearings [EMLLX Type] NTN

The ULTAGE™ series spherical roller bearings with high-strength cage [EMA type] are used under harsh conditions (eccentric rotation, impact load, etc.), and were developed to meet the demands of "long operating life", "vibration resistance", and "low temperature rise" that are required for various industrial machinery.

1. Features

1) Long operating life
Increasing the roller diameter, maximizing the number of rollers, and industry leading load ratings have led to higher load capacities and longer operating lives.

2) Vibration resistance
By modifying the shape and incorporating staggered pockets, the cage has improved in both strength and vibration resistance.

3) Low temperature rise
Through the optimization of internal specifications, heat generation rates have been reduced.

4) 200 °C heat resistant specification
Special heat treatment used as standard provides excellent dimensional stability at up to 200 °C, contributing to a long operating life.

2. Accuracy and clearance (specification for vibrating screens)

The bore and outside diameter tolerance and the radial internal clearance are set for vibrating screens to obtain the desired operating clearance (see **Table 2**). For bearing specifications (accuracy, clearance, etc.) other than those for the vibrating screen, please refer to the specifications for the ULTAGE™ series spherical roller bearings.

Table 1 Type

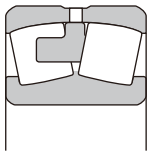
Structure	
Bearing size	Series 223 with bore diameter of 70 to 200 mm
Roller	Symmetrical
Cage type	Special machined cage

Table 2 Accuracy and clearance (specification for vibrating screens) Unit: mm

Dimensional tolerance of mean bore diameter within plane				Dimensional tolerance of mean outside diameter within plane				Radial internal clearance (cylindrical bore)					
Nominal bearing bore diameter		VS1, VS2		Nominal bearing outside diameter		VS1, VS2		Nominal bearing bore diameter		VS1		VS2	
d				D				d					
Over	Incl.	Upper	Lower	Over	Incl.	Upper	Lower	Over	Incl.	Min.	Max.	Min.	Max.
—	80	0	−0.010	—	150	−0.005	−0.013	—	65	0.075	0.090	0.100	0.120
80	120	0	−0.013	150	180	−0.005	−0.018	65	80	0.090	0.110	0.120	0.145
120	180	0	−0.015	180	315	−0.010	−0.023	80	100	0.110	0.135	0.150	0.180
180	200	0	−0.018	315	400	−0.013	−0.028	100	120	0.135	0.160	0.180	0.210
				400	420	−0.014	−0.030	120	140	0.160	0.190	0.205	0.240
								140	160	0.190	0.220	0.240	0.280
								160	180	0.200	0.240	0.260	0.310
								180	200	0.220	0.260	0.285	0.340

3. Bearing number

2 23 20 EMA K D1

- **Oil inlet/oil groove code** (D1: with oil inlet/oil groove)
- **Raceway shape code** (No code: bore diameter cylindrical bore, K: bore diameter tapered bore)
- **Type code**
- **Bore diameter No.** (20: 100 mm)
- **Dimension series code**
- **Bearing type code** (2: spherical roller bearing)

22320EMAD1 VS1

- Specification for vibrating screens (No code indicates general bearing clearance and accuracy.)

4. Allowable axial load

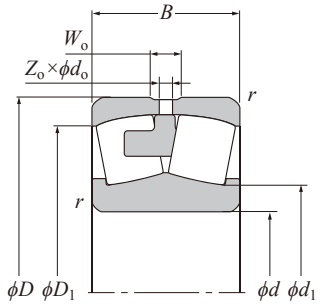
$F_a/F_r \leq e$
F_a : Axial load
F_r : Radial load
e : Constant (see dimension table)

If this bearing type is used for a vertical shaft or under a large axial load, the load on the rollers of the row that is not subject to the axial load can become small. This small load on the rollers can result in skidding of the rollers, which can cause bearing damage. If the ratio of the radial load exceeds the factor e in the dimension table ($F_a/F_r > e$), consult **NTN** Engineering.

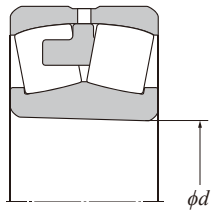
5. Allowable misalignment

Normal load or more ····· 1/115
Light load ····· 1/30

* Misalignment beyond the above limits may cause the roller to protrude from the outer ring, causing interference with the peripheral components.



Cylindrical bore

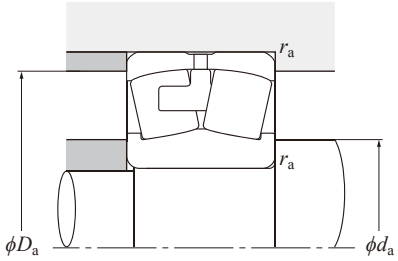


Tapered bore

Number of oil inlets on outer ring

Nominal bearing outside diameter D mm Incl.	Below	Number of oil inlets Z_o
—	320	4
320	—	8

ULTAGE Spherical Roller Bearings with High-strength Cage [EMA Type] NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Allowable speed min^{-1}	Bearing number	Bearing number	Dimension (Reference) mm		Installation-related dimensions mm			Constant	Axial load factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [1]	W_o	d_o	C_r	C_{0r}	C_u	Oil lubrication	Cylindrical bore	Tapered bore [2]	d_1	D_1	d_a Min.	D_a Max.	r_{as} Max.	e	Y_1	Y_2	Y_0	Cylindrical bore	Tapered bore
70	150	51	2.1	10	5	397	368	24.2	4 700	**22314EMAD1**	**22314EMAKD1**	85	131	82	138	2.1	0.34	2.00	2.98	1.96	4.34	4.25
75	160	55	2.1	10	5	464	434	27.6	4 400	**22315EMAD1**	**22315EMAKD1**	91	139	87	148	2.1	0.34	2.00	2.98	1.96	5.3	5.19
80	170	58	2.1	10	5	512	485	30.2	4 100	**22316EMAD1**	**22316EMAKD1**	98	148	92	158	2.1	0.34	2.00	2.98	1.96	6.32	6.19
85	180	60	3	11	5	538	524	31.5	3 900	**22317EMAD1**	**22317EMAKD1**	107	157	99	166	3	0.32	2.09	3.11	2.04	7.19	7.05
90	190	64	3	12	5	632	605	37.1	3 700	**22318EMAD1**	**22318EMAKD1**	110	166	104	176	3	0.33	2.06	3.06	2.01	8.58	8.41
95	200	67	3	12	6	658	650	37.6	3 500	**22319EMAD1**	**22319EMAKD1**	120	174	109	186	3	0.32	2.09	3.11	2.04	9.8	9.6
100	215	73	3	13	6	743	731	43.4	3 300	**22320EMAD1**	**22320EMAKD1**	127	187	114	201	3	0.34	1.98	2.94	1.93	12.8	12.5
110	240	80	3	16	7	869	833	50.5	3 000	**22322EMAD1**	**22322EMAKD1**	139	209	124	226	3	0.32	2.09	3.11	2.04	17.3	16.9
120	260	86	3	18	8	1 060	1 120	59.8	2 700	**22324EMAD1**	**22324EMAKD1**	156	225	134	246	3	0.32	2.09	3.11	2.04	22.5	22
130	280	93	4	19	9	1 260	1 310	72.6	2 500	**22326EMAD1**	**22326EMAKD1**	164	243	147	263	4	0.33	2.06	3.06	2.01	28.4	27.8
140	300	102	4	19	9	1 400	1 500	77.7	2 400	**22328EMAD1**	**22328EMAKD1**	181	261	157	283	4	0.33	2.03	3.02	1.98	34.6	33.8
150	320	108	4	20	9	1 570	1 640	85.7	2 200	**22330EMAD1**	**22330EMAKD1**	188	279	167	303	4	0.34	2.00	2.98	1.96	41.9	41
160	340	114	4	20	10	1 760	1 940	95.6	2 100	**22332EMAD1**	**22332EMAKD1**	205	296	177	323	4	0.33	2.03	3.02	1.98	50.1	49.1
170	360	120	4	20	10	2 010	2 320	107	1 900	**22334EMAD1**	**22334EMAKD1**	223	313	187	343	4	0.32	2.09	3.11	2.04	59.7	58.5
180	380	126	4	21	10	2 190	2 460	115	1 800	**22336EMAD1**	**22336EMAKD1**	229	329	197	363	4	0.32	2.09	3.11	2.04	69.3	67.9
190	400	132	5	21	10	2 370	2 750	128	1 700	**22338EMAD1**	**22338EMAKD1**	247	346	210	380	5	0.32	2.12	3.15	2.07	81	79.4
200	420	138	5	21	10	2 590	3 140	140	1 600	**22340EMAD1**	**22340EMAKD1**	265	364	220	400	5	0.31	2.15	3.20	2.10	94.1	92.2

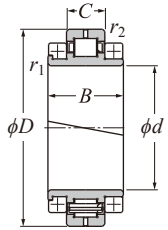
1) Smallest allowable dimension for chamfer dimension *r*.

2) "K" indicates bearings having a tapered bore with a taper ratio of 1:12.

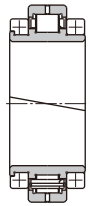
Split Cylindrical Roller Bearings

NTN

· Since the inner ring, outer ring and cage are split in two parts, it is possible to mount the bearing in places where a united bearing is difficult or impossible to mount (i.e. Places where mounting from the shaft end is impossible, an obstacle exists on the shaft, or the shaft is very long).
· These bearings also allow easy inspection and maintenance after mounting.



Drawing 1
Fixed side



Drawing 2
Floating side

d 120-770 mm

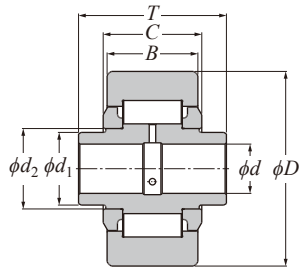
Boundary dimensions mm						Basic load rating kN		Bearing number [1]	Drawing [2] No.
d	*D*	*B*	*C*	r_1	r_2	dynamic C_r	static C_{0r}		
120	R254	125	60	C4	4	450	510	∗**RE2436** ∗**RE2437**	2 1
127	254	114.3	63.5	C5	C2	555	720	**RE2512**	1
160	240	76	38	C3	C3	238	340	**RE3220** **RE3221**	1 2
164	240	76	38	C3	C3	238	340	**RE3308**	1
170	R340	120	56	C3.5	3.5	435	565	∗**RE3420** ∗**RE3421**	1 2
180	285.75	109	55.5	C3.5	C3.5	415	580	**RE3617**	1
190	290	92	46	C3.5	C3.5	350	510	**RE3812** **RE3813**	1 2
200	311.15	109.5	60.3	C3.2	C3.2	480	760	**RE4022**	1
210	360	92	46	C3	C3	370	595	**RE4206** **RE4207**	1 2
230	360	92	46	C3	C3	350	550	**RE4604** **RE4605**	1 2
280	400	92	48	C3	C3	460	755	**RE5606** **RE5607**	2 1
320	622.3	272	160.4	C12	C6	2 900	4 250	**RE6405**	1
360	R600	200	116	C6	6	1 940	3 250	∗**RE7203**	2
500	850.9	360	210	C12	C6	5 250	9 050	**RE10013**	2
575	800	180	90	C3	C3	1 370	2 570	**RE11501** **RE11502**	1 2
670	900	200	103	C3	C3	1 650	3 150	**RE13405** **RE13406**	1 2
770	1 070	300	180	C2.5	C6	5 300	12 000	**RE15404** **RE15405**	1 2

1) The bearings marked "∗" has an outer ring with a spherical outside surface.
2) Drawing 1 and Drawing 2 are typical examples. For details, please contact **NTN** Engineering.

Cylindrical Roller Bearings for Chain Conveyors

NTN

· Since the outer ring directly supports heavy loads, the thickness of the outer ring is designed to be thicker than regular bearings.
· For operation under heavy loads and extremely low speed rotation, these bearings are designed to be a full complement roller type and have high load capacity.
· To prevent foreign matter from entering the bearing, a labyrinth structure is applied, which has a narrower clearance between the outer ring and rib ring.



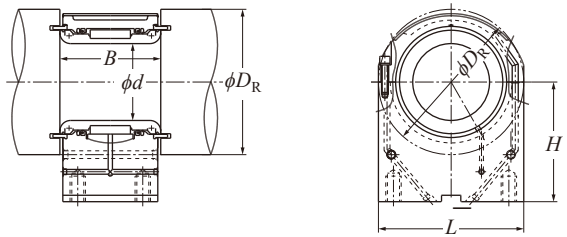
d 28.3-56 mm

Boundary dimensions mm							Basic load rating kN		Fatigue load limit kN	Bearing number
d	d_1	d_2	*D*	*B*	*C*	*T*	dynamic C_r	static C_0	C_u	
28.3	44.05	47	125	55	62	94	219	241	29.3	**R06A31V**
38.4	60	66	150	90	99	138	435	585	71.5	**R08A31V**
38.7	56	56	150	70	75	112	350	420	51.0	**R08A24V**
41.75	64.16	71	175	80	85	125	440	575	70.5	**R08A02V**
45	73	73	150	60	60	60	310	405	49.0	**R09A20V**
46	73	73	150	60	60	60	310	405	49.0	**R09A21V**
50	72	72	156	60	70	70	310	355	43.5	**R1099V**
56	74	74	160	51	55	49	289	310	37.5	**R11A01V**
	73	73	150	60	60	60	310	405	49.0	**R11A13V**

Split Cylindrical Roller Bearings for Continuous Casting Machinery (w/water cooled housings)

NTN

- These bearings are designed to be a full complement roller type and have high load capacity for heavy loads, ultra-low speed rotation and space-saving.
- These bearings provide a multi-seal with a labyrinth ring, seal ring and special rubber seal to prevent water from invading.
- The clamping ring of the inner ring is not needed anymore and the structure of direct clamping is applied to make a compact bearing.
- Bearings have a self-aligning nature due to the roll deflection since the outer ring outside surface and the housing inside surface are spherical.
- Application of a water cooling jacket-type housing controls rising bearing temperatures.



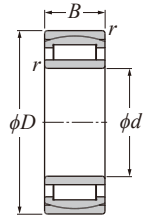
d 100-230 mm

Boundary dimensions mm					Basic load rating dynamic kN	static kN	Bearing number	Housing number
d	B	H	L	D_R	C_r	C_{0r}		
100	154	145	210	210	355	790	**RE2038V**	**SS2020**
	169	132	220	225	475	950	**RE2039V**	**SS2021**
110	154	150	230	230	425	1 040	**RE2224V**	**SS2228**
	154	180 155	230 230	230 225	390	930	**RE2225V**	**SS2230** **SS2234**
115	173	220	240	240	505	940	**RE2306V**	**SS2304**
120	151	190	240	250	395	970	**RE2439V**	**SS2420**
130	154	190	270	270	430	1 110	**RE2628V**	**SS2637**
140	179	245	270	270	600	1 240	**RE2827V**	**SS2835**
	191	250	265	265	525	1 280	**RE2824V**	**SS2825**
145	196	260	280	280	630	1 440	**RE2906V**	**SS2908**
150	169	180	265	300	695	1 700	**RE3036V**	**SS3043**
165	228	280	320	320	930	2 210	**RE3311V**	**SS3303**
180	169	217.5	335	335	815	2 010	**RE3621V**	**SS3616**
	235	280	340	340	1 030	2 580	**RE3620V**	**SS3415**
190	233	280	370	370	1 320	3 100	**RE3815V**	**SS3804**
230	239	300	450	450	1 590	3 700	**RE4606V**	**SS4601**

Cylindrical Roller Bearings with Self-Aligning Rings for Continuous Casting Machinery

NTN

- These bearings are designed to be a full complement roller type to have high load capacity.
- Bearings have a self-aligning nature since the outer ring outside surface and aligning ring inside surface are spherical.



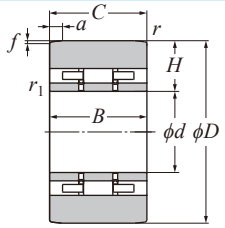
d 55-200 mm

Boundary dimensions mm				Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number
d	D	B	$r_{s\,min}$ [1]	C_r	C_{0r}	C_u	
55	90	32	1.1	94	202	24.6	**R11A11V**
	100	25	1.5	105	146	17.8	**R11A12V**
75	130	31	1.5	162	237	28.8	**R1564V**
110	170	60	2	330	720	80.0	**R2260V**
	180	56	2	360	635	70.0	**R2252V**
130	200	69	2	450	935	99.5	**R2674V**
	210	80	2	550	1 090	116	**R2677V**
140	210	69	2	465	990	104	**R2858V**
	225	85	2.1	605	1 230	127	**R2859V**
150	250	100	2.1	785	1 620	163	**R3056V**
160	270	109	2.1	950	1 830	180	**R3261V**
170	260	90	2.1	710	1 520	149	**R3444V**
180	280	100	2.1	875	1 870	180	**R3646V**
200	340	112	3	1 290	2 470	227	**R4051V**

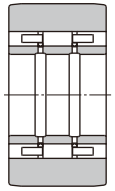
1) Smallest allowable dimension for chamfer dimension r.

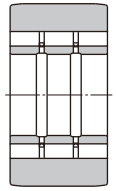
Bearings for Sendzimir Rolling Mill Backup Rolls NTN

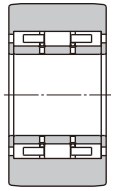
- Since bearings are directly used as backup rolls, the thickness of the outer ring is designed to be thicker than regular bearings.
- Since high accuracy under heavy loads is required, these bearings are designed to have high load capacity and high accuracy.
- Several bearings are assembled on one shaft for operation, and the mutual difference of assembled thickness (Dimension H) of bearings on the same shaft is very minimal.
- When the outer ring outside surface is worn, it is possible to recycle it by grinding it to a certain level.

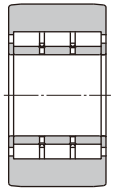


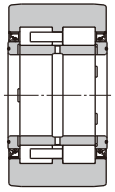
Drawing 1


Drawing 2


Drawing 3


Drawing 4


Drawing 5


Drawing 6

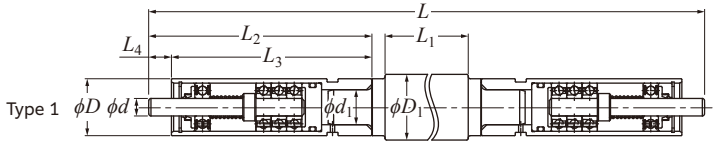
d 70-180 mm

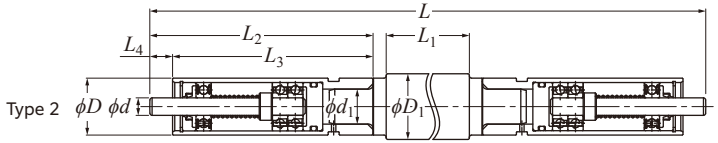
Boundary dimensions						Basic load rating		Fatigue load limit	Bearing number	Drawing No.	Sloping outer ring		Assembled thickness	Necessary number	Mass
						dynamic	static								
mm						kN		kN			mm		mm		kg
d	D	B	C	$r_{s\,min}$ [1]	$r_{ls\,min}$ [1]	C_r	C_{0r}	C_u			a	f	H	(P/C)	(approx.)
70	160	90	90	1.5	0.6	505	855	104	**3RCS1414VUP**	3	6	0.035	44.981(±0.010)	32	10.7
	160	90	90	1.5	0.6	390	605	74.0	**3RCS1418UP**	2	6	0.035	44.981(±0.010)	32	10.7
90	220	96	94	3	1.1	520	695	78.0	**2R1840LLUP-1**	6	21	0.5	64.980(±0.008)	64	21.7
	220	120	120	2	0.3	860	1 510	167	**3R1827VUP**	5	6	0.035	64.978(±0.008)	32	27.6
	220	120	120	2	1.5	720	1 150	127	**3R1829UP**	4	20.6	0.12	64.973(0 to −0.010)	40	27.5
	200	130	130	2	1.5	750	1 260	139	**3R1826UP**	4	6	0.1	64.960(±0.008)	40	29.8
100	255	120	120	1.5	1	795	1 350	149	**3RCS2035UP**	1	10	0.1	62.474(+0.010 to 0)	32	28
130	300	160	159.5	1.5	2	1 640	2 700	272	**3RCS2659UPV1**	1	10	0.1	84.954(±0.008)	40	67.4
	300	172.6	172.6	1.5	2	1 750	2 930	296	**3RCS2629UP**	1	10	0.1	84.954(±0.008)	40	73
180	406.4	171.04	171.04	2.5	4	2 290	3 800	350	**3RCS3615UP**	2	25	0.15	113.150(±0.010)	56	132
	406.4	224	224	1.45	4	2 610	4 500	415	**3RCS3618UP**	2	25	0.15	113.150(±0.010)	40	170

1) Smallest allowable dimension for chamfer dimension r or r_1.

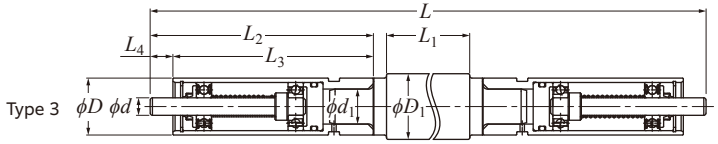
Cartridge Unit

- This unit has a precision small diameter and a long scaled roll, with the surface roughness of the roll designed to be low.
- Angular contact ball bearings are assembled in multiple rows in the cartridge unit to achieve higher load capacity in both axial directions and high speed.
- This unit has established both tight sealing and low torque operation by a labyrinth structure and light-contact seals.





Roll Unit for Tension Leveler
NTN



d 8-35 mm

Bearing number	Boundary dimensions mm									Allowable axial load N	Type	Mass kg
	d	*D*	D_1	*L*	L_1	d_1	L_2	L_3	L_4			(approx.)
CU8A05W+WK30/185X01	8	26	30	2 066	1 850	14	102	92	10	3 300	1	11.5
CU8A07W+IM38/150X02	8	26	38	1 716	1 500	14	102	92	10	3 300	1	15.5
CU8A12W+WK20/150X02	8	23.5	20	1 716	1 500	10	102	92	10	2 200	1	4.4
CU8A14W+WK50/150X03	8	26	50	1 716	1 500	16	102	92	10	3 300	1	23.6
CU8A28W+WK30/125	8	26	30	1 466	1 250	16	102	92	10	3 300	1	7.5
CU8C01W+WK25/85	8	24	25	1 082	850	15	110	100	10	290	3	4
CU10B01W+WK20/180	10	24	20	2 033.5	1 800	10	91.75	80	11.75	1 370	2	4.9
CU10B06W+WK25/180X02	10	24	25	2 032	1 800	10	91	80	11	1 370	2	7.5
CU12B07W+WK30/220	12	28	30	2 433.5	2 200	18	96.75	85	11.75	1 600	2	13.1
CU12B07W+IM38/180	12	28	38	2 033.5	1 800	18	96.75	85	11.75	1 600	2	16.9
CU12B08W+WK40/210	12	38	40	2 332	2 100	20	110	100	10	2 510	2	23
CU12B12W+WK40/150X01	12	32	40	1 716	1 500	16	102	92	10	2 510	2	15.6
CU12B13W+IM52/185	12	32	52	2 066	1 850	16	102	92	10	2 510	2	32
CU12B16W+WK30/70	12	28	30	933.5	700	18	96.75	85	11.75	1 600	2	4.7
CU12B32W+IM38/160X01	12	28	38	1 760	1 600	18	80	70	10	1 600	2	14.7
CU12C01W+IM40/85	12	28	40	1 010	850	16	74	63	11	800	3	4.7
CU15A06W+IM60/180	15	38	60	2 033.5	1 800	20	108.75	94	14.75	4 820	1	41.4
CU15A12W+WK40/210X02	15	38	40	2 333.5	2 100	20	108.75	94	14.75	4 820	1	22.1
CU15B01W+IM40/210	15	38	40	2 330	2 100	22	100	85	15	3 210	2	21.7
CU15B02W+IM60/180X01	15	38	60	1 960	1 800	20	80	70	10	3 210	2	40.9
CU35C02W+WK80/210	35	73	80	2 410	2 100	35	125	110	15	6 000	3	90.8

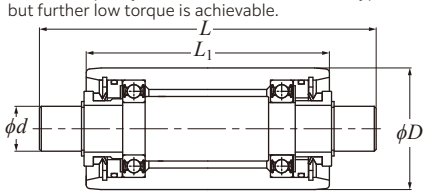
Roll Unit for Tension Leveler

NTN

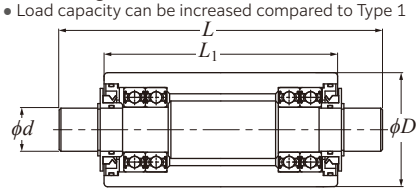
Backup Roll Unit

· This unit has established both tight sealing and low torque operation by a labyrinth structure and light-contact seals.
· When a torque lower than that of needle type (NKZ) is required, ball type (BUB), which uses only deep groove ball bearings, is available.

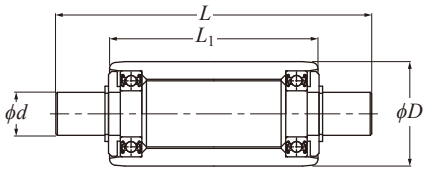
Type 1: Wet spec., ball type (BUB)
- Spec. with needle bearings omitted
- The load capacity is lower than that of needle type, but further low torque is achievable.



Type 2: Wet spec., ball type (BUB)
- The same spec. as Type 1, but with more deep groove ball bearings added
- Load capacity can be increased compared to Type 1



Type 3: Dry spec., ball type (BUB)
- Standard spec. for use without cleaning fluids (Dry spec.)
- Contact-seal-less spec. allows reduction in torque



d 14-24 mm

Bearing number	Boundary dimensions mm				Basic load rating dynamic kN	static kN	Type	Mass kg
	d	*D*	*L*	L_1	C_r	C_{0r}		(approx.)
BUB14×34×124-01	14	34	124	91	6.6	4.0	3	0.6
BUB14×34×180-01	14	34	180	145	6.6	4.0	3	1
BUB14×34×186-01	14	34	186	153	6.6	4.0	3	1.1
BUB14×34×270-01	14	34	270	235	6.6	4.0	3	1.6
NKZ20×50×168/L051	20	50	168	130	77.5	116	6	1.9
NKZ20×50×228/L051	20	50	228	190	77.5	116	6	2.7
NKZ24×52×157-1/L135	24	52	157	126	92	175	4	2
NKZ24×52×241-1/L135	24	52	241	210	92	175	4	3.3
BUB24×63.5×150-01	24	63.5	150	100	29.4	23.4	2	2.2
BUB24×63.5×190-01	24	63.5	190	140	29.4	23.4	2	3.1
BUB24×65×154-02	24	65	154	113	22.4	14.8	1	3.1
NKZ24×65×200-2/L135	24	65	200	150	114	186	5	3.5
BUB24×65×216-06	24	65	216	166	22.4	14.8	1	3.8
NKZ24×65×216-1/L051	24	65	216	166	82.5	122	6	4.4
NKZ24×65×216-10/L135	24	65	216	166	82.5	122	5	4.4
NKZ24×65×288-3/L051	24	65	288	238	82.5	122	6	5.8
NKZ24×65×294-2/L135	24	65	294	244	114	186	5	5.6
NKZ24×65×308-5/L051	24	65	308	258	82.5	122	6	5.9

Note: 1. Contact **NTN** for further information about the use of each bearing and consideration of bearing specifications.
2. Please test the bearing on an actual machine before use.

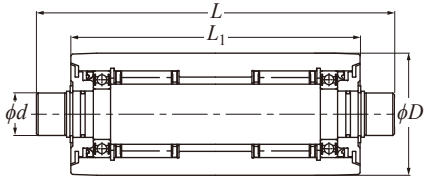
Roll Unit for Tension Leveler

NTN

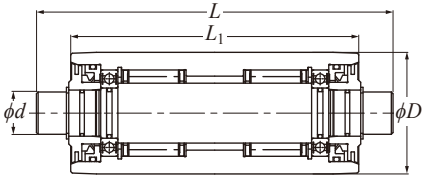
Backup Roll Unit

· Since it is used as a backup roll, the unit features high precision roll specifications with minimal runout in roundness and cylindricity, and is designed with careful consideration for the surface roughness, surface hardness, and crowning profile.

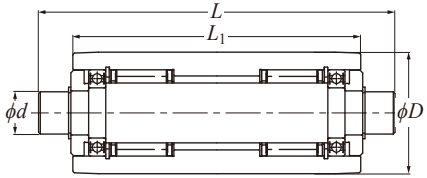
Type 4: Wet spec., needle type (NKZ)
- Spec. with seals for needle bearings
- Standard type of wet spec.



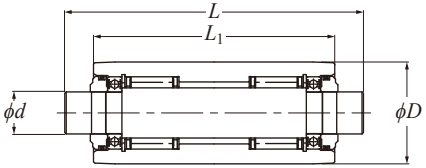
Type 5: Wet spec., needle type (NKZ)
- Spec. with V-seals (axial seals)
- Torque can be stabilized compared to Type 4



Type 6: Dry spec., needle type (NKZ)
- Standard spec. for use without cleaning fluids (Dry spec.)
- Contact-seal-less spec. allows reduction in torque



Type 7: Dry spec., needle type (NKZ)
- The same spec. as Type 6, but with labyrinth structure added upon request



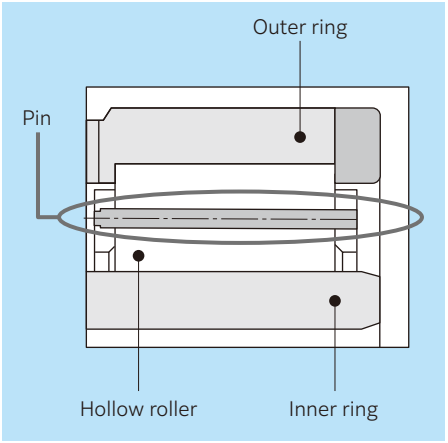
d 24-50 mm

Bearing number	Boundary dimensions mm				Basic load rating dynamic kN	static kN	Type	Mass kg
	d	*D*	*L*	L_1	C_r	C_{0r}		(approx.)
BUB24×65×324-06	24	65	324	274	22.4	14.8	1	6.2
NKZ24×65×324-1/L051	24	65	324	274	82.5	122	6	6.7
NKZ24×65×324-10/L135	24	65	324	274	82.5	122	5	6.9
NKZ24×65×400-4/L051	24	65	400	350	82.5	122	6	8.4
NKZ24×65×190/L051	25	65	190	145	114	186	6	3.4
NKZ26×75×210-6/L135	26	75	210	170	192	325	4	5.2
NKZ26×75×285-6/L135	26	75	285	245	192	325	4	7.4
NKZ30×65×196-3/L135	30	65	196	146	114	186	4	3.9
NKZ30×65×274-3/L135	30	65	274	224	114	186	4	5.8
NKZ30×75×150-16/L051	30	75	150	110	125	187	6	3.6
NKZ30×75×205-29/L135	30	75	205	155	151	228	4	5
NKZ30×75×205-33/L135	30	75	205	155	151	228	5	4.8
NKZ30×75×208-9/L135	30	75	208	160	151	228	4	5.6
NKZ30×75×225-16/L051	30	75	225	185	125	187	4	5.8
NKZ30×75×308-27/L135	30	75	308	258	125	187	4	8.2
NKZ30×75×308-30/L135	30	75	308	258	151	228	5	7.9
NKZ35×80×215/L051	35	80	215	165	189	365	6	5.9
NKZ45×98×265/L051	45	98	265	200	164	273	7	10.9
NKZ50×114×265/L051	50	114	265	200	305	590	7	14.5

Four-row cylindrical roller bearing

1. Features

1) The bearings are mainly used in the roll necks of steel rolling mills and designed so that the load rating is maximized in the allowable space of the roll neck part.
2) The cage types include a comb-type cage and a pin-type cage (that uses hollow rollers). The pin-type cage maximizes the number of rollers in the bearing to provide increased load capacity.
3) Carburizing (case hardened) steel is used in some cases to prevent inner ring cracks and to improve shock resistance.
4) Consult **NTN** Engineering for bearing internal clearance and fits to be used for back-up rolls of rolling mills.
5) There are many varieties of these bearings, including bearings which are sealed, have tapered bores, designed for high speed, have creep prevention, etc. Contact **NTN** Engineering for further details.



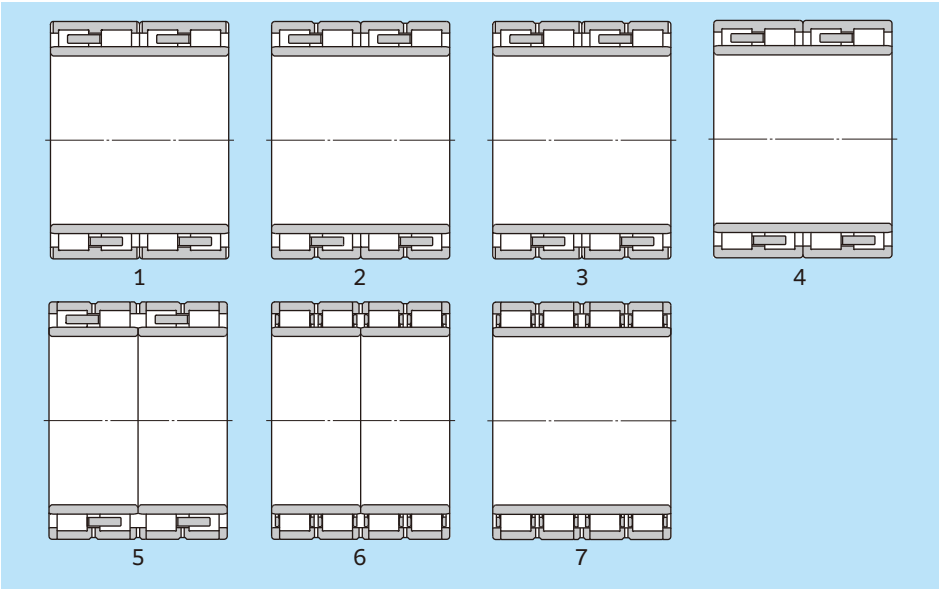
Pin-type cage

2. Types

Drawing 1 through **Drawing 7** show the several types of four-row cylindrical roller bearings that differ by the basic structure of inner rings, outer rings, and outer ring spacers.

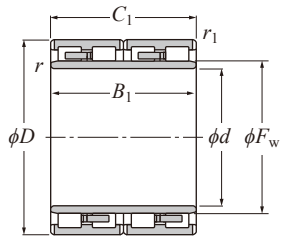
The dimension table has the identification code (Drawing + suffix code + oil groove code) specified in the Drawing number column.

Example) In the case of Drawing: 6, suffix code: M, oil groove code: (1), identification code "6M(1) " is specified in the Drawing number column.

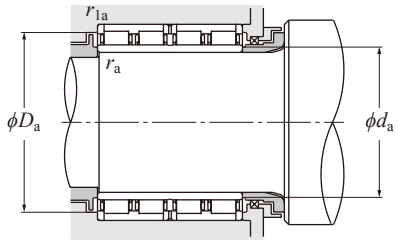


Drawings

Identification code	**See the above Drawings 1 to 7.** ∗ Drawings 1 to 5 use solid rollers + comb-type machined cage. ∗Drawings 6 to 7 use hollow rollers + pin-type cage. **Suffix code** M : The oil inlet of the outer ring is provided with a fitting nozzle for oil mist. R : The bore diameter surface of the inner ring has a helical groove. S : Special specification **Oil groove code** ①: Oil groove on both side faces of inner ring ②: Oil groove on one width surface of inner ring ③: Oil groove on one width surface of outer ring ④: No oil inlet or oil groove on outer ring spacer



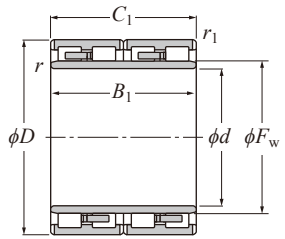
Four-Row Cylindrical Roller Bearings NTN

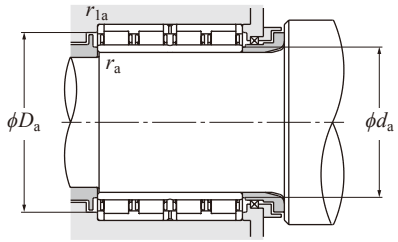


d 100-170 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Drawing No.[2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
100	150	74	74	2	2	291	510	58.5	**4R2035**	1	115	109	141	2	2	4.68
120	180	92	92	2.5	2.5	445	785	84.5	**4R2437**	1	137	131	169	2	2	8.2
	180	105	105	2.5	2.5	495	855	92.5	**4R2438**	1	135	131	169	2	2	9.3
130	200	104	104	2.5	2.5	540	955	100	**4R2628**	1	150	141	189	2	2	12.1
140	190	119	119	1.5	1.5	550	1 190	125	**4R2832**	2②	154	148	182	1.5	1.5	9.93
	210	116	116	2.5	2.5	565	1 030	106	**4R2823**	1	160	151	199	2	2	13.9
145	210	155	155	2.5	2.5	780	1 640	168	**4R2906**	1	166	156	199	2	2	18
	225	156	156	2.5	2.5	900	1 750	177	**4R2904**	1	169	156	214	2	2	23.3
150	220	127	120	2.5	2.5	685	1 280	129	**4R3036**	1	168	161	209	2	2	15.7
	220	150	150	2.5	2.5	830	1 640	167	**4R3031**	1	168	161	209	2	2	19.4
	220	150	150	2.5	2.5	830	1 640	167	**4R3056**	1	168	161	209	2	2	19.6
	230	130	130	2.5	2.5	800	1 520	153	**4R3029**	1	174	161	219	2	2	20
	230	156	156	2.5	2.5	1 030	2 040	204	**4R3040**	1	174	161	219	2	2	24.5
	230	168	168	2	2	935	1 950	194	**4R3042**	1	178	159	221	2	2	25.8
151.5	230	168	168	1.5	2.5	945	2 060	205	**4R3033K**	1	179	159.5	219	1.5	2	25.4
160	220	180	180	2.5	2.5	1 020	2 490	250	**4R3224**	1	177	171	209	2	2	20.2
	230	130	130	2.5	2.5	740	1 340	133	**4R3226**	1	180	171	219	2	2	16.6
	230	168	168	2.5	2.5	1 020	2 170	217	**4R3232**	1	179	171	219	2	2	23.4
	230	168	168	2.5	2.5	995	2 200	220	**4R3229**	1	180	171	219	2	2	23.2
	230	168	168	2.5	2.5	990	2 210	219	**4R3231**	1	182	171	219	2	2	23.2
	230	180	180	2.5	2.5	1 020	2 490	250	**4R3228**	4③	177	171	219	2	2	24.8
	240	170	170	2	2.5	1 090	2 290	227	**4R3225**	1	183	169	229	2	2	27.8
170	230	120	120	2.5	2.5	685	1 520	151	**4R3426**	1	187	181	219	2	2	14.2
	230	120	120	2	2	685	1 520	151	**4R3443**	3	187	179	221	2	2	14.6
	240	156	156	2.5	2.5	1 000	2 170	213	**4R3429**	1	189	181	229	2	2	22.2
	240	160	160	2.5	2.5	1 000	2 180	213	**4R3423**	1	190	181	229	2	2	22.8

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.
Note: **4R3033K** is a bearing having a tapered bore with a taper ratio of 1:12.



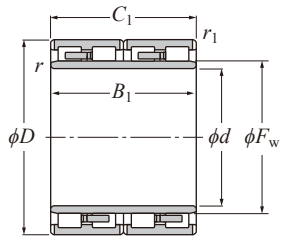


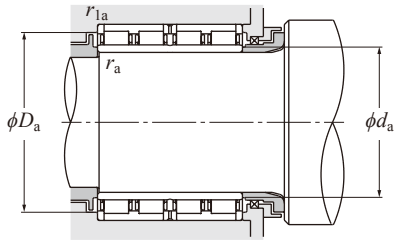
d 170-220 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Drawing No.[2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
170	250	168	168	2.5	2.5	1 080	2 220	216	**4R3432**	1	193	181	239	2	2	28.2
	250	168	168	2.5	2.5	1 140	2 390	232	**4R3428**	1	193	181	239	2	2	28.5
180	250	156	156	2.5	2.5	995	2 180	211	**4R3625**	1	200	191	239	2	2	23.2
	250	168	168	2	2	980	2 470	239	**4R3639**	1	202	189	241	2	2	25.6
	260	168	168	2.5	2.5	1 130	2 400	230	**4R3628**	1	202	191	249	2	2	29.4
	265	180	180	2.5	2.5	1 200	2 510	241	**4R3618**	1	204	191	254	2	2	34.2
190	260	168	168	2.5	2.5	1 080	2 600	248	**4R3820**	1	212	201	249	2	2	26.9
	270	170	170	2.5	2.5	1 210	2 660	252	**4R3818**	1	213	201	259	2	2	31.7
	270	200	200	2.5	2.5	1 400	3 100	292	**4R3821**	1	212	201	259	2	2	37.5
	270	200	200	2.5	2.5	1 360	3 200	305	**4R3817**	1	212	201	259	2	2	37.2
	280	200	200	2.5	2.5	1 370	2 910	274	**4R3823**	2	214	201	269	2	2	41.5
	280	200	200	2.5	2.5	1 370	2 910	274	**4R3830**	3	214	201	269	2	2	42.8
200	270	170	170	2.5	2.5	1 080	2 610	245	**4R4039**	1	222	211	259	2	2	28.5
	280	152	152	2.1	2.1	1 110	2 320	217	**4R4054**	2②	222	211	269	2	2	29.5
	280	170	170	2.5	2.5	1 150	2 430	228	**4R4048**	1	222	211	269	2	2	33
	280	190	190	2.5	2.5	1 320	3 150	294	**4R4026**	1	223	211	269	2	2	36.7
	280	200	200	2.5	2.5	1 460	3 300	310	**4R4037**	1	222	211	269	2	2	40.5
	280	200	200	2.5	2.5	1 380	3 350	310	**4R4027**	1	224	211	269	2	2	38.8
	290	192	192	2.5	2.5	1 430	3 150	292	**4R4041**	1	226	211	279	2	2	42.5
210	290	192	192	2.5	2.5	1 370	3 350	310	**4R4206**	1	236	221	279	2	2	39.5
220	290	192	192	2.5	2.5	1 320	3 350	310	**4R4413**	1	239	231	279	2	2	33.8
	300	160	160	2.5	2.5	1 110	2 590	237	**4R4419**	1	245	231	289	2	2	32.8
	300	160	160	2.1	2.1	1 110	2 590	237	**4R4445**	3	245	231	289	2	2	33.7
	310	192	192	2.5	2.5	1 500	3 550	320	**4R4410**	1	247	231	299	2	2	46.3
	310	192	192	2.5	2.5	1 540	3 400	310	**4R4426**	1	246	231	299	2	2	46.9
	310	225	225	2.5	2.5	1 640	3 950	360	**4R4416**	1	245	231	299	2	2	54.9

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.

Four-Row Cylindrical Roller Bearings NTN

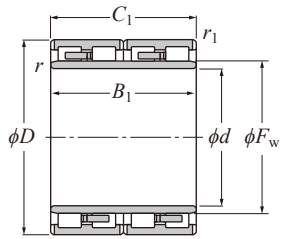


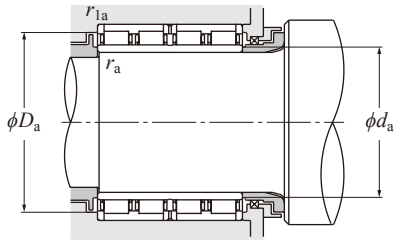


d 220-300 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Drawing No.[2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
220	310	225	225	2.5	2.5	1 760	3 950	360	**4R4449**	1	244	231	299	2	2	54.3
	320	160	160	3	3	1 320	2 550	231	**4R4428**	1	245	233	307	2.5	2.5	46.5
	320	210	210	2.5	2.5	1 720	3 650	325	**4R4429**	1	248	231	309	2	2	60.5
	320	210	210	2.5	2.5	1 720	3 600	330	**4R4444**	1	246	231	309	2	2	57.3
230	330	206	206	2.5	2.5	1 680	3 900	345	**4R4610**	1	260	241	319	2	2	58.3
	330	206	206	2.5	2.5	1 690	3 800	340	**4R4614**	1	258	241	319	2	2	58.6
240	330	220	220	3	3	1 650	4 150	365	**4R4811**	3	270	253	317	2.5	2.5	56.8
	330	220	220	3	3	1 790	4 250	380	**4R4819**	1	264	253	317	2.5	2.5	57.1
	330	220	220	3	3	1 650	4 150	365	**4R4821**	3	268	253	317	2.5	2.5	57.1
	330	220	220	3	3	1 690	4 250	375	**4R4804**	1	270	253	317	2.5	2.5	57.1
	340	220	220	3	3	1 850	4 200	370	**4R4806**	1	268	253	327	2.5	2.5	63.6
	360	220	220	2.5	2.5	1 950	4 050	355	**4R4813**	1	274	251	349	2	2	80.1
250	350	220	220	3	3	1 920	4 300	375	**4R5008**	1	278	263	337	2.5	2.5	66
260	360	260	260	2.5	2.1	2 030	4 850	420	**4R5231**	3①	287	271	349	2	2	81.5
	370	220	220	3	3	1 950	4 450	385	**4R5208**	1	292	273	357	2.5	2.5	77.1
	370	220	220	3	3	1 950	4 450	385	**4R5217**	1①	292	273	357	2.5	2.5	76.5
	380	280	280	3	3	2 680	6 250	535	**4R5213**	1	294	273	367	2.5	2.5	109
	400	290	290	4	2	3 400	7 150	—	**E-4R5218**	5④	296	276	391	3	2	135
270	380	280	280	2.5	2.5	2 510	5 750	490	**4R5407**	1	297	281	369	2	2	101
	380	280	280	2.5	2.5	2 860	6 850	585	**4R5405**	6④	299.7	281	369	2	2	105
280	350	208	208	2.5	2.5	1 430	3 950	345	**4R5614**	1	298	291	339	2	2	46.4
	390	220	220	3	3	1 970	4 650	395	**4R5611**	1	312	293	377	2.5	2.5	81.3
	390	220	220	3	3	2 020	4 800	405	**4R5604**	1	312	293	377	2.5	2.5	82
	390	275	275	2.5	2.5	2 540	6 250	525	**4R5612**	4③	312	291	379	2	2	105
290	420	300	300	3	3	3 150	7 500	625	**4R5805**	1	327	303	407	2.5	2.5	141
300	400	300	300	3	3	2 750	7 500	—	**E-4R6014**	1	328	313	387	2.5	2.5	104

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.



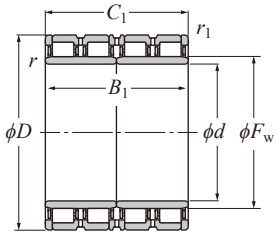


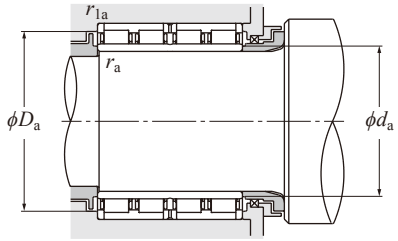
d 300-380 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Drawing 2) No.	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
300	420	240	240	3	3	2 240	5 450	450	**4R6017**	1①	334	313	407	2.5	2.5	106
	420	240	240	3	3	2 240	5 450	450	**4R6012**	1	334	313	407	2.5	2.5	105
	420	240	240	3	3	2 230	5 450	450	**4R6023**	1①	336	313	407	2.5	2.5	105
	420	240	240	3	3	2 530	5 750	475	**4R6027**	1	332	313	407	2.5	2.5	105
	420	300	300	3	3	3 300	8 150	—	**E-4R6030**	6①	331	313	407	2.5	2.5	136
	420	300	300	3	3	3 000	7 600	—	**E-4R6015**	1	334	313	407	2.5	2.5	125
	420	300	300	3	3	3 200	7 850	—	**E-4R6020**	6①	332	313	407	2.5	2.5	130
	430	240	240	3	3	2 400	5 150	425	**4R6021**	1	338	313	417	2.5	2.5	115
310	430	240	240	3	3	2 580	5 950	490	**4R6202**	1	344.5	323	417	2.5	2.5	108
320	440	240	230	3	3	2 540	6 050	—	**E-4R6414**	1	351	333	427	2.5	2.5	106
	450	240	240	3	3	2 630	6 150	—	**E-4R6411**	1	358	333	437	2.5	2.5	125
	460	340	340	3	3	3 750	9 450	765	**4R6412**	1	360	333	447	2.5	2.5	178
	470	350	350	3	3	4 600	10 900	875	**4R6406**	6④	361.7	333	457	2.5	2.5	212
330	440	200	200	5	3	1 910	4 550	370	**4R6608**	2①	360	350	427	4	2.5	85.6
	460	340	340	4	4	3 600	8 850	—	**E-4R6605**	1	365	346	444	3	3	181
	460	340	340	4	4	3 650	9 550	—	**E-4R6602**	1	368	346	444	3	3	177
340	480	350	350	4	4	4 400	10 900	—	**E-4R6819**	6M①	378	356	464	3	3	211
	490	300	300	4	4	3 700	8 300	—	**E-4R6804**	1	377	356	474	3	3	187
	490	300	300	5	5	3 450	7 950	—	**E-4R6805**	1	380	360	470	4	4	189
356.76	550	400	400	4	4	5 650	13 800	1 060	**4R7105K**	5	426	372.757	534	3	3	354
360	480	290	290	3	3	3 300	8 150	—	**E-4R7207**	1	388	373	467	2.5	2.5	148
	510	370	370	4	4	3 950	9 700	—	**E-4R7212**	3	400	376	494	3	3	244
	510	400	380	4	2	4 850	11 900	—	**E-4R7205**	5①	399	376	509	3	2	251
370	480	250	250	3	3	2 440	6 450	—	**E-4R7408**	1	401	383	467	2.5	2.5	118
	520	380	380	5	5	4 350	10 800	845	**4R7411**	1	409	390	500	4	4	256
380	520	280	280	4	4	3 800	9 150	710	**4R7605**	1	417	396	504	3	3	174

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.
Note: **4R7105K** is a bearing having a tapered bore with a taper ratio of 1:12.

Four-Row Cylindrical Roller Bearings NTN



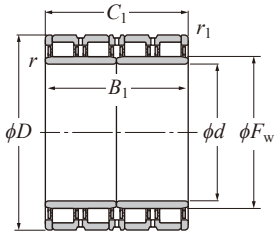


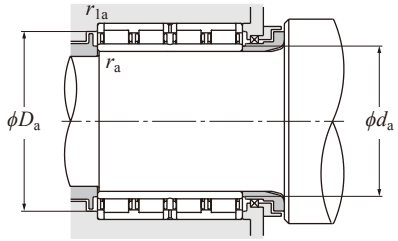
d 380-600 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN	Fatigue load limit kN	Bearing number	Drawing No.[2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
380	540	400	400	4	4	5 500	14 400	—	**E-4R7618**	6M①	422	396	524	3	3	309
	540	400	400	5	5	5 050	12 700	—	**E-4R7613**	2①③	424	400	520	4	4	298
400	590	420	420	4	4	5 750	13 000	980	**4R8011**	1	450	416	574	3	3	399
420	560	280	280	4	4	3 900	9 800	740	**4R8403**	1	457	436	544	3	3	189
430	591	420	420	5	5	6 100	17 400	—	**E-4R8605**	6R①④	476	450	571	4	4	362
440	600	450	450	1.5	5	6 700	17 900	—	**E-4R8806**	6R②	480	448	580	1.5	4	392
	600	450	450	1.5	5	7 050	19 100	—	**E-4R8805**	6R①	480	448	580	1.5	4	392
	620	450	450	5	5	7 150	18 700	—	**E-4R8803**	6①	487	460	600	4	4	450
460	620	400	400	4	4	5 900	16 700	—	**E-4R9211**	7S	502	476	604	3	3	383
	620	400	400	4	4	5 450	15 000	—	**E-4R9209**	1	502	476	604	3	3	341
	620	460	460	4	4	6 600	19 100	—	**E-4R9223**	6M①	502	476	604	3	3	417
	650	470	470	5	5	7 900	20 600	—	**E-4R9216**	6①	509	480	630	4	4	540
470	660	470	470	5	5	8 100	21 300	—	**E-4R9403**	6M①	517	490	640	4	4	529
480	650	420	420	5	5	6 350	17 200	—	**E-4R9613**	7①	523	500	630	4	4	423
	680	500	500	6	6	8 800	24 000	—	**E-4R9604**	6	532	504	656	5	5	640
500	680	420	405	5	5	7 000	18 800	—	**E-4R10020**	6②	550	520	660	4	4	451
	690	470	470	5	5	8 500	22 500	—	**E-4R10016**	6①	547	520	670	4	4	590
	720	530	530	5	5	9 150	25 000	—	**E-4R10024**	6M①	568	520	700	4	4	745
520	720	550	550	5	5	10 400	27 700	—	**E-4R10406**	6R①	566	540	700	4	4	715
530	780	570	570	6	6	11 400	29 100	—	**E-4R10602**	6①	601	554	756	5	5	1 010
	780	570	570	7.5	6	11 400	29 100	—	**E-4R10606**	6M①	595	562	756	6	5	978
536.18	762.03	558.8	558.8	5	6	11 200	29 200	—	**E-4R10704**	6②	600	556.176	738.03	4	5	859
570	800	514	514	2.5	6	11 300	29 200	—	**E-4R11404**	6R①	626	581	776	2	5	849
	815	594	594	6	6	13 100	34 500	—	**E-4R11402**	6	628	594	791	5	5	1 040
600	820	575	575	7.5	7.5	11 100	31 500	—	**E-4R12006**	6M①	660	632	788	6	6	941
	870	640	640	7.5	7.5	15 100	40 500	—	**E-4R12001**	6	672	632	838	6	6	1 330

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.

Four-Row Cylindrical Roller Bearings NTN





d 628-900 mm

Boundary dimensions mm						Basic load rating dynamic kN	Basic load rating static kN	Fatigue load limit kN	Bearing number	Drawing No.[2]	Dimension mm		Installation-related dimensions mm			Mass kg
d	D	B_1	C_1	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_u			F_w	d_a	D_a	r_{as}	r_{1as}	(approx.)
628	922	600	600	3	6	15 100	38 500	—	**E-4R12602**	6①	702	641	898	2.5	5	1 430
640	880	600	600	6	6	12 700	36 000	—	**E-4R12802**	6②	700	664	856	5	5	1 150
650	920	670	670	7.5	4	16 200	46 000	—	**E-4R13005**	6①	723	682	904	6	3	1 500
	920	680	680	7.5	7.5	16 600	47 000	—	**E-4R13010**	6R①	723	682	888	6	6	1 510
680	1 020	650	650	6	6	17 400	48 000	—	**E-4R13603**	6M②	803	704	996	5	5	1 970
	1 020	680	680	3	5	19 200	49 500	—	**E-4R13604**	6②	775	693	1 000	2.5	4	2 060
690	980	750	750	7.5	7.5	18 300	53 000	—	**E-4R13803**	6M②	766	722	948	6	6	1 900
710	1 000	715	715	9.5	6	18 600	54 500	—	**E-4R14205**	6S④	787.5	750	976	8	5	1 900
755	1 070	750	750	7.5	7.5	20 800	58 500	—	**E-4R15101**	6①	837	787	1 038	6	6	2 260
760	1 030	750	750	7.5	7.5	19 200	59 500	—	**E-4R15204**	6M①	828	792	998	6	6	2 000
761.43	1 079.6	787.4	787.4	9.5	7.5	21 900	63 000	—	**E-4R15201**	6①	846	801.425	1 047.6	8	6	2 420
800	1 080	750	750	6	6	19 200	59 000	—	**E-4R16005**	6①	880	824	1 056	5	5	2 090
820	1 130	800	800	7.5	7.5	21 800	66 500	—	**E-4R16406**	6M①	903	852	1 098	6	6	2 450
	1 130	800	800	7.5	7.5	23 900	72 000	—	**E-4R16413**	6MS②	903	852	1 098	6	6	2 530
	1 130	800	800	7.5	7.5	21 800	66 500	—	**E-4R16415**	6②	903	852	1 098	6	6	2 530
	1 130	825	800	7.5	7.5	21 800	66 500	—	**E-4R16405**	6M①	903	852	1 098	6	6	2 520
840	1 160	840	840	5	7.5	23 900	71 000	—	**E-4R16801**	6①	920	860	1 128	4	6	2 840
850	1 150	840	840	6	6	24 400	77 500	—	**E-4R17009**	6①	928	874	1 126	5	5	2 640
	1 180	850	850	7.5	7.5	24 100	72 000	—	**E-4R17014**	6②	940	882	1 148	6	6	2 980
860	1 140	750	750	7.5	7.5	20 000	61 000	—	**E-4R17202**	6②	938	892	1 108	6	6	2 200
900	1 230	895	870	7.5	7.5	30 000	88 000	—	**E-4R18001**	6M②	985	932	1 198	6	6	3 250

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Refer to section "2. Types" on page **C-33** for details of drawings.

Four-Row Cylindrical Roller Bearings NTN

Four-row tapered roller bearing

1. Features

1) This type of bearing includes two double-row inner rings with rollers, one double-row outer ring, two single-row outer rings, and two outer ring spacers (see **Fig. 1** TYPE B). There is also a type with an inner ring spacer (see **Fig. 1** TYPE A). These bearings are manufactured so that the internal clearance values are fixed. Due to this, only parts with identical manufacturing numbers can be used, and they must be assembled according to their code numbers.

2) These bearings are mainly used in the roll necks of steel rolling mills and designed so that the load rating is maximized in the allowable space of the roll neck part.

3) Loose fitting is used to make the assembly and removal of the bearings easy. Carburizing (case hardened) steel is used to prevent inner ring cracks due to creeping and to improve shock resistance. There is also a bearing design with a helical groove in the inner ring bore to prevent wear.

4) The cage type includes a pressed steel cage and a pin-type cage (that uses a hollow roller as shown in **Fig. 2**). The pin-type cage maximizes the number of rollers in the bearing to provide increased load capacity.

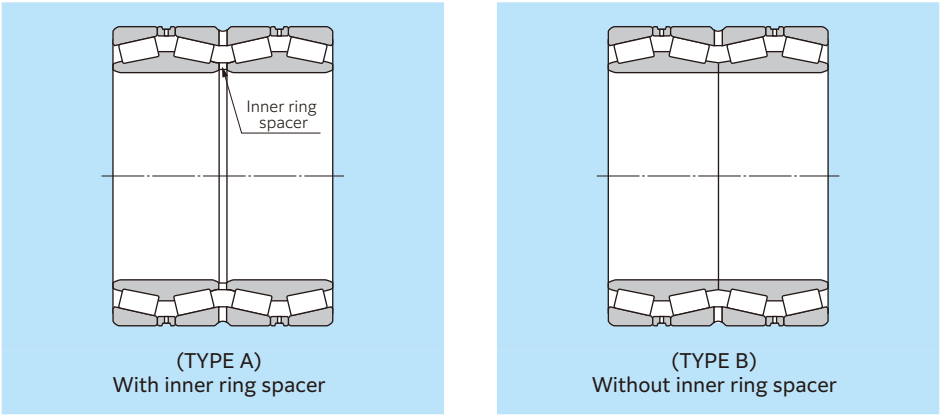


Fig. 1

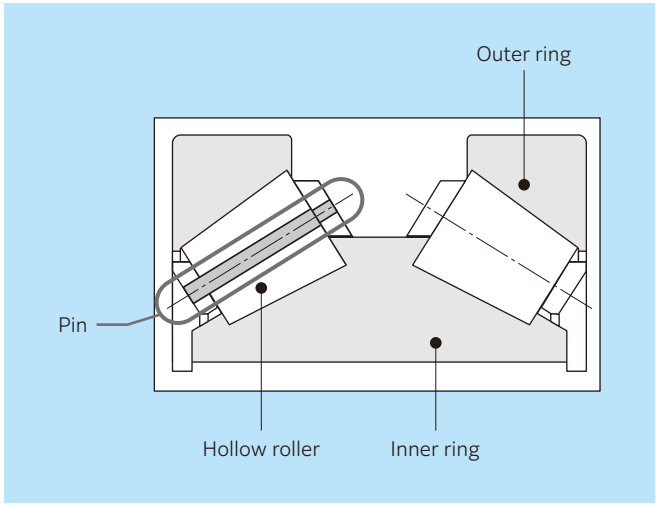
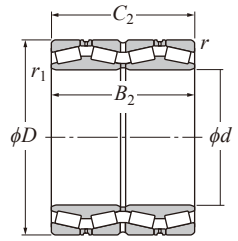
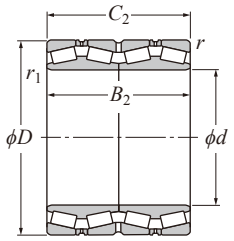


Fig. 2 Pin-type cage

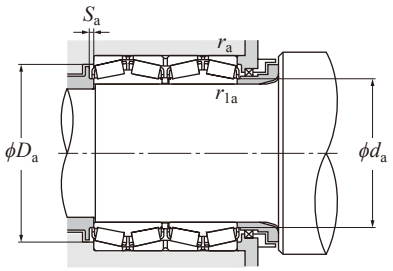


(TYPE A) with inner ring spacer



(TYPE B) without inner ring spacer

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

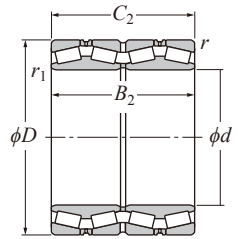
$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

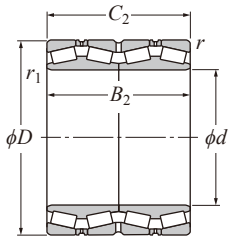
d 120-177.800 mm

Boundary dimensions mm						Basic load rating dynamic kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
120	170	124	124	2	2.5	430	1 020	*	E-625924	E-CRO-2451	133	151	5	2	2	0.33	2.03	3.02	1.98	8.97
	180	100	100	2	2.5	435	745	*	E-623024		135	166.5	3.8	2	2	0.37	1.80	2.69	1.76	8.87
	200	132	132	2	2.5	710	1 220	*	E-623124		143	182	4.1	2	2	0.37	1.80	2.69	1.76	16.7
	210	174	174	2.5	2.5	950	1 710	*	E-CRO-2418		139	178	4.5	2	2	0.40	1.67	2.50	1.64	22.2
120.650	174.625	141.288	139.703	1.5	0.8	670	1 490	◎ *	T-E-M224749D/M224710/M224710D		129	162	3	1.5	0.8	0.33	2.03	3.02	1.98	11.5
127.000	182.562	158.750	158.750	3.3	1.5	730	1 730	◎ *	T-E-48290D/48220/48220D		137	168	4.5	3.3	1.5	0.31	2.21	3.29	2.16	14.3
130	184	134	134	2	2.5	535	1 190	*	E-625926		144.5	169	5	2	2	0.33	2.03	3.02	1.98	11.3
130.175	196.850	200.025	200.025	3.3	1.5	995	2 210	◎ *	T-E-67391DW/67322/67323D		142	180	7	3.3	1.5	0.34	1.96	2.92	1.93	21.3
135	180	160	160	2	1	555	1 360	*	E-CRO-2701		143	161	2	2	1	0.33	2.03	3.02	1.98	13.5
136.525	190.500	161.925	161.925	3.3	1.5	770	1 900	◎ *	T-E-48393D/48320/48320D		144	177	4	3.3	1.5	0.32	2.10	3.13	2.05	14.8
139.700	200.025	157.165	160.340	3.3	0.8	780	1 950	◎ *	T-E-48680D/48620/48620D		150	185	3	3.3	0.8	0.34	2.01	2.99	1.96	17.3
140	198	144	144	2	2.5	640	1 460	*	E-625928		156	183	5	2	2	0.33	2.03	3.02	1.98	14
	210	114	114	2	2.5	570	1 070	*	E-623028		159	193	3.5	2	2	0.37	1.84	2.74	1.80	13.8
	210	115	115	2	2.5	570	1 070	*	E-CRO-2817	E-CRO-2819	159	187	3.4	2	2	0.37	1.84	2.74	1.80	13.9
150	210	190	190	2	1.5	925	2 270	*		E-CRO-3058	164.2	192	5	2	1.5	0.38	1.77	2.64	1.73	20.1
	212	155	155	2.5	3	735	1 700	*	E-625930		167.5	195	5.5	2	2.5	0.33	2.03	3.02	1.98	16.9
152.400	222.250	174.625	174.625	1.5	1.5	1 030	2 350	◎ *	T-E-M231649D/M231610/M231610D	E-CRO-3059	165	207	4	1.5	1.5	0.36	1.87	2.79	1.83	24.7
160	226	165	165	2.5	3	855	2 030	*	E-625932	E-CRO-3212	177.5	208.5	5.5	2	2.5	0.33	2.03	3.02	1.98	20.2
	265	173	173	2.5	2.5	1 220	2 270	*	E-CRO-3209	E-CRO-3210	189	231	4.5	2	2	0.33	2.03	3.02	1.98	37
165.100	225.425	165.100	168.275	3.3	0.8	830	2 220	◎ *	E-T-46791D/46720/46721D	E-CRO-3304	180.5	199.5	3	0.8	2.5	0.38	1.76	2.62	1.72	20.7
170	230	175	175	2.5	1	935	2 230	*	E-CRO-3456	E-CRO-3457	181	206.5	5	2	1	0.38	1.76	2.62	1.72	21
	240	175	175	2.5	3	930	2 200	*	E-625934	E-CRO-3418	187.5	220	5.5	2	2.5	0.33	2.03	3.02	1.98	24.8
	240	175	175	2	1.7	1 080	2 440	*		E-CRO-3416	185.4	214	7	2	1.5	0.40	1.68	2.50	1.64	24.4
	260	144	144	2.5	3	930	1 730	*	E-623034		192.5	239	3.8	2	2.5	0.37	1.80	2.69	1.76	27.5
	280	185	185	2.5	3	1 380	2 540	*	E-623134		197	253.5	6.4	2	2.5	0.37	1.80	2.69	1.76	45.2
177.800	247.650	192.088	192.088	3.3	1.5	1 110	2 760	◎ *	E-67791D/67720/67721D	E-CRO-3664	190	217	5	3.3	1.5	0.44	1.54	2.29	1.48	29.4

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



(TYPE A) with inner ring spacer



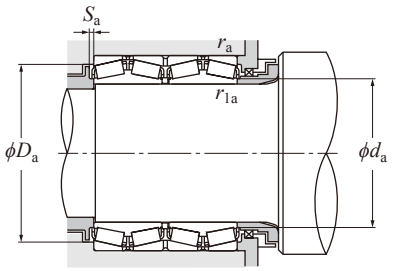
(TYPE B) without inner ring spacer

d 177.800-228.600 mm

Boundary dimensions mm						Basic load rating dynamic kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
177.800	304.800	238.227	233.365	3.3	3.3	1 750	3 100	◎ ＊	**E-EE280700D/281200/281201D**	**E-CRO-3663**	206	274.5	7	3.3	3.3	0.36	1.87	2.79	1.83	69.9
	250	185	185	2	3.5	995	2 350	＊	**E-625936/250**	**E-CRO-3670**	195.1	221	6	2	3	0.44	1.54	2.30	1.51	26.8
180	254	185	185	2.5	3	1 010	2 390	＊	**E-625936**	**E-CRO-3669**	200.5	233.5	5.5	2	2.5	0.33	2.03	3.02	1.98	28.9
	260	185	185	2.5	3	1 010	2 390	＊		**E-CRO-3666**	200.5	235.5	5.5	2	2.5	0.33	2.03	3.02	1.98	32.3
187.325	269.875	211.138	211.138	3.3	1.5	1 490	3 500	◎ ＊	**T-E-M238849D/M238810/M238810D**	**E-CRO-3701**	199.9	250	4	3.3	1.5	0.33	2.03	3.02	1.98	41.8
190	268	196	196	2.5	3	1 170	2 850	＊	**E-625938**		209	245.5	6	2	2.5	0.33	2.03	3.02	1.98	34.7
	270	190	190	2.5	0.6	1 160	2 990	＊	**E-CRO-3816**		209.6	244	6.5	2	0.6	0.48	1.41	2.11	1.38	36.4
190.500	266.700	187.325	188.912	3.3	1.5	1 160	2 990	◎ ＊	**T-E-67885D/67820/67820D**	**E-CRO-3814**	208	234	3	1.5	2.5	0.48	1.41	2.11	1.38	33.6
198.438	284.162	225.425	225.425	3.3	1.5	1 690	4 000	◎	**E-M240648D/M240611/M240611D**	**E-CRO-4026**	212.1	263.9	5.5	3.3	1.5	0.33	2.03	3.02	1.98	46
	280	206	206	2.5	3	1 330	3 300		**E-625940/280**	**E-CRO-4028**	219.5	257.5	5	2	2.5	0.33	2.03	3.02	1.98	39
200	282	206	206	2.5	3	1 330	3 300		**E-625940**	**E-CRO-4024**	219.5	260.5	6	2	2.5	0.33	2.03	3.02	1.98	40.5
	290	160	160	2.5	2.5	1 060	2 210		**E-CRO-4013**		224	267.5	5	2	2	0.37	1.80	2.69	1.76	35.1
205	320	205	205	3	3	1 450	2 510		**E-CRO-4109**		233	293.5	8	2.5	2.5	0.46	1.47	2.19	1.44	59.1
206.375	282.575	190.500	190.500	3.3	0.8	1 180	3 150	◎	**T-E-67986D/67920/67920D**	**E-CRO-4120**	219	260	5	3.3	0.8	0.51	1.33	1.97	1.30	35.4
215.900	288.925	177.800	177.800	3.3	0.8	1 240	3 250	◎	**T-E-LM742749D/LM742714/LM742714D**		229.4	267	5	0.8	2.5	0.48	1.40	2.09	1.37	34.3
216.103	330.200	263.525	269.875	3.3	1.5	2 220	5 150	◎	**E-9974D/9920/9920D**		235	300	6	3.3	1.5	0.55	1.23	1.82	1.20	82.1
	300	230	230	2.5	2.5	1 500	3 650		**E-CRO-4412**		236.5	277.5	6.5	0	2	0.43	1.59	2.36	1.55	42.1
	310	226	226	3	4	1 530	3 800		**E-625944**	**E-CRO-4441**	242	284.5	6	2.5	3	0.33	2.03	3.02	1.98	53.5
220	320	200	200	3	1	1 540	3 400		**E-CRO-4411**	**E-CRO-4447**	238	294	6.5	2.5	2	0.35	1.95	2.90	1.91	53
	330	260	260	3	3	2 140	4 900		**E-CRO-4432**		237.5	284.5	7	2.5	2.5	0.55	1.24	1.84	1.21	76.7
	330	260	260	4	3	2 200	5 100			**E-CRO-4440**	242	299	9	3	2.5	0.40	1.68	2.50	1.64	77.9
	340	190	190	3	4	1 670	3 300		**E-623044**		250.5	315	5.5	2.5	3	0.37	1.80	2.69	1.76	63.2
220.662	314.325	239.712	239.712	3.3	1.5	2 040	4 900	◎	**T-E-M244249D/M244210/M244210D**	**E-CRO-4442**	239.5	288.5	4	1.5	2.5	0.33	2.03	3.02	1.98	60.2
	311.150	200.025	200.025	3.3	1.5	1 540	3 650	◎		**E-CRO-4612**	242	293	8	3.3	1.5	0.33	2.03	3.02	1.98	42.9
228.600	364.000	296.875	296.875	3.3	3.3	2 630	5 550	◎	**E-CRO-4606**		262	334.5	6.5	3.3	3.3	0.32	2.12	3.15	2.07	117.9
	425.450	349.250	361.950	6.4	3.5	3 850	8 250	◎	**E-EE700090D/700167/700168D**		259	381	3	6.4	3.5	0.33	2.03	3.02	1.98	232

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "＊", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

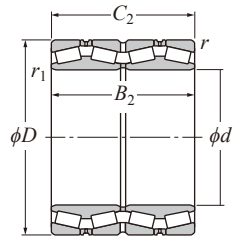
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

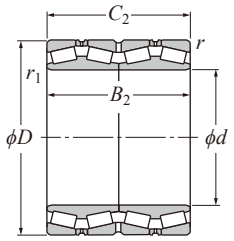
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.



(TYPE A) with inner ring spacer

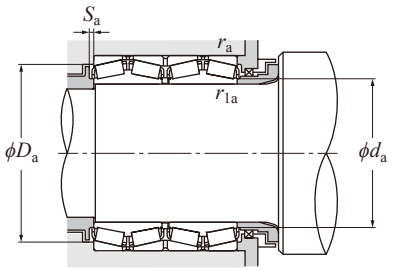


(TYPE B) without inner ring spacer

d 234.950-279.578 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN		Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
234.950	327.025	196.850	196.850	3.3	1.5	1 370	3 700	◎	**T-E-8576D/8520/8520D**	**E-CRO-4704**	256	301	5	3.3	1.5	0.41	1.66	2.47	1.62	53.6
240	338	248	248	3	4	2 080	4 950		**E-625948A**	**E-CRO-4825**	260.5	312	6	3	2.5	0.33	2.03	3.02	1.98	70
	350	230	230	2.5	1.5	2 030	4 700		**E-CRO-4829**		263	320.5	7	2	1.5	0.42	1.61	2.39	1.57	73.8
	360	194	194	3	4	1 710	3 550			**E-CRO-4834**	267	323	9	2.5	3	0.37	1.80	2.69	1.76	67.1
	365	290	290	2.5	2.5	2 700	5 850		**E-CRO-4803**		263	333	6	2	2	0.46	1.47	2.19	1.44	105
244.475	327.025	193.675	193.675	3.3	1.5	1 580	4 100	◎	**E-LM247748D/LM247710/LM247710DA**	**E-CRO-4905**	264.5	306	5	3.3	1.5	0.32	2.09	3.11	2.04	46.1
	381.000	304.800	304.800	4.8	3.3	2 470	5 750	◎	**E-EE126096D/126150/126151D**		269	343	6.5	3.3	4.8	0.52	1.31	1.95	1.28	132
250	365	270	270	4.3	3	2 630	6 250		**E-CRO-5011**	**E-CRO-5017**	273.5	321.5	8	4.3	2.5	0.33	2.03	3.02	1.98	94.7
254.000	358.775	269.875	269.875	3.3	3.3	2 650	6 550	◎	**T-E-M249748D/M249710/M249710D**	**E-CRO-5118**	272.5	335	7.5	2.5	2.5	0.33	2.03	3.02	1.98	85.6
	444.500	279.400	279.400	6.4	3.3	3 200	5 900	◎	**E-EE822101D/822175/822176D**		282	405	8	6.4	3.3	0.34	1.98	2.94	1.93	185
260	360	272	272	2.5	3	2 310	5 750		**E-CRO-5220**	**E-CRO-5236**	279	332.5	8	2	2.5	0.41	1.66	2.47	1.62	82.1
	368	268	268	4	5	2 210	5 700		**E-625952**		290	338.5	6	3	3	0.33	2.03	3.02	1.98	90.3
	368	268	268	2.5	3	2 310	5 750			**E-CRO-5239**	278.5	335.5	8	2	2.5	0.41	1.66	2.47	1.62	90
	400	220	220	4	5	2 180	4 400		**E-623052**		293	367	6.5	3	3	0.37	1.80	2.69	1.76	98.9
	400	255	255	7.5	4	2 450	5 300		**E-CRO-5215**		293	360.5	8	6	3	0.39	1.71	2.54	1.67	106
	400	320	320	4	4	3 100	7 050		**E-CRO-5228**	**E-CRO-5242**	292	363	11	3	3	0.33	2.03	3.02	1.98	145
260.350	365.125	228.600	228.600	6.4	3.3	1 750	4 550	◎	**E-EE134102D/134143/134144D**		280	339	6.5	6.4	3.3	0.37	1.80	2.69	1.76	76.5
	422.275	314.325	317.500	3.3	6.4	3 900	7 550	◎		**E-CRO-5237**	298	387	3	3.3	6.4	0.33	2.03	3.02	1.98	172
266.700	355.600	230.188	228.600	3.3	1.5	1 590	4 350	◎	**E-CRO-5305**		290	330.5	3.5	3.3	1.5	0.37	1.83	2.72	1.79	62.3
	355.600	230.188	228.600	3.3	1.5	2 040	5 350	◎	**T-E-LM451349D/LM451310/LM451310D**	**E-CRO-5307**	287	331.5	8.5	3.3	1.5	0.36	1.87	2.79	1.83	62
269.875	381.000	282.575	282.575	3.3	3.3	2 890	7 150	◎	**T-E-M252349D/M252310/M252310D**	**E-CRO-5409**	294	351	6	2.5	2.5	0.33	2.03	3.02	1.98	97.5
276.225	393.700	269.878	269.878	6.4	1.5	2 250	5 650	◎	**E-EE275109D/275155/275156D**		293.5	373	8	6.4	1.5	0.40	1.68	2.50	1.64	103
279.400	381.000	269.875	269.875	3.3	1.5	2 490	6 450	◎	**E-CRO-5628**		298.5	355.5	5	2.5	1.5	0.37	1.80	2.69	1.76	79.6
	393.700	269.875	269.875	6.4	1.5	2 150	5 350	◎	**E-EE135111D/135155/135156D**	**E-CRO-5687**	297	368	6.5	5	1.5	0.40	1.68	2.50	1.64	103
	469.900	346.075	349.250	3.3	6.4	3 850	8 700	◎	**E-EE722111D/722185/722186D**		314	430	5	3.3	6.4	0.37	1.78	2.65	1.74	258
279.578	380.898	244.475	244.475	3.3	1.5	2 160	6 200	◎	**T-E-LM654644D/LM654610/LM654610D**	**E-CRO-5679**	304.5	350.5	5	3.3	1.5	0.43	1.56	2.33	1.52	83.2

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*****", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



Dynamic equivalent radial load

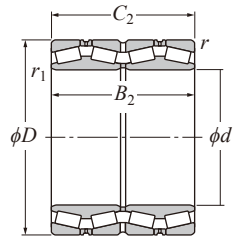
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

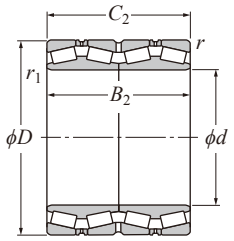
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.



(TYPE A) with inner ring spacer

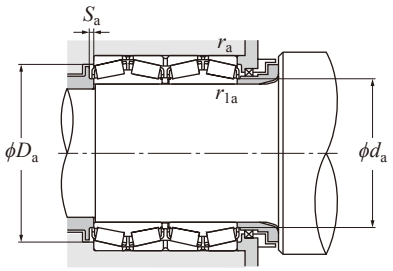


(TYPE B) without inner ring spacer

d 280-305.000 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN		Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
280	380	290	290	3.1	1.7	2 740	7 250		E-CRO-5650	E-CRO-5676	301	353.5	6.5	2.5	1.5	0.33	2.03	3.02	1.98	105
	395	288	288	4	5	2 840	7 100		E-625956	E-CRO-5684	304.5	363.5	7	3	4	0.33	2.03	3.02	1.98	111
	395	290	290	4	3	3 100	7 850		E-CRO-5645	E-CRO-5683	306	365	9	3	3	0.33	2.03	3.02	2.07	97.5
285.750	380.898	244.475	244.475	3.3	1.5	2 160	6 200	◎	T-E-LM654648D/LM654610/LM654610D	E-CRO-5710	308	350.5	5	1.5	2.5	0.43	1.56	2.33	1.53	82.5
288.925	406.400	298.450	298.450	3.3	3.3	3 300	8 300	◎	E-M255449D/M255410/M255410DA	E-CRO-5815	310	376	5	3.3	3.3	0.34	2.00	2.98	1.96	125
292.100	422.275	269.875	269.875	3.3	6.4	2 850	6 540	◎	E-EE330116D/330166/330167D		314.2	395	6	3.3	6.4	0.32	2.11	3.14	2.07	97.5
	476.250	296.047	292.100	3.3	1.5	3 400	6 800	◎	E-EE921150D/921875/921876D		314	442	7	3.3	1.5	0.29	2.30	3.42	2.25	208
300	420	310	310	4	5	2 850	7 450		E-625960/420		329	388	7	3	4	0.33	2.03	3.02	1.98	131
	420	310	310	5	3	3 400	8 300			E-CRO-6046	319.4	387	8	4	2.5	0.34	2.00	2.98	1.96	130
	424	310	310	4	5	2 850	7 450		E-625960	E-CRO-6035	329	389.5	7	3	4	0.33	2.03	3.02	1.98	138
	430	280	280	4	4	2 990	7 100		E-CRO-6019		325.5	394.5	8	3	3	0.47	1.45	2.16	1.42	132
	430	300	300	4	4	2 990	7 100		E-CRO-6022	E-CRO-6034	323	393	3	3	3	0.47	1.45	2.16	1.42	141
	460	360	360	4	4	4 500	10 100			E-CRO-6044	334	422	9	3	3	0.31	2.21	3.29	2.16	213
	470	270	270	4	5	3 450	7 000		☆ E-CRO-6016	E-CRO-6050	347	432	9	3	4	0.37	1.80	2.69	1.76	177
	470	292	292	4	4	3 900	8 300		☆ E-CRO-6017	E-CRO-6053	343.5	430	7	3	3	0.37	1.80	2.69	1.76	164
	500	332	332	5	6	4 000	8 100		E-623160	E-CRO-6051	346.5	449	5	4	4	0.40	1.68	2.50	1.64	257
	500	350	350	5	6	4 000	8 100		E-CRO-6056	E-CRO-6054	352	449	7	4	5	0.40	1.68	2.50	1.64	266
	500	380	380	5	5	5 100	10 400		E-CRO-6028	E-CRO-6052	339	450	8	4	4	0.40	1.68	2.50	1.64	300
300.038	422.275	311.150	311.150	3.3	3.3	3 400	8 300	◎		E-CRO-6040	322	389	8	3.3	3.3	0.34	2.00	2.98	1.96	134
	422.275	311.150	311.150	3.3	3.3	3 700	9 600	◎	☆ T-E-HM256849D/HM256810/HM256810DG2	E-CRO-6039	322	394	6	3.3	3.3	0.34	2.00	2.98	1.95	143
304.648	438.048	279.400	279.400	3.3	3.3	2 740	6 500	◎	E-EE329119D/329172/329173D		327	410	8	3.3	3.3	0.33	2.04	3.04	2.00	143
	438.048	280.990	279.400	4.8	3.3	2 920	6 900	◎	E-M757448D/M757410/M757410D	E-CRO-6146	328	407	7	4.8	3.3	0.47	1.43	2.12	1.39	140
304.800	419.100	269.875	269.875	6.4	1.5	2 650	6 850	◎	E-M257149D/M257110/M257110D	E-CRO-6148	330.5	387	5	6.4	1.5	0.33	2.03	3.02	1.98	115
	495.300	342.900	349.250	6.4	3.3	4 050	9 400	◎	E-EE724121D/724195/724196D		334	450	3	6.4	3.3	0.40	1.68	2.50	1.64	273
304.902	412.648	266.700	266.700	3.3	3.3	2 860	7 450	◎	E-M257248D/M257210/M257210D	E-CRO-6144	328.5	385.5	8.5	3.3	3.3	0.32	2.12	3.15	2.07	107
305.000	438.048	280.990	279.400	4.8	3.3	2 920	6 900	◎	E-M757449D/M757410/M757410D	E-CRO-6145	331	400.5	7	4.8	3.3	0.47	1.43	2.12	1.39	139

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*****", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



Dynamic equivalent radial load

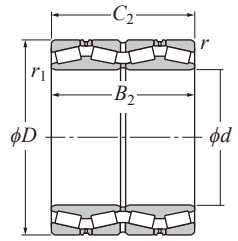
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

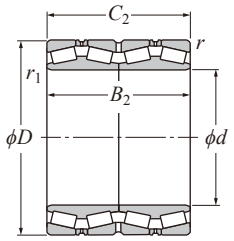
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.



(TYPE A) with inner ring spacer



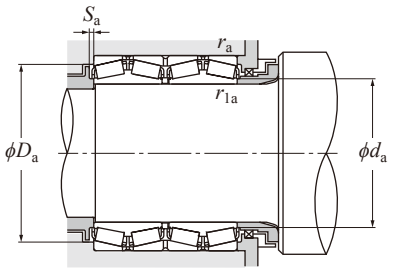
(TYPE B) without inner ring spacer

d 310-360 mm

Boundary dimensions mm						Basic load rating dynamic kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
310	430	310	310	4	2.2	3 200	8 100		**E-CRO-6213**	**E-CRO-6229**	333	396.5	8.5	3	2	0.40	1.68	2.50	1.64	133
	430	310	310	5.5	2.2	3 400	8 600		**E-CRO-6224**		336	397.5	7.5	4	2	0.33	2.03	3.02	1.98	135
317.500	422.275	269.875	269.875	3.3	1.5	2 510	7 050	◎	**E-LM258649D/LM258610/LM258610D**	**E-CRO-6431**	342.5	393.5	7	3.3	1.5	0.32	2.10	3.13	2.06	110
	447.675	327.025	327.025	3.3	3.3	3 100	8 600	◎	**E-CRO-6424**		352	410.5	6	3.3	3.3	0.33	2.02	3.00	1.97	165
	447.675	327.025	327.025	3.3	3.3	3 800	9 550	◎	**T-E-HM259049D/HM259010/HM259010D**	**E-CRO-6430**	340	418	7.5	2.5	2.5	0.33	2.02	3.00	1.97	161
320	460	338	338	4	5	3 250	8 650		**E-625964**		355	420.5	7	3	4	0.33	2.03	3.02	1.98	183
327	445	230	230	4	2	2 380	5 650		**E-CRO-6501**		353.5	416	5.5	3	2	0.33	2.03	3.02	1.98	99.8
330	470	340	340	2.5	2.5	3 500	10 200		**E-CRO-6604**		370	431.5	5.5	2	2	0.33	2.02	3.00	1.97	141
330.200	482.600	306.388	311.150	3.3	1.5	3 100	7 900	◎	**E-EE526131D/526190/526191D**		351	449	3	3.3	1.5	0.39	1.72	2.56	1.68	197
	533.400	254.000	254.000	6	6	3 550	6 750	◎	**E-CRO-6606**		378.5	488	6.5	5	5	0.37	1.80	2.69	1.76	221
333.375	469.900	342.900	342.900	3.3	3.3	4 400	11 000	◎	**E-HM261049D/HM261010/HM261010DA**	**E-CRO-6711**	356.5	434	5	2.5	2.5	0.33	2.02	3.00	1.97	187
335	460	342.9	342.9	5	1	3 900	10 300			**E-CRO-6710**	354.5	424	7	4	1	0.40	1.68	2.50	1.64	168
340	480	350	350	5	6	3 800	10 400		**E-625968**	**E-CRO-6806**	376	440.5	7	4	5	0.33	2.03	3.02	1.98	200
	520	278	278	5	6	3 600	7 500		**E-623068**		384	478.5	6.5	4	4	0.37	1.80	2.69	1.76	213
342.900	533.400	307.985	301.625	3.3	3.3	3 500	6 900	◎	**E-EE971355D/972100/972103D**		370	501	11	3.3	3.3	0.33	2.03	3.02	1.98	252
343.052	457.098	254.000	254.000	3.3	1.5	2 630	6 900	◎	**E-LM761649D/LM761610/LM761610D**	**E-CRO-6945**	368.8	424.5	5	3.3	1.5	0.47	1.43	2.12	1.39	117
	457.098	254.000	254.000	3.3	1.5	2 700	6 750	◎	**E-CRO-6910**	**E-CRO-6944**	360.5	425.5	5	3.3	1.5	0.47	1.43	2.12	1.40	109
346.075	488.950	358.775	358.775	3.3	3.3	4 350	12 800	◎	☆ **T-E-HM262749D/HM262710/HM262710DG2**		368	456	6	2.5	2.5	0.33	2.02	3.00	1.97	227
347.662	469.900	260.350	260.350	3.3	1.5	3 050	8 200	◎		**E-CRO-7005**	378.5	440.5	8	3.3	1.5	0.33	2.03	3.02	1.98	130
	469.900	292.100	292.100	3.3	3.3	3 550	9 100	◎	**E-M262449D/M262410/M262410D**		365	444	8	3.3	3.3	0.33	2.03	3.02	1.98	143
	469.900	292.100	292.100	3.3	3.3	3 600	9 400	◎		**E-CRO-7004**	370.5	439.5	9	3.3	3.3	0.33	2.03	3.02	1.98	145
355.600	444.500	241.300	241.300	3.3	1.5	2 020	6 450	◎	**T-E-L163149D/L163110/L163110D**		370	422	6.5	3.3	1.5	0.31	2.20	3.27	2.15	89.5
	457.200	252.412	252.412	3.3	1.5	2 730	7 850	◎	**E-LM263149D/LM263110/LM263110D**		372	434	6	3.3	1.5	0.32	2.12	3.15	2.07	106
	482.600	265.112	269.875	3.3	1.5	3 100	7 650	◎	**E-LM763449D/LM763410/LM763410D**	**E-CRO-7123**	379	449	3	3.3	1.5	0.47	1.43	2.14	1.40	145
	488.950	317.500	317.500	3.3	1.5	3 850	10 000	◎	**E-M263349D/M263310/M263310D**	**E-CRO-7125**	374	459	5	3.3	1.5	0.33	2.03	3.02	1.98	173
360	480	370	370	5	2.5	3 750	10 500			**E-CRO-7232**	387	443.5	3	4	2	0.33	2.03	3.02	1.98	182

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*****", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

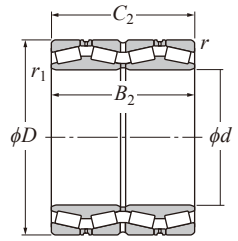
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

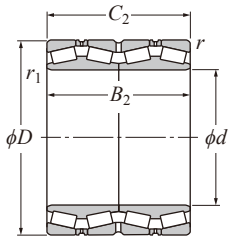
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.



(TYPE A) with inner ring spacer

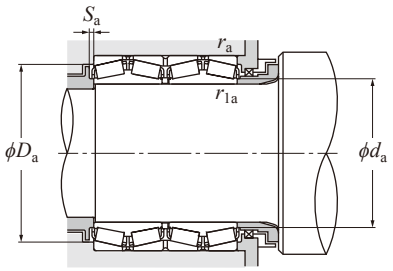


(TYPE B) without inner ring spacer

d 360-409.575 mm

Boundary dimensions mm						Basic load rating dynamic kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
360	480	375	375	3	3	3 750	11 900		E-CRO-7209	E-CRO-7230	378	444	9	2.5	2.5	0.33	2.02	3.00	1.97	186
	508	370	370	5	6	4 100	11 200		E-625972	E-CRO-7227	394	466.5	7	4	5	0.33	2.03	3.02	1.98	236
	520	370	370	5.5	3.5	4 950	12 300		E-CRO-7220	E-CRO-7229	391.5	478	5	4.5	3	0.33	2.03	3.02	1.98	260
	520	410	410	5	5	5 700	14 700	☆	E-CRO-7217		396	478	8.5	4	4	0.33	2.03	3.02	1.98	297
	540	340	340	5	3	4 850	11 100		E-CRO-7211		400	496	5	4	2.5	0.33	2.03	3.02	1.98	270
	600	396	396	5	6	6 100	13 000			E-CRO-7228	416.5	541.5	8	4	5	0.40	1.68	2.50	1.64	447
368.300	523.875	382.588	382.588	6.4	3.3	4 950	13 100	◎ ☆	E-HM265049D/HM265010/HM265010DG2	E-CRO-7406	408	481.5	6	6.4	3.3	0.33	2.03	3.02	1.98	280
	596.900	342.900	342.900	6.4	6.4	4 750	10 600	◎	E-EE181455D/182350/182351D		421	552	7.5	6.4	6.4	0.42	1.62	2.42	1.59	373
374.650	501.650	250.825	260.350	3.3	1.5	3 000	6 250	◎	E-LM765149D/LM765110/LM765110D		393	472	2	3.3	1.5	0.47	1.43	2.12	1.40	145
380	536	390	390	5	6	5 450	14 100		E-625976	E-CRO-7627	410	494	8	4	5	0.33	2.03	3.02	1.98	278
	560	282	282	5	6	3 950	8 700		E-623076		421	518.5	6.5	4	4	0.37	1.80	2.69	1.76	240
	560	360	360	6	1.5	5 150	12 100		E-CRO-7622		416.5	514	7	5	1.5	0.40	1.68	2.50	1.64	302
	560	360	360	5	1.5	5 600	13 500	☆	E-CRO-7621		423	514.5	6.5	4	1.5	0.40	1.68	2.50	1.64	300
	620	418.5	418.5	5	5	6 400	13 900		E-CRO-7623		428.5	560	9	4	4	0.46	1.47	2.19	1.44	489
384.175	546.100	400.050	400.050	6.4	3.3	4 800	13 300	◎	E-HM266449D/HM266410/HM266410D	E-CRO-7702	411	507	6.5	6.4	3.3	0.33	2.03	3.02	1.98	312
	546.100	400.050	400.050	6.4	3.3	6 000	16 100	◎ ☆	T-E-HM266449D/HM266410/HM266410DG2		411	507	6.5	6.4	3.3	0.33	2.03	3.02	1.98	312
385.762	514.350	317.500	317.500	3.3	3.3	4 000	11 100	◎	E-LM665949D/LM665910/LM665910D		409	482	7	3.3	3.3	0.42	1.61	2.40	1.58	240
390	510	350	350	3.5	1.6	4 100	11 800		E-CRO-7804		411	478	9	3	1.5	0.33	2.03	3.02	1.98	189
393.700	546.100	288.925	288.925	6.4	1.5	3 550	10 200	◎	E-LM767745D/LM767710/LM767710D		418	510	6.5	6.4	1.5	0.48	1.42	2.11	1.38	219
400	564	412	412	5	5	4 850	13 900		E-CRO-8009		426.5	517.5	6.5	4	4	0.40	1.68	2.50	1.64	312
	564	412	412	6	6	5 400	14 700		E-625980	E-CRO-8019	438	518	6	5	5	0.33	2.03	3.02	1.98	325
	590	304	304	5	5	4 200	9 450			E-CRO-8017	442	543	9	4	4	0.42	1.62	2.42	1.59	267
406.400	546.100	288.925	288.925	6.4	1.5	3 550	10 200	◎	E-LM767749D/LM767710/LM767710D	E-CRO-8109	427	510	6.5	6.4	1.5	0.48	1.42	2.11	1.38	193
	546.100	288.925	288.925	6.4	1.5	3 700	9 400	◎		E-CRO-8110	431.5	508	8	6.4	1.5	0.43	1.57	2.34	1.53	185
	590.550	400.050	400.050	6.4	3.3	5 350	13 600	◎	E-EE833161D/833232/833233D		435	549	6.5	6.4	3.3	0.33	2.07	3.09	2.03	395
409.575	546.100	334.962	334.962	6.4	1.5	4 400	12 200	◎		E-CRO-8205	431	510	9	6.4	1.5	0.42	1.61	2.40	1.58	216

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



Dynamic equivalent radial load

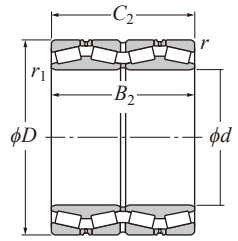
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

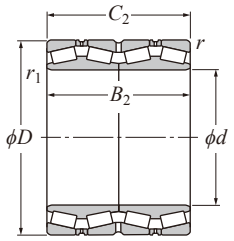
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

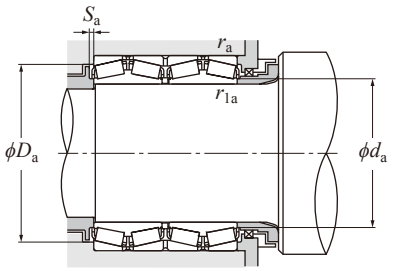


(TYPE A) with inner ring spacer



(TYPE B) without inner ring spacer

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

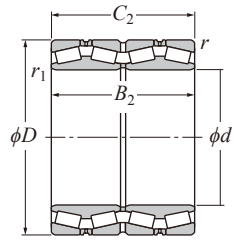
$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

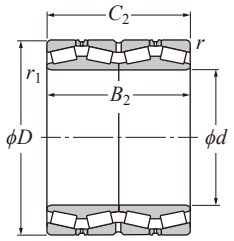
d 409.575-480 mm

Boundary dimensions mm						Basic load rating dynamic / static kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
409.575	546.100	334.962	334.962	6.4	1.5	4 400	12 700	◎	☆ **E-M667947D/M667911/M667911DG2**		431	510	5.5	6.4	1.5	0.42	1.61	2.40	1.57	226
415.925	590.550	434.975	434.975	6.4	3.3	6 950	18 900	◎	☆ **T-E-M268749D/M268710/M268710DG2**	**E-CRO-8304**	444	548.9	9	6.4	3.3	0.33	2.03	3.02	1.98	421
420	592	432	432	5	6	5 950	16 300		**E-625984**	**E-CRO-8414**	457	545	7	4	5	0.33	2.03	3.02	1.98	374
431.800	571.500	279.400	279.400	3.3	1.5	3 550	9 850	◎	**T-E-LM869449D/LM869410/LM869410D**		453	537	8	3.3	1.5	0.55	1.24	1.84	1.21	193
	571.500	336.550	336.550	6.4	1.5	4 100	11 800	◎	**E-LM769349D/LM769310/LM769310D**		453	534	6.5	6.4	1.5	0.44	1.52	2.26	1.49	232
	571.500	336.550	336.550	6.4	1.5	4 600	13 600	◎	☆	**E-CRO-8616**	453	534	8	6.4	1.5	0.44	1.52	2.26	1.49	241
	635.000	355.600	355.600	6.4	6.4	6 300	15 000	◎	☆ **E-EE931170D/931250/931251XDG2**		468.1	591.1	6.6	6.4	6.4	0.32	2.12	3.15	2.07	402
432.003	609.524	317.500	317.500	6.4	3.5	4 850	11 500	◎	**E-EE736173D/736238/736239D**		459	570	6.5	6.4	3.5	0.35	1.95	2.90	1.91	297
440	580	360	360	6	4	4 750	15 000		**E-CRO-8846**	**E-CRO-8844**	474	540	8	5	3	0.33	2.03	3.02	1.98	261
	620	454	454	6	6	7 200	19 900		☆ **E-625988**	**E-CRO-8839**	479	572.5	8	5	5	0.33	2.03	3.02	1.64	430
	650	355	355	7.5	4	5 700	12 900		☆	**E-CRO-8842**	489	601	9	6	3	0.33	2.03	3.02	1.98	393
	650	450	450	6	6	7 800	20 600		**E-CRO-8824**	**E-CRO-8838**	495	598	9	5	5	0.40	1.68	2.50	1.98	573
447.675	635.000	463.550	463.550	6.4	3.3	7 900	22 100	◎	☆ **E-M270749D/M270710/M270710DG2**		478	591	8	6.4	3.3	0.33	2.03	3.02	1.98	509
448	635	464	464	5	2.5	7 950	21 600		☆	**E-CRO-9012**	490	587	10	4	2	0.33	2.03	3.02	1.98	485
449.949	549.949	368.000	368.000	6	3	5 550	16 100	◎	☆ **E-M270449DA/M270410/M270410DG2**		474	561	9	5	2.5	0.33	2.03	3.02	1.98	284
450	595	368	368	4	4	5 300	15 100			**E-CRO-9018**	476	555	8	3	3	0.33	2.03	3.02	1.98	275
457.200	596.900	276.225	279.400	3.3	1.5	3 200	9 150	◎	**E-L770847D/L770810/L770810D**		478	567	5.5	3.3	1.5	0.47	1.43	2.12	1.40	201
	596.900	276.225	276.225	3.3	1.6	3 200	9 400	◎	**E-EE244181D/244235/244236D**		478	567	5.5	3.3	1.6	0.40	1.67	2.49	1.63	207
	596.900	276.225	279.400	3.3	1.5	3 750	10 800	◎		**E-CRO-9113**	492.5	562	8	3.3	1.5	0.47	1.43	2.12	1.40	203
	660.400	323.850	323.847	6.4	3.3	4 600	11 200	◎	**E-EE737179D/737260/737260D**		489	614.9	6.5	6.4	3.3	0.37	1.80	2.69	1.76	379
460	625	421	421	9	3	7 000	19 900			**E-CRO-9208**	486	585	8	8	2.5	0.33	2.03	3.02	1.98	387
475	620	380	380	6	2	5 000	14 200			**E-CRO-9505**	505	582.5	8	5	2	0.33	2.03	3.02	1.98	294
	660	450	450	5	3	7 250	19 800		**E-CRO-9501**	**E-CRO-9508**	510.5	611.5	10	4	2.5	0.34	1.98	2.94	1.93	465
479.425	679.450	495.300	495.300	6.4	3.3	9 300	25 900	◎	☆	**E-CRO-9617**	528	625	5	6.4	3.3	0.33	2.03	3.02	1.98	585
480	678	494	494	6	6	6 950	19 600		**E-625996**		525	623	7	5	5	0.33	2.03	3.02	1.98	563
	678	494	494	8.7	8.7	9 000	24 800			**E-CRO-9623**	523	624.5	10	8.7	8.7	0.33	2.03	3.02	1.98	580

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



(TYPE A) with inner ring spacer



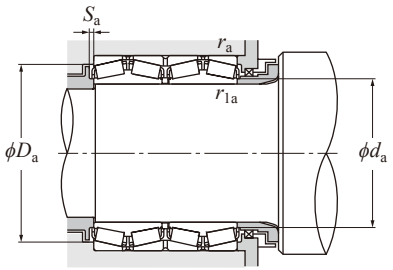
(TYPE B) without inner ring spacer

d 480-533.400 mm

Boundary dimensions mm						Basic load rating dynamic kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
480	700	390	390	6	6	7 100	16 900		**E-CRO-9609**	**E-CRO-9619**	534	647.5	8	5	5	0.40	1.68	2.50	1.98	511
	790	528.5	528.5	6.4	3.3	10 900	23 900			**E-CRO-9622**	562	720.5	13	6.4	3.3	0.33	2.03	3.02	1.98	1 071
	615.950	330.200	330.200	6.4	3.3	4 300	12 800	◎		**E-CRO-9737**	504	585	8	6.4	3.3	0.33	2.03	3.02	1.98	239
482.600	615.950	330.200	330.200	6.4	3.3	4 400	13 400	◎	☆ **E-LM272249D/LM272210/LM272210DG2**		504	585	6.5	6.4	3.3	0.33	2.03	3.02	1.98	250
	647.700	417.512	417.512	6.4	3.3	6 350	20 300	◎	☆	**E-CRO-9728**	510	609	10	6.4	3.3	0.33	2.03	3.02	1.98	398
488.950	660.400	365.125	361.950	6.4	8	5 950	16 100	◎	☆ **T-E-EE640193D/640260/640261DG2**		516	624	9	6.4	8	0.31	2.20	3.27	2.15	364
489.026	634.873	320.675	320.675	3.3	3.3	4 750	12 000	◎	**E-LM772749D/LM772710/LM772710DA**	**E-CEO-9814**	516	600	6.5	3.3	3.3	0.47	1.43	2.12	1.40	268
490	625	385	385	4	3	5 300	16 200		**E-CRO-9808**		513	588.5	5	3	2.5	0.32	2.12	3.15	2.07	285
500	640	450	450	4	4.5	6 850	21 400		**E-CRO-10031**	**E-CRO-10039**	527	590.9	10	3	4	0.26	2.55	3.80	2.45	354
	670	515	515	5	1.5	7 750	24 000		**E-CRO-10010**		540	603	3	4	1.5	0.32	2.12	3.15	2.07	518
	705	515	515	6	6	9 350	27 100		☆ **E-6259/500G2**	**E-CRO-10040**	553	649.5	7.5	5	5	0.33	2.03	3.02	1.98	632
	710	425	430	6.4	4.7	7 850	20 000		**E-CRO-10041**		541.3	636	11	6.4	4.7	0.37	1.80	2.69	1.76	528
	720	418.5	418.5	6	6	7 650	19 100		☆ **E-CRO-10045**		555	666.5	7.5	5	5	0.32	2.12	3.15	2.07	569
	730	420	420	6	6	8 250	19 900		☆ **E-CRO-10023**		554	675	7.5	5	5	0.40	1.68	2.50	1.64	606
	730	420	420	5	5	8 250	20 400		**E-CRO-10034**		549	678.5	10	4	4	0.33	2.03	3.02	1.98	600
501.650	673.100	400.050	387.350	6.4	3.3	6 400	17 900	◎	☆	**E-CRO-10046**	530	636	11	6.4	3.3	0.31	2.15	3.20	2.10	400
	711.200	520.700	520.700	6.4	3.3	9 600	27 300	◎	☆ **E-M274149D/M274110/M274110DG2**		534	663	9.5	6.4	3.3	0.33	2.03	3.02	1.98	726
508.000	762.000	463.550	463.550	6.4	6.4	8 600	21 400	◎	☆ **E-EE531201D/531300/531301XDG2**		550.5	710.9	9.5	6.4	6.4	0.38	1.77	2.64	1.73	740
509.948	654.924	377.000	379.000	6.4	1.5	5 650	17 600	◎	☆ **E-CRO-10208**	**E-CRO-10214**	540	611.5	5	6.4	1.5	0.41	1.65	2.46	1.61	320
514.350	673.100	422.275	422.275	6.4	3.3	6 600	20 500	◎	**E-LM274449D/LM274410/LM274410D**	**E-CRO-10302**	540	636	8	6.4	3.3	0.33	2.03	3.02	1.98	390
519.112	736.600	536.575	536.575	6.4	3.3	10 100	28 700	◎	☆ **E-M275349D/M275310/M275310DG2**	**E-CRO-10408**	569	677	9.5	6.4	3.3	0.33	2.03	3.02	1.98	761
520	735	535	535	5	7	10 100	28 700		☆ **E-CRO-10402**		569	676.5	11	4	6	0.33	2.03	3.02	1.98	750
530	750	480	480	6	3	9 250	25 100		☆	**E-CRO-10617**	581	692.5	9	5	2.5	0.40	1.68	2.50	1.64	692
	780	570	570	6	6	11 500	31 000			**E-CRO-10612**	584	718.5	7	5	5	0.33	2.03	3.02	1.98	949
	880	544	542	7.5	7.5	11 400	26 000		☆	**E-CRO-10615**	643	799	7	6	6	0.46	1.47	2.19	1.44	1 360
533.400	965.200	495.300	495.300	7.5	7.5	12 300	28 700	◎	☆ **E-CRO-10702**		680	854.5	7.5	6	6	0.32	2.12	3.15	2.07	1 662

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*****", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

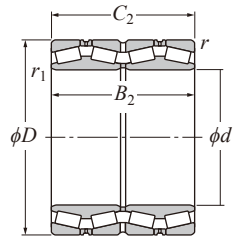
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

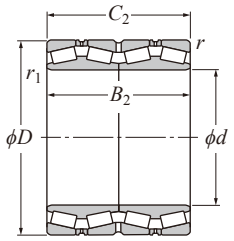
Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

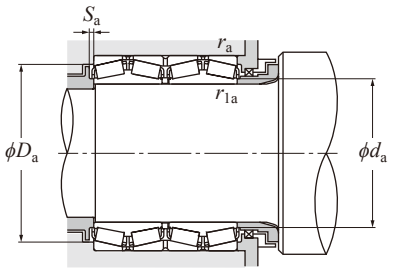


(TYPE A) with inner ring spacer



(TYPE B) without inner ring spacer

Four-Row Tapered Roller Bearings NTN



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

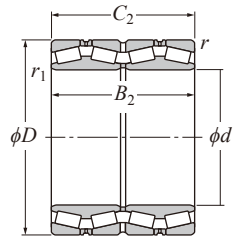
$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

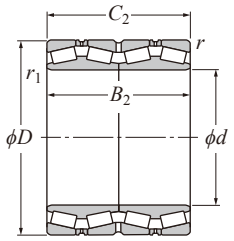
d 536.575-670 mm

Boundary dimensions mm						Basic load rating dynamic / static kN			Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
536.575	761.873	558.800	558.800	6.4	3.3	10 100	30 500	◎	☆ **E-M276449D/M276410/M276410DG2**	**E-CRO-10706**	564	711	9.5	6.4	3.3	0.33	2.03	3.02	1.98	833
555.625	698.500	349.250	349.250	6.4	3.2	4 850	14 300	◎	**E-CRO-11101**	**E-CRO-11103**	581	659	6.5	6.4	3.3	0.33	2.03	3.02	1.98	298
558.800	736.600	322.263	322.263	6.4	3.3	6 200	16 800	◎	☆	**E-CRO-11217**	603	695.5	8	6.4	3.3	0.34	1.97	2.93	1.93	378
	736.600	322.265	322.268	6.4	3.3	4 750	15 700	◎	☆ **E-EE843221D/843290/843291DG2**		585	699	8.5	6.4	3.3	0.34	1.98	2.94	1.93	383
	736.600	409.575	409.575	6.4	3.3	6 750	20 500	◎	☆ **E-LM377449D/LM377410/LM377410DG2**	**E-CRO-11216**	602	688	8	6.4	3.3	0.35	1.95	2.90	1.91	502
	736.600	450.000	450.000	5	5	8 100	25 100	◎	☆ **E-CRO-11201**		603	689.5	9	4	4	0.33	2.03	3.02	1.98	541
560	920	618	618	5	5	15 200	34 000		☆ **E-CRO-11227**	**E-CRO-11226**	661	846.5	9	4	4	0.33	2.03	3.02	1.98	1 660
570	780	515	515	6.4	3.4	10 400	29 700		☆ **E-CRO-11404**	**E-CRO-11409**	612	727.5	9	6.4	3.4	0.42	1.61	2.39	1.57	738
571.500	812.800	593.725	593.725	6.4	3.3	13 200	36 500	◎	☆ **E-M278749D/M278710/M278710DAG2**	**E-CRO-11412**	609	756	11	6.4	3.3	0.33	2.03	3.02	1.98	1 080
584.200	762.000	396.875	401.638	6.4	3.3	7 300	22 300	◎	☆ **E-LM778549D/LM778510/LM778510DG2**	**E-CRO-11703**	615	717	7	6.4	3.3	0.47	1.43	2.14	1.40	511
585.788	771.525	404.425	404.425	6.4	3.3	6 800	21 200	◎	☆	**E-CRO-11708**	620	726.5	11	6.4	3.3	0.35	1.95	2.90	1.91	498
	771.525	479.425	479.425	6.4	3.3	8 150	25 700	◎	☆ **E-CRO-11701**	**E-CRO-11706**	628	717.5	9.5	6.4	3.3	0.35	1.95	2.90	1.91	610
595.312	844.550	615.950	615.950	6.4	3.3	13 600	39 000	◎	☆ **E-CRO-11915**		654	779	8	6.4	3.3	0.33	2.03	3.02	1.98	1 140
	844.550	615.950	615.950	6.4	3.3	14 000	40 500	◎	☆ **E-M280049D/M280010/M280010DG2**	**E-CRO-11920**	633	786	11	6.4	3.3	0.33	2.03	3.02	1.98	1 160
600	800	365	365	6	6	7 150	20 300		☆	**E-CRO-12021**	654	751	10	5	5	0.33	2.03	3.02	1.98	524
	800	380	380	6	4	6 450	18 000			**E-CRO-12019**	655.5	756.5	9.5	5	3	0.33	2.03	3.02	1.98	518
	855	620	620	6	6	13 500	36 500		☆	**E-CRO-12020**	656	790	9.5	5	5	0.33	2.03	3.02	1.98	1 160
609.600	787.400	361.950	361.950	6.4	3.3	7 150	20 300	◎	☆ **E-EE649241D/649310/649311DG2**	**E-CRO-12206**	636	747	9.5	6.4	3.3	0.33	2.03	3.02	1.98	458
	863.600	660.400	660.400	6.4	3.3	15 000	42 000	◎	☆ **E-M280349D/M280310/M280310DG2**	**E-CRO-12205**	648	807	13.5	6.4	3.3	0.33	2.03	3.02	1.98	1 250
630	920	600	600	7.5	7.5	14 200	37 500			**E-CRO-12608**	684.5	847	10	6	6	0.36	1.87	2.79	1.83	1 330
	920	600	600	7.5	7.8	14 600	39 000		☆ **E-CRO-12604**		702	848.5	7.5	6	6	0.33	2.03	3.02	1.98	1 390
650	1 030	560	560	10	7.5	11 900	37 500		**E-CRO-13006**	**E-CRO-13005**	782	927	7	9	6	0.35	1.95	2.90	1.91	1 930
	1 030	560	560	10	7.5	15 700	35 000		☆ **E-CRO-13004**		756	951	8	9	6	0.31	2.21	3.29	2.16	1 829
660	1 070	642	642	7.5	7.5	17 000	43 500		☆ **E-CRO-13202**		778	964	9	6	6	0.32	2.12	3.15	2.07	1 950
660.400	812.800	365.125	365.125	6.4	3.3	6 900	23 200	◎	☆ **E-L281149D/L281110/L281110DG2**	**E-CRO-13211**	695	770.5	9	6.4	3.3	0.37	1.80	2.69	1.98	448
670	960	700	700	8	7.5	17 800	49 000		☆ **E-CRO-13408**	**E-CRO-13409**	736	889	10	7	6	0.33	2.03	3.02	1.98	1 690

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



(TYPE A) with inner ring spacer

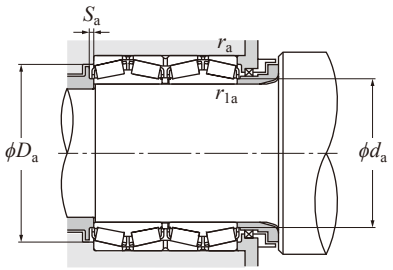


(TYPE B) without inner ring spacer

d 670-938.212 mm

Boundary dimensions mm						Basic load rating dynamic kN	static kN		Bearing number 2) 3) 4)	Bearing number 2) 3) 4)	Installation-related dimensions mm					Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	2) 3) 4)	(TYPE A) With inner ring spacer	(TYPE B) Without inner ring spacer	d_a	D_a	S_a Min.	r_{as} Max.	r_{1as} Max.	e	Y_1	Y_2	Y_0	(approx.)
670	1 090	710	710	7.5	7.5	21 200	50 000		☆ **E-CRO-13407**		782	996.5	13.5	6	6	0.29	2.32	3.45	2.26	2 690
679.450	901.700	552.450	552.450	6.4	3.3	12 400	38 000	◎	☆ **E-CRO-13607**		714	852	12	6.4	3.3	0.33	2.03	3.02	1.98	1 010
685.800	876.300	352.425	355.600	6.4	3.3	6 700	21 800	◎	☆ **E-EE655271D/655345/655346DG2**	**E-CRO-13708**	738	824	8	6.4	3.3	0.42	1.61	2.40	1.58	539
710	900	410	410	4	2	8 550	27 800		☆ **E-CRO-14230**	**E-CRO-14226**	760	855.5	10	3	2	0.33	2.07	3.09	2.03	648
711.200	914.400	317.500	317.500	6.4	16	5 900	17 900	◎	☆ **E-EE755280D/755360/755361DG2**	**E-CRO-14219**	762	873	8	6.4	16	0.38	1.77	2.64	1.73	527
	914.400	355.600	355.600	6.4	6.4	7 400	21 700	◎	☆ **E-CRO-14207**		762	864	11	6.4	6.4	0.40	1.68	2.50	1.64	601
717.550	946.150	565.150	565.150	6.4	3.3	12 900	41 500	◎	☆ **E-LM282847D/LM282810/LM282810DG2**	**E-CRO-14403**	770	886	10	6.4	3.3	0.33	2.03	3.02	1.98	1 112
730.250	1 035.050	755.650	755.650	6.4	3.3	20 100	59 500	◎	☆ **E-M283449D/M283410/M283410DG2**	**E-CRO-14601**	804	961	13	6.4	3.3	0.33	2.03	3.02	1.98	2 210
749.300	990.600	605.000	605.000	6.4	3.3	14 000	45 500	◎	☆ **E-LM283649D/LM283610/LM283610DG2**	**E-CRO-15006**	786	936	10.5	6.4	3.3	0.33	2.03	3.02	1.98	1 250
	1 066.800	723.900	736.600	12.7	6.4	20 000	58 500	◎	☆ **E-EE325296DGW/325420/325421XDG2**		806.5	996	10	12.7	6.4	0.33	2.05	3.05	2.01	2 187
762.000	1 066.800	723.900	736.600	12.7	8	19 500	58 500	◎	☆ **E-M284148D/M284111/M284110DG2**		819	996	3.5	12.7	8	0.33	2.03	3.02	1.98	2 112
	1 079.500	787.400	787.400	12.7	4.8	21 100	65 000	◎	☆ **E-M284249D/M284210/M284210DG2**	**E-CRO-15203**	835	1 005	13	12.7	4.8	0.33	2.03	3.02	1.98	2 480
790	1 120	780	780	7.5	3	19 600	66 500		☆	**E-CRO-15801**	882	1 041.5	12	6	2	0.32	2.12	3.15	2.07	2 580
825.500	1 168.400	844.550	844.550	12.7	4.8	24 700	76 500	◎	☆ **E-M285848D/M285810/M285810DG2**	**E-CRO-16502**	879	1 085	13	12.7	4.8	0.33	2.03	3.02	1.98	3 010
863.600	1 130.300	669.925	669.925	12.7	4.8	17 500	59 500	◎	☆ **E-LM286249D/LM286210/LM286210DG2**	**E-CRO-17302**	928	1 056	11	12.7	4.8	0.33	2.03	3.02	1.98	1 950
	1 169.873	845.000	845.000	12.7	4.8	23 400	76 500	◎	☆	**E-CRO-17304**	926	1 081.5	11	12.7	4.8	0.33	2.03	3.02	1.98	2 718
	1 219.200	876.300	889.000	12.7	4.8	26 700	83 000	◎	☆ **E-EE547341D/547480/547481DG2**	**E-CRO-17301**	946	1 123.5	6.5	12.7	4.8	0.33	2.03	3.02	1.98	3 640
915	1 220	900	900	9.5	5	25 500	86 000		☆	**E-CRO-18301**	977	1 189.5	8	8	4	0.35	1.96	2.91	1.91	3 030
938.212	1 270.000	825.500	825.500	12.7	4.8	25 000	80 000	◎	☆ **E-LM287649D/LM287610/LM287610DG2**	**E-CRO-18802**	1 015	1 183	10	12.7	4.8	0.33	2.03	3.02	1.98	4 100

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked "◎" designate inch series bearings. "**CRO**" series bearings are also inch sized.
3) When adopting bearings with bearing numbers marked with "*", please consult **NTN** Engineering.
4) Bearing numbers marked "☆" designate bearings with hollow rollers and pin-type cages.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

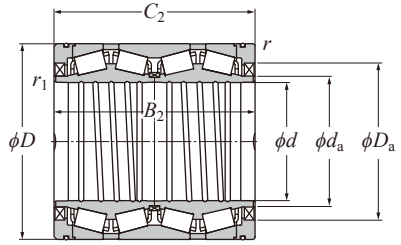
$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

For values of e, Y_1, Y_2 and Y_0 see the table below.

· Bearings are designed with oil seals on both sides of the bearing, which is the same as the four-row tapered roller bearings.
· Please consult with **NTN** Engineering for fitting and bearing internal clearance.



d 200-310 mm

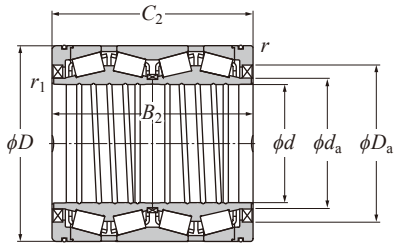
Boundary dimensions mm						Basic load rating kN		Bearing number [2]	Installation-related dimensions mm		Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	dynamic C_r	static C_{0r}		d_a	D_a	e	Y_1	Y_2	Y_0	(approx.)
200	282	206	206	2.5	2.5	1 050	2 450	**E-CRO-4022LL**	220	250	0.33	2.03	3.02	1.98	39
216.103	330.200	263.525	269.875	3.3	1.5	1 960	4 000	◎ **E-CRO-4303LL**	235	265	0.55	1.23	1.82	1.20	78.2
220	295	315	315	2.5	1	1 410	3 850	**E-CRO-4424LL**	235	270	0.37	1.80	2.69	1.76	57.5
	310	280	280	2.5	1	1 760	4 100	**E-CRO-4427LL**	235	265	0.33	2.03	3.02	1.98	63.5
	320	290	290	3	2.7	1 970	4 850	**E-CRO-4436LL**	240	275	0.39	1.74	2.59	1.70	77
240	338	248	248	3	3	1 760	4 200	**E-CRO-4811LL**	260	299.3	0.43	1.57	2.34	1.53	67.8
	338	340	340	2.5	1	2 270	6 000	**E-CRO-4817LL**	256	290	0.40	1.68	2.50	1.64	94.4
245	345	310	310	3	1	2 300	5 950	**E-CRO-4906LL**	263	290	0.40	1.68	2.50	1.64	90.5
250	365	270	270	3	2.5	2 130	4 750	**E-CRO-5015LL**	272.5	312.5	0.40	1.68	2.50	1.64	90.2
254.000	358.775	269.875	269.875	3.3	3.3	2 050	4 750	◎ **E-CRO-5116LL**	272.5	312.5	0.55	1.24	1.84	1.21	81.7
	358.775	269.875	269.875	3.3	1.5	2 160	4 900	◎ **E-CRO-5117LL**	273	305	0.40	1.68	2.50	1.64	83
260	365	339	339	4	1	2 490	5 950	**E-CRO-5224LL**	276	316	0.40	1.68	2.50	1.64	103
260.350	422.275	314.325	317.500	3.3	4.8	2 980	5 950	◎ **E-CRO-5227LL**	290	330	0.55	1.24	1.84	1.21	177
279.400	393.700	269.875	269.875	6.4	1.5	2 210	4 950	◎ **E-CRO-5652LL**	298	338	0.47	1.43	2.12	1.40	96.4
280	380	290	290	3	1	2 280	5 750	**E-CRO-5660LL**	300	330	0.33	2.03	3.02	1.98	91.5
	395	290	290	4	1.5	2 350	5 450	**E-CRO-5665LL**	304	335	0.33	2.07	3.09	2.03	106
	395	340	340	2.5	3.2	2 870	7 150	**E-CRO-5664LL**	300	340	0.40	1.68	2.50	1.64	126
	410	268	268	6.4	2.2	2 380	5 000	**E-CRO-5639LL**	304	367	0.33	2.07	3.09	2.03	116
285	400	340	340	4	1	2 840	7 650	**E-CRO-5709LL**	310	340	0.40	1.68	2.50	1.64	134
290	400	346	346	4	3.1	2 840	7 650	**E-CRO-5814LL**	310	340	0.40	1.68	2.50	1.64	129
300	400	254	254	4	5	2 130	5 300	**E-CRO-6038LL**	325	360	0.28	2.43	3.61	2.37	84.6
	420	310	310	4	3.2	2 780	6 850	**E-CRO-6042LL**	325	360	0.40	1.68	2.50	1.64	128
	430	295	305	5	1	2 390	5 550	**E-CRO-6031LL**	330	370	0.33	2.03	3.02	1.98	136
304.648	438.048	280.990	279.400	3.7	2.8	2 490	5 450	◎ **E-CRO-6143LL**	330	382.5	0.47	1.43	2.12	1.40	136
310	430	310	310	4	1.5	2 600	6 600	**E-CRO-6220LL**	335.5	375.5	0.40	1.68	2.50	1.64	131
	430	350	350	2.5	3.2	3 150	7 950	**E-CRO-6222LL**	330	370	0.40	1.68	2.50	1.64	147

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked " ◎ " designate inch series bearings.

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2, and Y_0, see the table below.



d 320-711.200 mm

Boundary dimensions mm						Basic load rating kN		Bearing number [2]	Installation-related dimensions mm		Constant	Axial load factors			Mass kg
d	D	B_2	C_2	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	dynamic C_r	static C_{0r}		d_a	D_a	e	Y_1	Y_2	Y_0	(approx.)
320	480	360	360	4	2	4 000	8 850	**E-CRO-6426LL**	350	390	0.47	1.43	2.12	1.40	228
	457.098	254.000	254.000	3.3	1.5	2 290	5 500	◎ **E-CRO-6930LL**	365	405	0.47	1.43	2.12	1.40	105
343.052	457.098	254.000	254.000	3.3	0.6	2 110	5 050	◎ **E-CRO-6920LL**	368.3	406.4	0.33	2.03	3.02	1.98	107
	457.098	299.000	299.000	3.3	1.5	2 740	7 100	◎ **E-CRO-6936LL**	364	417	0.43	1.57	2.34	1.53	130
355	490	316	316	4	2.3	2 790	6 600	**E-CRO-7109LL**	375	420	0.33	2.03	3.02	1.98	159
355.600	482.600	265.112	269.876	3.3	1.6	2 120	5 450	◎ **E-CRO-7110LL**	375	420	0.47	1.43	2.14	1.40	140
360	480	375	375	3	2.8	3 750	10 200	**E-CRO-7226LL**	380	443.5	0.33	2.03	3.02	1.98	180
410	546	400	400	5	1.5	4 250	11 900	**E-CRO-8204LL**	436	470	0.33	2.03	3.02	1.98	253
420	620	395	320	6	6	5 050	11 800	**E-CRO-8412LL**	470	530	0.37	1.80	2.69	1.76	384
440	590	480	480	6	1.5	5 050	13 900	**E-CRO-8830LL**	466	506	0.33	2.03	3.02	1.98	358
	620	454	454	6	1.5	6 450	16 600	**E-CRO-8832LL**	470	520	0.33	2.03	3.02	1.98	426
457.200	596.900	276.225	279.400	3.3	1.5	2 810	6 800	◎ **E-CRO-9107LL**	482.6	520.7	0.47	1.43	2.12	1.40	190.5
479.425	679.450	495.300	495.300	6.4	0.6	7 150	18 400	◎ **E-CRO-9610LL**	514	554	0.33	2.03	3.02	1.98	569
482.600	615.950	330.200	330.200	6.4	3.3	3 550	9 650	◎ **E-CRO-9725LL**	510	550	0.33	2.03	3.02	1.98	225
530	715	590	590	6	4	9 100	26 900	**E-CRO-10607LL**	560	610	0.32	2.12	3.15	2.07	700
595.312	844.550	615.950	615.950	6.4	3	11 800	32 000	◎ **E-CRO-11919LL**	640	690	0.33	2.03	3.02	1.98	1 130
711.200	914.400	387.350	387.350	6.4	3.3	7 000	19 600	◎ **E-CRO-14214LL**	750	855	0.38	1.78	2.65	1.74	616
	914.400	410.000	410.000	5	2.5	7 100	20 700	◎ **E-CRO-14209LL**	760	850	0.38	1.77	2.64	1.73	676

1) Smallest allowable dimension for chamfer dimension r or r_1.
2) Bearing numbers marked " ◎ " designate inch series bearings.

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load
$P_{0r} = F_r + Y_0 F_a$
For values of e, Y_1, Y_2, and Y_0, see the table below.

Fixed side SL-type cylindrical roller bearing (open type)

Floating side SL-type cylindrical roller bearing (open type)

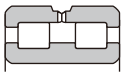
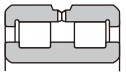
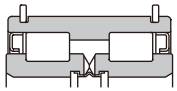
SL-type cylindrical roller bearing for sheaves (sealed type)

1. Types, design features, and characteristics

SL-type cylindrical roller bearings are double row full complement cylindrical roller bearings that have a thin cross-section and can withstand extremely large radial loads and impact loads. These bearings are suitable for a wide range of slow-moderate speed, heavily loaded applications such as construction machinery, vehicles, steel machinery, and lifting machinery.

These bearings can be produced both with and without seals. **Table 1** shows the characteristics of this bearing type.

Table 1 SL-type cylindrical roller bearing types and characteristics

Type		Characteristics
Open type	 SL01 type  SL02 type	• The SL01 type is used for fixed side bearings and the SL02 is used for float side bearings. • The outer ring is divided in the circumferential direction by a special method and reconnected after rollers are embedded. **The bearing side surface needs to be firmly fixed in the axial direction by the shoulders of shafts and housings**. • The outer ring has oil grooves and oil holes. • The SL01 type can receive an axial load in both directions. • Dimensions D_a and d_a are applied for the shoulder dimension of shafts and housings. However, when a moment load or a large axial load is to be used, dimensions J and K are recommended.
Sealed type	 SL04 type	• The SL04 type is only designed as the fixed side bearing. • The inner ring is divided in the circumferential direction by a special method and reconnected after rollers are embedded. **The bearing side surface needs to be firmly fixed in the axial direction by the shoulders of shafts and housings.** • The inner ring has oil grooves and oil holes. • A radial load and an axial load in both directions can be applied to the bearing. • The bearings are shielded, filled with grease, and have snap rings in the outer ring. These bearings allow easy design into the application. The bearings are mainly used for sheaves. • Surface coating treatment is applied to prevent rust.

Note: For SL-type cylindrical roller bearings, three-row, four-row, and five-row bearings are also available besides the double-row. Please contact **NTN** Engineering.

2. Dimensional and rotational accuracy

SL-type cylindrical roller bearings are made according to JIS Class 0 [refer to **Table 3.3** (pages A-18 and A-19) in section "3. Bearing tolerances"]. The outer ring accuracy of the SL01 type and the SL02 type is before division. Regarding the SL04 type, the inner ring accuracy is before surface treatment and division, and the outer ring accuracy is before surface treatment.

3. Radial internal clearance

Table 2 shows the radial internal clearance values. It should be noted that the values differ from standard cylindrical roller bearings.

Table 2 Radial internal clearance Unit: μm

Nominal bore diameter d mm		CN (normal)		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.
80	120	35	105	80	150	105	175
120	180	60	150	110	200	150	240
180	250	90	190	155	255	205	305
250	315	110	225	195	310	255	370
315	400	140	265	245	370	320	445
400	500	180	320	300	440	395	535

4. Selection of recommended fits and radial internal clearance

Table 3 lists the recommended fit for outer ring rotation such as sheaves and wheels, **Table 4** lists the relation between the fitting and the radial internal clearance.

It is necessary to equally apply load on the entire surface of the raceway end on the bearing side face at the time of assembly and removal.

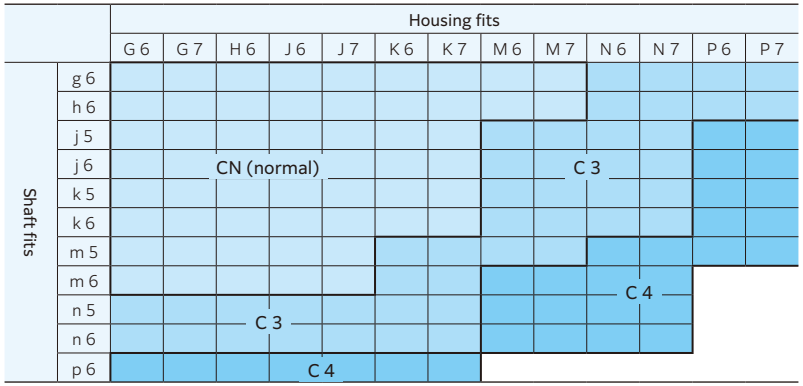
Table 3 Recommended fits

Conditions		Shaft tolerance class	Housing tolerance class
Outer ring Outer ring rotational load	Heavy load with thin wall housing	g6 or h6	P7
	Ordinary or heavy load		N7 [1]
	Light or fluctuating load		M7

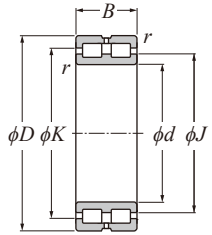
1) N7 must be used for sheaves (to prevent snap ring from coming off).

Refer to **Table 4.2** (page A-33) in section "4. Bearing fits" for the inner ring rotational load.

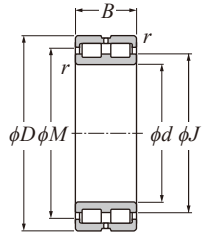
Table 4 Relationship between fits and radial internal clearance



Note: Use CN (normal) clearance when the shaft fit is g6, the housing fit is N7 (N6), and the speed is low (for sheaves, etc.).



SL01-48 type SL01-49 type (fixed side)

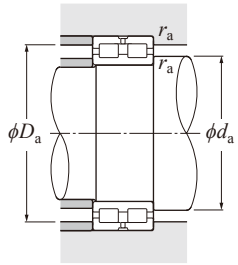


SL02-48 type SL02-49 type (floating side)

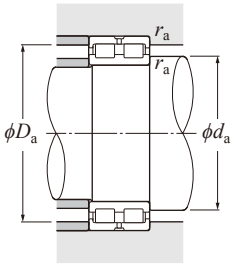
d 100-260 mm

Boundary dimensions mm				Basic load rating dynamic kN	static kN	Allowable speed min^{-1} Grease lubrication	Allowable speed min^{-1} Oil lubrication	Bearing number Fixed side	Bearing number Floating side	Dimensions mm				Installation-related dimensions mm			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [1]	C_r	C_{0r}					J	K	M	e [2]	d_a [3] Min.	D_a [3] Max.	r_{as} Max.	Fixed side	Floating side
100	140	40	1.1	194	400	1 000	2 000	**SL01-4920**	**SL02-4920**	116	125	126.5	2	106.5	133.5	1	1.95	1.9
110	150	40	1.1	202	430	910	1 800	**SL01-4922**	**SL02-4922**	125	134	135.5	2	116.5	143.5	1	2.15	2.1
120	165	45	1.1	226	480	830	1 700	**SL01-4924**	**SL02-4924**	138.5	148.5	150.5	3	126.5	158.5	1	2.95	2.85
130	180	50	1.5	262	555	770	1 500	**SL01-4926**	**SL02-4926**	149	160	162	4	138	172	1.5	3.95	3.8
140	190	50	1.5	272	595	710	1 400	**SL01-4928**	**SL02-4928**	159.5	170	172.5	4	148	182	1.5	4.2	4.1
150	190	40	1.1	235	575	670	1 300	**SL01-4830**	**SL02-4830**	165.5	173.5	175.5	2	156.5	183.5	1	2.9	2.8
	210	60	2	410	865	670	1 300	**SL01-4930**	**SL02-4930**	171.5	186	189.5	4	159	201	2	6.65	6.45
160	200	40	1.1	241	605	630	1 300	**SL01-4832**	**SL02-4832**	173.5	182.5	184	2	166.5	193.5	1	3.05	2.9
	220	60	2	425	935	630	1 300	**SL01-4932**	**SL02-4932**	185	199	203	4	169	211	2	7	6.8
170	215	45	1.1	265	650	590	1 200	**SL01-4834**	**SL02-4834**	186.5	196.5	198	3	176.5	208.5	1	4.1	3.95
	230	60	2	435	980	590	1 200	**SL01-4934**	**SL02-4934**	194	208	211.5	4	179	221	2	7.35	7.1
180	225	45	1.1	275	695	560	1 100	**SL01-4836**	**SL02-4836**	199	209	211	3	186.5	218.5	1	4.3	4.15
	250	69	2	550	1 230	560	1 100	**SL01-4936**	**SL02-4936**	206	222	225.5	4	189	241	2	10.7	10.5
190	240	50	1.5	315	785	530	1 100	**SL01-4838**	**SL02-4838**	208.5	219.5	221.5	4	198	232	1.5	5.65	5.45
	260	69	2	565	1 290	530	1 100	**SL01-4938**	**SL02-4938**	216.5	232.5	235.5	4	199	251	2	11.2	10.9
200	250	50	1.5	320	825	500	1 000	**SL01-4840**	**SL02-4840**	219	230	232	4	208	242	1.5	5.9	5.7
	280	80	2.1	665	1 500	500	1 000	**SL01-4940**	**SL02-4940**	232	250	253.5	5	211	269	2	15.7	15.3
220	270	50	1.5	340	905	450	910	**SL01-4844**	**SL02-4844**	240	251	253	4	228	262	1.5	6.4	6.2
	300	80	2.1	695	1 620	450	910	**SL01-4944**	**SL02-4944**	249.5	267.5	271	5	231	289	2	17.1	16.6
240	300	60	2	510	1 330	420	830	**SL01-4848**	**SL02-4848**	261	275	276.5	4	249	291	2	10.2	9.9
	320	80	2.1	730	1 770	420	830	**SL01-4948**	**SL02-4948**	272.5	290.5	294	5	251	309	2	18.4	17.9
260	320	60	2	535	1 450	380	770	**SL01-4852**	**SL02-4852**	283	297	300	4	269	311	2	11	10.6
	360	100	2.1	1 070	2 520	380	770	**SL01-4952**	**SL02-4952**	297	320	324.5	6	271	349	2	32	31.2

1) Smallest allowable dimension for chamfer dimension r.
2) Effective movement amount in axial direction.

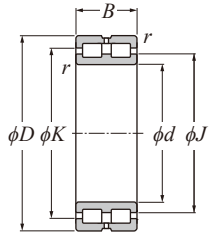


Fixed side

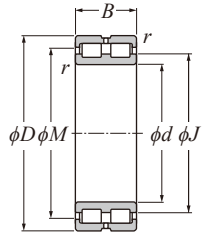


Floating side

3) If the bearing on the fixed side supports an eccentric axial load or a large axial load, shoulder dimensions J and K are recommended.

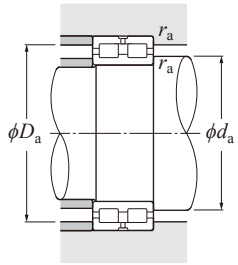


SL01-48 type SL01-49 type
(fixed side)

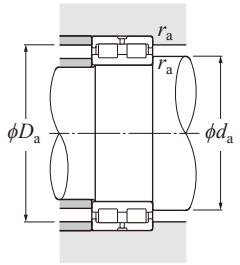


SL02-48 type SL02-49 type
(floating side)

SL Type Cylindrical Roller Bearings NTN



Fixed side



Floating side

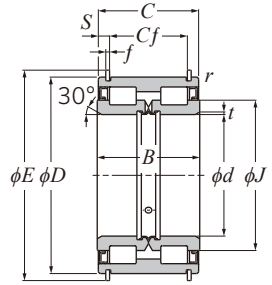
d 280-440 mm

Boundary dimensions mm				Basic load rating kN dynamic	static	Allowable speed min^{-1} Grease lubrication	Oil lubrication	Bearing number Fixed side	Floating side	Dimensions mm				Installation-related dimensions mm			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [1]	C_r	C_{0r}					J	K	M	e [2]	d_a [3] Min.	D_a [3] Max.	r_{as} Max.	Fixed side	Floating side
280	350	69	2	685	1 860	360	710	**SL01-4856**	**SL02-4856**	308	324	327	4	289	341	2	16	15.6
	380	100	2.1	1 110	2 710	360	710	**SL01-4956**	**SL02-4956**	319	342	346	6	291	369	2	33.9	33.1
300	380	80	2.1	805	2 160	330	670	**SL01-4860**	**SL02-4860**	330	348	351	6	311	369	2	23	22.2
	420	118	3	1 580	3 800	330	670	**SL01-4960**	**SL02-4960**	344	371	377	6	313	407	2.5	53	51.9
320	400	80	2.1	835	2 310	310	630	**SL01-4864**	**SL02-4864**	353	371	374	6	331	389	2	24.3	23.5
	440	118	3	1 650	4 100	310	630	**SL01-4964**	**SL02-4964**	371	398	404	6	333	427	2.5	56	54.9
340	420	80	2.1	855	2 430	290	590	**SL01-4868**	**SL02-4868**	370	388	391	6	351	409	2	25.6	24.8
	460	118	3	1 690	4 300	290	590	**SL01-4968**	**SL02-4968**	388	416	421	6	353	447	2.5	59	57.8
360	440	80	2.1	885	2 580	280	560	**SL01-4872**	**SL02-4872**	393	411	414	6	371	429	2	27	26
	480	118	3	1 730	4 500	280	560	**SL01-4972**	**SL02-4972**	406	434	439	6	373	467	2.5	62	60.8
380	480	100	2.1	1 290	3 600	260	530	**SL01-4876**	**SL02-4876**	422	444	449	6	391	469	2	45.3	44
	520	140	4	2 300	5 900	260	530	**SL01-4976**	**SL02-4976**	437	469	475	7	396	504	3	92.3	90.5
400	540	140	4	2 410	6 200	250	500	**SL01-4980**	**SL02-4980**	450	484	490	7	416	524	3	96.4	94.6
420	560	140	4	2 470	6 500	240	480	**SL01-4984**	**SL02-4984**	472	505	512	7	436	544	3	101	98.6
440	600	160	4	3 000	7 850	230	450	**SL01-4988**	**SL02-4988**	503	540	546	7	456	584	3	139	137

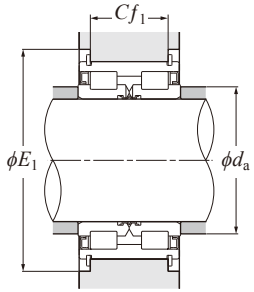
1) Smallest allowable dimension for chamfer dimension r.
2) Effective movement amount in axial direction.

3) If the bearing on the fixed side supports an eccentric axial load or a large axial load, shoulder dimensions J and K are recommended.

For Sheaves



SL Type Cylindrical Roller Bearings
NTN



d 100-440 mm

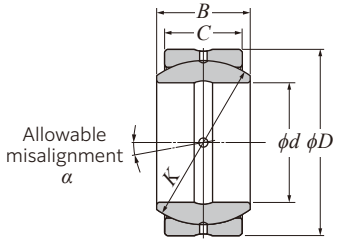
Boundary dimensions mm						Basic load rating kN		Allowable speed min⁻¹	Bearing number	Dimensions mm					Installation-related dimensions mm			Mass kg
						dynamic	static											
d	*D*	*B*	*C*	*t*	$r_{s\,min}$ [1]	C_r	C_{0r}	Grease lubrication		*J*	*E* Max.	*f*	*Cf*	*S*	d_a Min.	E_1	Cf_1 [2]	(approx.)
100	150	67	66	1.5	0.6	330	580	1 000	**SL04-5020NR**	118.5	156.3	2.5	54	6	106	180	54	4.03
110	170	80	79	1.8	1	385	695	910	**SL04-5022NR**	131.5	176.4	2.5	65	7	116.5	200	65	7
120	180	80	79	1.8	1	400	750	830	**SL04-5024NR**	141.5	188.4	3	65	7	126.5	210	65	7.5
130	200	95	94	1.8	1	535	1 000	770	**SL04-5026NR**	158	208.4	3	77	8.5	136.5	230	77	11.4
140	210	95	94	1.8	1	600	1 120	710	**SL04-5028NR**	167	218.5	3	77	8.5	146.5	245	77	12.1
150	225	100	99	2	1	690	1 290	670	**SL04-5030NR**	178.3	233.5	3	81	9	157	260	81	14.6
160	240	109	108	2	1.1	720	1 390	630	**SL04-5032NR**	191	248.5	3	89	9.5	167	275	89	18.2
170	260	122	121	2	1.1	925	1 790	590	**SL04-5034NR**	202.7	270.5	4	99	11	177	300	99	24.6
180	280	136	135	2	1.1	1 090	2 140	560	**SL04-5036NR**	220	290.5	4	110	12.5	187	320	110	32.3
190	290	136	135	2	1.1	1 120	2 230	530	**SL04-5038NR**	226	300.5	4	110	12.5	197	330	110	33.7
200	310	150	149	2	1.1	1 310	2 650	500	**SL04-5040NR**	245.5	320.5	4	120	14.5	207	350	120	43.5
220	340	160	159	2.5	1.1	1 640	3 300	450	**SL04-5044NR**	260	357	6	130	14.5	228.5	380	130	55.5
240	360	160	159	2.5	1.1	1 710	3 550	420	**SL04-5048NR**	280.5	377	6	130	14.5	248.5	400	130	59.5
260	400	190	189	3	1.5	1 950	4 200	380	**SL04-5052NR**	310	417	7	154	17.5	270	445	154	90.7
280	420	190	189	3	1.5	2 170	4 700	360	**SL04-5056NR**	325	437	7	154	17.5	290	465	154	96.2
300	460	218	216	3	1.5	2 670	5 850	330	**SL04-5060NR**	363	481	8	176	20	310	510	176	137
320	480	218	216	3	1.5	2 720	6 100	310	**SL04-5064NR**	376	501	8	176	20	330	530	176	144
340	520	243	241	3.5	2	3 650	8 000	290	**SL04-5068NR**	406	545	8	194	23.5	352	580	194	194
360	540	243	241	3.5	2	3 750	8 300	280	**SL04-5072NR**	421	565	10	194	23.5	372	600	194	203
380	560	243	241	3.5	2	3 800	8 750	260	**SL04-5076NR**	442	585	10	194	23.5	392	620	194	212
400	600	272	270	3.5	2	4 250	9 950	250	**SL04-5080NR**	470	627	12	210	30	412	675	210	281
420	620	272	270	3.5	2	4 350	10 300	240	**SL04-5084NR**	486	647	12	210	30	432	695	210	292
440	650	280	278	4.5	3	4 500	11 000	230	**SL04-5088NR**	518	677	12	210	34	456	725	210	331

1) Smallest allowable dimension for chamfer dimension *r*.
2) Tolerance of dimension *Cf*1 SL04-5020NR to SL04-5034NR: −0.1 to −0.5 mm
SL04-5036NR to SL04-5088NR: −0.1 to −0.7 mm

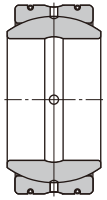
Note: 1. The bearings have grease filled in. 2. Surface treatment is applied to bearings to prevent rust.
3. The bearings are non-contact shielded-type bearings, but contact sealed-type bearings are also available based on your request.

Lubrication type

- These are self-aligning sliding bearings: the sliding parts form a spherical surface. The bearings also can support radial loads and axial loads in either direction.
- A lubricant (oil or grease) should be used since the sliding parts are steel on steel.
- These bearings are suitable for swinging and aligning movements, and used in joint-movement parts for industrial and construction machines.

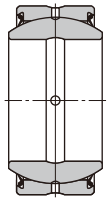


Drawing 1
Outer ring: Split at one position

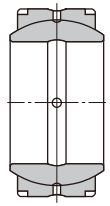


Drawing 2
Outer ring: Split into halves

Spherical Plain Bearings
NTN



Drawing 3
Outer ring: Split at one position
With plastic sealed



Drawing 4
Outer ring: Split into halves
Snap ring (shrink fitting) type
($D \geq 500$ mm)

d 110-420 mm

Boundary dimensions mm					Allowable misalignment °	Basic load rating kN dynamic	Basic load rating kN static	Bearing number	Drawing No.	Mass kg	Remarks
d	*D*	*B*	*C*	*K*	*α*	C_d	C_s			(approx.)	
110	180	85	70	160	6	1 100	6 600	**W2222**	1	9.42	
	180	100	75	160	10	1 180	7 050	**W2225**	3	10.3	
180	260	105	60	225	12	1 110	6 670	**W3617**	1	16.1	Inner ring spherical surface with annular oil groove
200	290	130	120	250	2	2 550	15 300	**W4029**	2	33	Inner ring spherical surface with annular oil groove
260	430	215	195	375	3	6 350	38 000	**W52A07**	2	140	Inner ring spherical surface with annular oil groove
280	350	69	69	320	—	2 170	13 000	**W5605**	2	18.7	Inner ring without oil inlet and oil groove
	430	220	140	375	10	4 900	29 600	**W5613**	2	106	Inner ring spherical surface with annular oil groove
300	440	190	150	380	6	5 000	30 500	**W6022**	2	101	Inner ring spherical surface with annular oil groove
320	440	160	120	380	6	4 200	25 300	**W6415**	2	72	Inner ring spherical surface with annular oil groove
380	480	100	100	430	—	4 200	25 300	**W7601**	2	52.9	Inner ring without oil inlet and oil groove
420	540	120	120	480	—	5 650	34 000	**W8407**	4	85	Inner ring without oil inlet and oil groove

Appendix Table

Appendix Table Contents

NTN

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-1

Unit: mm

Single row radial ball bearings	67							68 78								
Double row radial ball bearings																
Cylindrical roller bearings									N28	N38	NN48					
Needle roller bearings											NA48					
Spherical roller bearings																

Nominal bearing bore diameter d		Diameter series 7							Diameter series 8								
		Nominal bearing outside diameter D	Dimension series						Nominal bearing outside diameter D	Dimension series							
			17	27	37	47	17-47			08	18	28	38	48	58	68	08	18-68
Number	Dimension		Nominal width B				Chamfer dimension r's min			Nominal width B							Chamfer dimension r's min	
—	0.6	2	0.8	—	—	—	0.05	2.5	—	1	—	1.4	—	—	—	—	0.05	
1	1	2.5	1	—	—	—	0.05	3	—	1	—	1.5	—	—	—	—	0.05	
—	1.5	3	1	—	1.8	—	0.05	4	—	1.2	—	2	—	—	—	—	0.05	
2	2	4	1.2	—	2	—	0.05	5	—	1.5	—	2.3	—	—	—	—	0.08	
—	2.5	5	1.5	1.8	2.3	—	0.08	6	—	1.8	—	2.6	—	—	—	—	0.08	
3	3	6	2	2.5	3	—	0.08	7	—	2	—	3	—	—	—	—	0.1	
4	4	7	2	2.5	3	—	0.08	9	—	2.5	3.5	4	—	—	—	—	0.1	
5	5	8	2	2.5	3	—	0.08	11	—	3	4	5	—	—	—	—	0.15	
6	6	10	2.5	3	3.5	—	0.1	13	—	3.5	5	6	—	—	—	—	0.15	
7	7	11	2.5	3	3.5	—	0.1	14	—	3.5	5	6	—	—	—	—	0.15	
8	8	12	2.5	—	3.5	—	0.1	16	—	4	5	6	8	—	—	—	0.2	
9	9	14	3	—	4.5	—	0.1	17	—	4	5	6	8	—	—	—	0.2	
00	10	15	3	—	4.5	—	0.1	19	—	5	6	7	9	—	—	—	0.3	
01	12	18	4	—	5	—	0.2	21	—	5	6	7	9	—	—	—	0.3	
02	15	21	4	—	5	—	0.2	24	—	5	6	7	9	—	—	—	0.3	
03	17	23	4	—	5	—	0.2	26	—	5	6	7	9	—	—	—	0.3	
04	20	27	4	—	5	7	0.2	32	4	7	8	10	12	16	22	0.3	0.3	
/22	22	30	4	—	5	7	0.2	34	4	7	—	10	—	16	22	0.3	0.3	
05	25	32	4	—	5	7	0.2	37	4	7	8	10	12	16	22	0.3	0.3	
/28	28	35	4	—	5	7	0.2	40	4	7	—	10	—	16	22	0.3	0.3	
06	30	37	4	—	5	7	0.2	42	4	7	8	10	12	16	22	0.3	0.3	
/32	32	40	4	—	6	8	0.2	44	4	7	—	10	—	16	22	0.3	0.3	
07	35	44	5	—	7	9	0.3	47	4	7	8	10	12	16	22	0.3	0.3	
08	40	50	6	—	8	10	0.3	52	4	7	8	10	12	16	22	0.3	0.3	
09	45	55	6	—	8	10	0.3	58	4	7	8	10	13	18	23	0.3	0.3	
10	50	62	6	—	10	12	0.3	65	5	7	10	12	15	20	27	0.3	0.3	
11	55	68	7	—	10	13	0.3	72	7	9	11	13	17	23	30	0.3	0.3	
12	60	75	7	—	12	15	0.3	78	7	10	12	14	18	24	32	0.3	0.3	
13	65	80	7	—	12	15	0.3	85	7	10	13	15	20	27	36	0.3	0.6	
14	70	85	7	—	12	15	0.3	90	8	10	13	15	20	27	36	0.3	0.6	
15	75	90	7	—	12	15	0.3	95	8	10	13	15	20	27	36	0.3	0.6	
16	80	95	7	—	12	15	0.3	100	8	10	13	15	20	27	36	0.3	0.6	
17	85	105	10	—	15	—	0.6	110	9	13	16	19	25	34	45	0.3	1	
18	90	110	10	—	15	—	0.6	115	9	13	16	19	25	34	45	0.3	1	
19	95	115	10	—	15	—	0.6	120	9	13	16	19	25	34	45	0.3	1	
20	100	120	10	—	15	—	0.6	125	9	13	16	19	25	34	45	0.3	1	
21	105	125	10	—	15	—	0.6	130	9	13	16	19	25	34	45	0.3	1	
22	110	135	13	—	19	—	1	140	10	16	19	23	30	40	54	0.6	1	
24	120	145	13	—	19	—	1	150	10	16	19	23	30	40	54	0.6	1	
26	130	160	16	—	23	—	1	165	11	18	22	26	35	46	63	0.6	1.1	
28	140	170	16	—	23	—	1	175	11	18	22	26	35	46	63	0.6	1.1	
30	150	180	16	—	23	—	1	190	13	20	24	30	40	54	71	0.6	1.1	
32	160	190	16	—	23	—	1	200	13	20	24	30	40	54	71	0.6	1.1	
34	170	200	16	—	23	—	1	215	14	22	27	34	45	60	80	0.6	1.1	

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-2

Unit: mm

Single row radial ball bearings		69 79										160	60 70							
Double row radial ball bearings																				
Cylindrical roller bearings		N19	N29	NN39	NN49								N10	N20	NN30	NN40				
Needle roller bearings					NA49	NA59	NA69													
Spherical roller bearings				239	249										230	240				

Nominal bearing bore diameter d		Diameter series 9										Diameter series 0								
		Nominal bearing outside diameter D	Dimension series									Nominal bearing outside diameter D	Dimension series							
			09	19	29	39	49	59	69	09	19-39	49-69		00	10	20	30	40	50	60	00	10-60
Number	Dimension		Nominal width B							Chamfer dimension r's min				Nominal width B							Chamfer dimension r's min	
—	0.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	1	4	—	1.6	—	2.3	—	—	—	—	0.1	—	—	—	—	—	—	—	—	—	—	—
—	1.5	5	—	2	—	2.6	—	—	—	—	0.15	—	6	—	2.5	—	3	—	—	—	—	0.15
2	2	6	—	2.3	—	3	—	—	—	—	0.15	—	7	—	2.8	—	3.5	—	—	—	—	0.15
—	2.5	7	—	2.5	—	3.5	—	—	—	—	0.15	—	8	—	2.8	—	4	—	—	—	—	0.15
3	3	8	—	3	—	4	—	—	—	—	0.15	—	9	—	3	—	5	—	—	—	—	0.15
4	4	11	—	4	—	5	—	—	—	—	0.15	—	12	—	4	—	6	—	—	—	—	0.2
5	5	13	—	4	—	6	10	—	—	—	0.2	0.15	14	—	5	—	7	—	—	—	—	0.2
6	6	15	—	5	—	7	10	—	—	—	0.2	0.15	17	—	6	—	9	—	—	—	—	0.3
7	7	17	—	5	—	7	10	—	—	—	0.3	0.15	19	—	6	8	10	—	—	—	—	0.3
8	8	19	—	6	—	9	11	—	—	—	0.3	0.2	22	—	7	9	11	14	19	25	—	0.3
9	9	20	—	6	—	9	11	—	—	—	0.3	0.3	24	—	7	10	12	15	20	27	—	0.3
00	10	22	—	6	8	10	13	16	22	—	0.3	0.3	26	—	8	10	12	16	21	29	—	0.3
01	12	24	—	6	8	10	13	16	22	—	0.3	0.3	28	7	8	10	12	16	21	29	0.3	0.3
02	15	28	—	7	8.5	10	13	18	23	—	0.3	0.3	32	8	9	11	13	17	23	30	0.3	0.3
03	17	30	—	7	8.5	10	13	18	23	—	0.3	0.3	35	8	10	12	14	18	24	32	0.3	0.3
04	20	37	7	9	11	13	17	23	30	0.3	0.3	0.3	42	8	12	14	16	22	30	40	0.3	0.6
/22	22	39	7	9	11	13	17	23	30	0.3	0.3	0.3	44	8	12	14	16	22	30	40	0.3	0.6
05	25	42	7	9	11	13	17	23	30	0.3	0.3	0.3	47	8	12	14	16	22	30	40	0.3	0.6
/28	28	45	7	9	11	13	17	23	30	0.3	0.3	0.3	52	8	12	15	18	24	32	43	0.3	0.6
06	30	47	7	9	11	13	17	23	30	0.3	0.3	0.3	55	9	13	16	19	25	34	45	0.3	1
/32	32	52	7	10	13	15	20	27	36	0.3	0.6	0.6	58	9	13	16	20	26	35	47	0.3	1
07	35	55	7	10	13	15	20	27	36	0.3	0.6	0.6	62	9	14	17	20	27	36	48	0.3	1
08	40	62	8	12	14	16	22	30	40	0.3	0.6	0.6	68	9	15	18	21	28	38	50	0.3	1
09	45	68	8	12	14	16	22	30	40	0.3	0.6	0.6	75	10	16	19	23	30	40	54	0.3	1
10	50	72	8	12	14	16	22	30	40	0.3	0.6	0.6	80	10	16	19	23	30	40	54	0.6	1
11	55	80	9	13	16	19	25	34	45	0.3	1	1	90	11	18	22	26	35	46	63	0.6	1.1
12	60	85	9	13	16	19	25	34	45	0.3	1	1	95	11	18	22	26	35	46	63	0.6	1.1
13	65	90	9	13	16	19	25	34	45	0.6	1	1	100	11	18	22	26	35	46	63	0.6	1.1
14	70	100	10	16	19	23	30	40	54	0.6	1	1	110	13	20	24	30	40	54	71	0.6	1.1
15	75	105	10	16	19	23	30	40	54	0.6	1	1	115	13	20	24	30	40	54	71	0.6	1.1
16	80	110	10	16	19	23	30	40	54	0.6	1	1	125	14	22	27	34	45	60	80	0.6	1.1
17	85	120	11	18	22	26	35	46	63	0.6	1.1	1.1	130	14	22	27	34	45	60	80	0.6	1.1
18	90	125	11	18	22	26	35	46	63	0.6	1.1	1.1	140	16	24	30	37	50	67	90	1	1.5
19	95	130	11	18	22	26	35	46	63	0.6	1.1	1.1	145	16	24	30	37	50	67	90	1	1.5
20	100	140	13	20	24	30	40	54	71	0.6	1.1	1.1	150	16	24	30	37	50	67	100	1	1.5
21	105	145	13	20	24	30	40	54	71	0.6	1.1	1.1	160	18	26	33	41	56	75	109	1	2
22	110	150	13	20	24	30	40	54	71	0.6	1.1	1.1	170	19	28	36	45	60	80	109	1	2
24	120	165	14	22	27	34	45	60	80	0.6	1.1	1.1	180	19	28	36	46	60	80	109	1	2
26	130	180	16	24	30	37	50	67	90	1	1.5	1.5	200	22	33	42	52	69	95	125	1.1	2
28	140	190	16	24	30	37	50	67	90	1	1.5	1.5	210	22	33	42	53	69	65	125	1.1	2
30	150	210	19	28	36	45	60	80	109	1	2	2	225	24	35	45	56	75	100	136	1.1	2.1
32	160	220	19	28	36	45	60	80	109	1	2	2	240	25	38	48	60	80	109	145	1.5	2.1
34	170	230	19	28	36	45	60	80	109	1	2	2	260	28	42	54	67	90	122	160	1.5	2.1

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-3

Unit: mm

Single row radial ball bearings		67							68 78							
Double row radial ball bearings																
Cylindrical roller bearings										N28	N38	NN48				
Needle roller bearings												NA48				
Spherical roller bearings																

Nominal bearing bore diameter d		Diameter series 7						Diameter series 8								
		Nominal bearing outside diameter D	Dimension series					Nominal bearing outside diameter D	Dimension series							
Number	Dimension		17	27	37	47	17-47		08	18	28	38	48	58	68	08	18-68
			Nominal width B				Chamfer dimension $r_{s\,min}$		Nominal width B							Chamfer dimension $r_{s\,min}$	
36	180	215	18	—	26	—	1.1	225	14	22	27	34	45	60	80	0.6	1.1
38	190	230	20	—	30	—	1.1	240	16	24	30	37	50	67	90	1	1.5
40	200	240	20	—	30	—	1.1	250	16	24	30	37	50	67	90	1	1.5
44	220	—	—	—	—	—	—	270	16	24	30	37	50	67	90	1	1.5
48	240	—	—	—	—	—	—	300	19	28	36	45	60	80	100	1	2
52	260	—	—	—	—	—	—	320	19	28	36	45	60	80	100	1	2
56	280	—	—	—	—	—	—	350	22	33	42	52	69	95	125	1.1	2
60	300	—	—	—	—	—	—	380	25	38	48	60	80	109	145	1.5	2.1
64	320	—	—	—	—	—	—	400	25	38	48	60	80	109	145	1.5	2.1
68	340	—	—	—	—	—	—	420	25	38	48	60	80	109	145	1.5	2.1
72	360	—	—	—	—	—	—	440	25	38	48	60	80	109	145	1.5	2.1
76	380	—	—	—	—	—	—	480	31	46	60	75	100	136	180	2	2.1
80	400	—	—	—	—	—	—	500	31	46	60	75	100	136	180	2	2.1
84	420	—	—	—	—	—	—	520	31	46	60	75	100	136	180	2	2.1
88	440	—	—	—	—	—	—	540	31	46	60	75	100	136	180	2	2.1
92	460	—	—	—	—	—	—	580	37	56	72	90	118	160	218	2.1	3
96	480	—	—	—	—	—	—	600	37	56	72	90	118	160	218	2.1	3
/500	500	—	—	—	—	—	—	620	37	56	72	90	118	160	218	2.1	3
/530	530	—	—	—	—	—	—	650	37	56	72	90	118	160	218	2.1	3
/560	560	—	—	—	—	—	—	680	37	56	72	90	118	160	218	2.1	3
/600	600	—	—	—	—	—	—	730	42	60	78	98	128	175	236	3	3
/630	630	—	—	—	—	—	—	780	48	69	88	112	150	200	272	3	4
/670	670	—	—	—	—	—	—	820	48	69	88	112	150	200	272	3	4
/710	710	—	—	—	—	—	—	870	50	74	95	118	160	218	290	4	4
/750	750	—	—	—	—	—	—	920	54	78	100	128	170	230	308	4	5
/800	800	—	—	—	—	—	—	980	57	82	106	136	180	243	325	4	5
/850	850	—	—	—	—	—	—	1 030	57	82	106	136	180	243	325	4	5
/900	900	—	—	—	—	—	—	1 090	60	85	112	140	190	258	345	5	5
/950	950	—	—	—	—	—	—	1 150	63	90	118	150	200	272	355	5	5
/1000	1 000	—	—	—	—	—	—	1 220	71	100	128	165	218	300	400	5	6
/1060	1 060	—	—	—	—	—	—	1 280	71	100	128	165	218	300	400	5	6
/1120	1 120	—	—	—	—	—	—	1 360	78	106	140	180	243	325	438	5	6
/1180	1 180	—	—	—	—	—	—	1 420	78	106	140	180	243	325	438	5	6
/1250	1 250	—	—	—	—	—	—	1 500	80	112	145	185	250	335	450	6	6
/1320	1 320	—	—	—	—	—	—	1 600	88	122	165	206	280	375	500	6	6
/1400	1 400	—	—	—	—	—	—	1 700	95	132	175	224	300	400	545	6	7.5
/1500	1 500	—	—	—	—	—	—	1 820	—	140	185	243	315	—	—	—	7.5
/1600	1 600	—	—	—	—	—	—	1 950	—	155	200	265	345	—	—	—	7.5
/1700	1 700	—	—	—	—	—	—	2 060	—	160	206	272	355	—	—	—	7.5
/1800	1 800	—	—	—	—	—	—	2 180	—	165	218	290	375	—	—	—	9.5
/1900	1 900	—	—	—	—	—	—	2 300	—	175	230	300	400	—	—	—	9.5
/2000	2 000	—	—	—	—	—	—	2 430	—	190	250	325	425	—	—	—	9.5

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-4

Unit: mm

Single row radial ball bearings			69 79											160	60 70						
Double row radial ball bearings																					
Cylindrical roller bearings			N19	N29	NN39	NN49									N10	N20	NN30	NN40			
Needle roller bearings						NA49	NA59	NA69													
Spherical roller bearings					239	249											230	240			

Nominal bearing bore diameter d		Diameter series 9										Diameter series 0									
		Nominal bearing outside diameter D	Dimension series									Nominal bearing outside diameter D	Dimension series								
Number	Dimension		09	19	29	39	49	59	69	09	19-39	49-69		00	10	20	30	40	50	60	00	10-60
			Nominal width B							Chamfer dimension $r_{s\,min}$				Nominal width B							Chamfer dimension $r_{s\,min}$	
36	180	250	22	33	42	52	69	95	125	1.1	2	2	280	31	46	60	74	100	136	180	2	2.1
38	190	260	22	33	42	52	69	95	125	1.1	2	2	290	31	46	60	75	100	136	180	2	2.1
40	200	280	25	38	48	60	80	109	145	1.5	2.1	2.1	310	34	51	66	82	109	150	200	2	2.1
44	220	300	25	38	48	60	80	109	145	1.5	2.1	2.1	340	37	56	72	90	118	160	218	2.1	3
48	240	320	25	38	48	60	80	109	145	1.5	2.1	2.1	360	37	56	72	92	118	160	218	2.1	3
52	260	360	31	46	60	75	100	136	180	2	2.1	2.1	400	44	65	82	104	140	190	250	3	4
56	280	380	31	46	60	75	100	136	180	2	2.1	2.1	420	44	65	82	106	140	190	250	3	4
60	300	420	37	56	72	90	118	160	218	2.1	3	3	460	50	74	95	118	160	218	290	4	4
64	320	440	37	56	72	90	118	160	218	2.1	3	3	480	50	74	95	121	160	218	290	4	4
68	340	460	37	56	72	90	118	160	218	2.1	3	3	520	57	82	106	133	180	243	325	4	5
72	360	480	37	56	72	90	118	160	218	2.1	3	3	540	57	82	106	134	180	243	325	4	5
76	380	520	44	65	82	106	140	190	250	3	4	4	560	57	82	106	135	180	243	325	4	5
80	400	540	44	65	82	106	140	190	250	3	4	4	600	63	90	118	148	200	272	355	5	5
84	420	560	44	65	82	106	140	190	250	3	4	4	620	63	90	118	150	200	272	355	5	5
88	440	600	50	74	95	118	160	218	290	4	4	4	650	67	94	122	157	212	280	375	5	6
92	460	620	50	74	95	118	160	218	290	4	4	4	680	71	100	128	163	218	300	400	5	6
96	480	650	54	78	100	128	170	230	308	4	5	5	700	71	100	128	165	218	300	400	5	6
/500	500	670	54	78	100	128	170	230	308	4	5	5	720	71	100	128	167	218	300	400	5	6
/530	530	710	57	82	106	136	180	243	325	4	5	5	780	80	112	145	185	250	335	450	6	6
/560	560	750	60	85	112	140	190	258	345	5	5	5	820	82	115	150	195	258	355	462	6	6
/600	600	800	63	90	118	150	200	272	355	5	5	5	870	85	118	155	200	272	365	488	6	6
/630	630	850	71	100	128	165	218	300	400	5	6	6	920	92	128	170	212	290	388	515	6	7.5
/670	670	900	73	103	136	170	230	308	412	5	6	6	980	100	136	180	230	308	425	560	6	7.5
/710	710	950	78	106	140	180	243	325	438	5	6	6	1 030	103	140	185	236	315	438	580	6	7.5
/750	750	1 000	80	112	145	185	250	335	450	6	6	6	1 090	109	150	195	250	335	462	615	7.5	7.5
/800	800	1 060	82	115	150	195	258	355	462	6	6	6	1 150	112	155	200	258	345	475	630	7.5	7.5
/850	850	1 120	85	118	155	200	272	365	488	6	6	6	1 220	118	165	212	272	365	500	670	7.5	7.5
/900	900	1 180	88	122	165	206	280	375	500	6	6	6	1 280	122	170	218	280	375	515	690	7.5	7.5
/950	950	1 250	95	132	175	224	300	400	545	6	7.5	7.5	1 360	132	180	236	300	412	560	730	7.5	7.5
/1000	1 000	1 320	103	140	185	236	315	438	580	6	7.5	7.5	1 420	136	185	243	308	412	560	750	7.5	7.5
/1060	1 060	1 400	109	150	195	250	335	462	615	7.5	7.5	7.5	1 500	140	195	250	325	438	600	800	9.5	9.5
/1120	1 120	1 460	109	150	195	250	335	462	615	7.5	7.5	7.5	1 580	145	200	265	345	462	615	825	9.5	9.5
/1180	1 180	1 540	115	160	206	272	355	488	650	7.5	7.5	7.5	1 660	155	212	272	355	475	650	875	9.5	9.5
/1250	1 250	1 630	122	170	218	280	375	515	690	7.5	7.5	7.5	1 750	—	218	290	375	500	—	—	—	9.5
/1320	1 320	1 720	128	175	230	300	400	545	710	7.5	7.5	7.5	1 850	—	230	300	400	530	—	—	—	12
/1400	1 400	1 820	—	185	243	315	425	—	—	—	9.5	9.5	1 950	—	243	315	412	545	—	—	—	12
/1500	1 500	1 950	—	195	258	335	450	—	—	—	9.5	9.5	2 120	—	272	355	462	615	—	—	—	12
/1600	1 600	2 060	—	200	265	345	462	—	—	—	9.5	9.5	2 240	—	280	365	475	630	—	—	—	12
/1700	1 700	2 180	—	212	280	355	475	—	—	—	9.5	9.5	2 360	—	290	375	500	650	—	—	—	15
/1800	1 800	2 300	—	218	290	375	500	—	—	—	12	12	2 500	—	308	400	530	690	—	—	—	15
/1900	1 900	2 430	—	230	308	400	530	—	—	—	12	12	—	—	—	—	—	—	—	—	—	—
/2000	2 000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-5

Unit: mm

Single row radial ball bearings													62 72		622	632					
Double row radial ball bearings													12		42 22	52 32					
Cylindrical roller bearings				NN31									N2		N22	N32					
Needle roller bearings																					
Spherical roller bearings				231	241										222	232					

Nominal bearing bore diameter d		Diameter series 1										Diameter series 2									
		Nominal bearing outside diameter D	Dimension series									Nominal bearing outside diameter D	Dimension series								
			01	11	21	31	41	51	61	01	11-61		82	02	12	22	32	42	52	62	82	02-62
Number	Dimension		Nominal width B							Chamfer dimension $r_{s\,min}$			Nominal width B								Chamfer dimension $r_{s\,min}$	
—	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—	—			—	—
1	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—	—			—	—
—	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—	—			—	—
2	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—	—			—	—
—	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—	—			—	—
3	3	—	—	—	—	—	—			—	—	10	2.5	4	—	—	5	—	—	—	0.1	0.15
4	4	—	—	—	—	—	—			—	—	13	3	5	—	—	7	—	—	—	0.15	0.2
5	5	15	—	—	—	7	—	—	—	—	0.3	16	3.5	5	—	—	8	—	—	—	0.15	0.3
6	6	18	—	—	8	10	—	—	—	—	0.3	19	4	6	—	—	10	—	18	23	0.2	0.3
7	7	21	—	—	9	11	14	19	25	—	0.3	22	5	7	—	—	11	—	20	27	0.3	0.3
8	8	23	—	—	10	12	15	20	27	—	0.3	24	5	8	—	—	12	—	21	29	0.3	0.3
9	9	25	—	—	10	12	16	21	29	—	0.3	26	6	8	—	—	13	—	23	30	0.3	0.3
00	10	28	—	—	12	14	18	24	32	—	0.3	30	7	9	—	14	14.3	—	27	36	0.3	0.6
01	12	30	—	—	12	14	18	24	32	—	0.3	32	7	10	—	14	15.9	—	27	36	0.3	0.6
02	15	33	—	—	12	14	18	24	32	—	0.3	35	8	11	—	14	15.9	20	27	36	0.3	0.6
03	17	37	—	—	13	15	20	27	36	—	0.6	40	8	12	—	16	17.5	22	30	40	0.3	0.6
04	20	44	—	—	15	18	24	32	43	—	0.6	47	9	14	—	18	20.6	27	36	48	0.3	1
/22	22	47	—	—	16	19	25	34	45	—	1	50	9	14	—	18	20.6	27	36	48	0.3	1
05	25	50	—	—	16	19	25	34	45	—	1	52	10	15	—	18	20.6	27	36	48	0.3	1
/28	28	55	—	—	17	20	27	36	48	—	1	58	10	16	—	19	23	30	40	54	0.6	1
06	30	58	—	—	18	21	28	38	50	—	1	62	10	16	—	20	23.8	32	43	58	0.6	1
/32	32	62	—	—	19	23	30	40	54	—	1	65	11	17	—	21	25	33	43	60	0.6	1
07	35	68	—	—	21	25	33	43	60	—	1.1	72	12	17	—	23	27	37	50	67	0.6	1.1
08	40	75	—	—	22	26	35	46	63	—	1.1	80	13	18	—	23	30.2	40	54	71	0.6	1.1
09	45	80	—	—	22	26	35	46	63	—	1.1	85	13	19	—	23	30.2	40	54	71	0.6	1.1
10	50	85	—	—	22	26	35	46	63	—	1.1	90	13	20	—	23	30.2	40	54	71	0.6	1.1
11	55	95	—	—	24	30	40	54	71	—	1.1	100	14	21	—	25	33.3	45	60	80	0.6	1.5
12	60	100	—	—	24	30	40	54	71	—	1.1	110	16	22	—	28	36.5	50	67	90	1	1.5
13	65	110	—	—	27	34	45	60	80	—	1.5	120	18	23	—	31	38.1	56	75	100	1	1.5
14	70	115	—	—	27	34	45	60	80	—	1.5	125	18	24	—	31	39.7	56	75	100	1	1.5
15	75	125	—	—	30	37	50	67	90	—	1.5	130	18	25	—	31	41.3	56	75	100	1	1.5
16	80	130	—	—	30	37	50	67	90	—	1.5	140	19	26	—	33	44.4	60	80	109	1	2
17	85	140	—	—	31	41	56	75	100	—	1.5	150	21	28	—	36	49.2	65	88	118	1.1	2
18	90	150	—	—	33	45	60	80	109	—	2	160	22	30	—	40	52.4	69	95	125	1.1	2
19	95	160	—	—	39	52	65	88	118	—	2	170	24	32	—	43	55.6	75	100	136	1.1	2.1
20	100	165	21	30	39	52	65	88	118	1.1	2	180	25	34	—	46	60.3	80	109	145	1.5	2.1
21	105	175	22	33	42	56	69	95	125	1.1	2	190	27	36	—	50	65.1	85	115	155	1.5	2.1
22	110	180	22	33	42	56	69	95	125	1.1	2	200	28	38	—	53	69.8	90	122	160	1.5	2.1
24	120	200	25	38	48	62	80	109	145	1.5	2	215	—	40	42	58	76	95	128	170	—	2.1
26	130	210	25	38	48	64	80	109	145	1.5	2	230	—	40	46	64	80	100	136	180	—	3
28	140	225	27	40	50	68	85	115	155	1.5	2.1	250	—	42	50	68	88	109	150	200	—	3

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-6

Unit: mm

Single row radial ball bearings		63 73		623	633				64 74		
Double row radial ball bearings		13		43 23	53 33						
Cylindrical roller bearings		N3		N23	N33				N4		
Needle roller bearings											
Spherical roller bearings		213		223							

Nominal bearing bore diameter d		Diameter series 3								Diameter series 4			
		Nominal bearing outside diameter D	Dimension series							Nominal bearing outside diameter D	Dimension series		
			83	03	13	23	33	83	03-33		04	24	
Number	Dimension		Nominal width B					Chamfer dimension $r_{s\,min}$			Nominal width B		Chamfer dimension $r_{s\,min}$
—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	3	13	—	5	—	—	7	—	0.2	—	—	—	—
4	4	16	—	5	—	—	9	—	0.3	—	—	—	—
5	5	19	—	6	—	—	10	—	0.3	—	—	—	—
6	6	22	—	7	—	11	13	—	0.3	—	—	—	—
7	7	26	—	9	—	13	15	—	0.3	—	—	—	—
8	8	28	—	9	—	13	15	—	0.3	30	10	14	0.6
9	9	30	—	10	—	14	16	—	0.6	32	11	15	0.6
00	10	35	9	11	—	17	19	0.3	0.6	37	12	16	0.6
01	12	37	9	12	—	17	19	0.3	1	42	13	19	1
02	15	42	9	13	—	17	19	0.3	1	52	15	24	1.1
03	17	47	10	14	—	19	22.2	0.6	1	62	17	29	1.1
04	20	52	10	15	—	21	22.2	0.6	1.1	72	19	33	1.1
/22	22	56	11	16	—	21	25	0.6	1.1	—	—	—	—
05	25	62	12	17	—	24	25.4	0.6	1.1	80	21	36	1.5
/28	28	68	13	18	—	24	30	0.6	1.1	—	—	—	—
06	30	72	13	19	—	27	30.2	0.6	1.1	90	23	40	1.5
/32	32	75	14	20	—	28	32	0.6	1.1	—	—	—	—
07	35	80	14	21	—	31	34.9	0.6	1.5	100	25	43	1.5
08	40	90	16	23	—	33	36.5	1	1.5	110	27	46	2
09	45	100	17	25	—	36	39.7	1	1.5	120	29	50	2
10	50	110	19	27	—	40	44.4	1	2	130	31	53	2.1
11	55	120	21	29	—	43	49.2	1.1	2	140	33	57	2.1
12	60	130	22	31	—	46	54	1.1	2.1	150	35	60	2.1
13	65	140	24	33	—	48	58.7	1.1	2.1	160	37	64	2.1
14	70	150	25	35	—	51	63.5	1.5	2.1	180	42	74	3
15	75	160	27	37	—	55	68.3	1.5	2.1	190	45	77	3
16	80	170	28	39	—	58	68.3	1.5	2.1	200	48	80	3
17	85	180	30	41	—	60	73	2	3	210	52	86	4
18	90	190	30	43	—	64	73	2	3	225	54	90	4
19	95	200	33	45	—	67	77.8	2	3	240	55	95	4
20	100	215	36	47	51	73	82.6	2.1	3	250	58	98	4
21	105	225	37	49	53	77	87.3	2.1	3	260	60	100	4
22	110	240	42	50	57	80	92.1	3	3	280	65	108	4
24	120	260	44	55	62	86	106	3	3	310	72	118	5
26	130	280	48	58	66	93	112	3	4	340	78	128	5
28	140	300	50	62	70	102	118	4	4	360	82	132	5

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-7

Unit: mm

Single row radial ball bearings													62 72		622	632					
Double row radial ball bearings													12		42 22	52 32					
Cylindrical roller bearings				NN31									N2		N22	N32					
Needle roller bearings																					
Spherical roller bearings				231	241										222	232					

Nominal bearing bore diameter d		Diameter series 1										Diameter series 2									
		Nominal bearing outside diameter D	Dimension series									Nominal bearing outside diameter D	Dimension series								
			01	11	21	31	41	51	61	01	11-61		82	02	12	22	32	42	52	62	82	02-62
			Nominal width B							Chamfer dimension $r_{s\,min}$			Nominal width B								Chamfer dimension $r_{s\,min}$	
Number	Dimension																					
30	150	250	31	46	60	80	100	136	180	2	2.1	270	—	45	54	73	96	118	160	218	—	3
32	160	270	34	51	66	86	109	150	200	2	2.1	290	—	48	58	80	104	128	175	236	—	3
34	170	280	34	51	66	88	109	150	200	2	2.1	310	—	52	62	86	110	140	190	250	—	4
36	180	300	37	56	72	96	118	160	218	2.1	3	320	—	52	62	86	112	140	190	250	—	4
38	190	320	42	60	78	104	128	175	236	3	3	340	—	55	65	92	120	150	200	272	—	4
40	200	340	44	65	82	112	140	190	250	3	3	360	—	58	70	98	128	160	218	290	—	4
44	220	370	48	69	88	120	150	200	272	3	4	400	—	65	78	108	144	180	243	325	—	4
48	240	400	50	74	95	128	160	218	290	4	4	440	—	72	85	120	160	200	272	355	—	4
52	260	440	57	82	106	144	180	243	325	4	4	480	—	80	90	130	174	218	300	400	—	5
56	280	460	57	82	106	146	180	243	325	4	5	500	—	80	90	130	176	218	300	400	—	5
60	300	500	63	90	118	160	200	272	355	5	5	540	—	85	98	140	192	243	325	438	—	5
64	320	540	71	100	128	176	218	300	400	5	5	580	—	92	105	150	208	258	355	462	—	5
68	340	580	78	106	140	190	243	325	438	5	5	620	—	92	118	165	224	280	375	500	—	6
72	360	600	78	106	140	192	243	325	438	5	5	650	—	95	122	170	232	290	388	515	—	6
76	380	620	78	106	140	194	243	325	438	5	5	680	—	95	132	175	240	300	400	545	—	6
80	400	650	80	112	145	200	250	335	450	6	6	720	—	103	140	185	256	315	438	580	—	6
84	420	700	88	122	165	224	280	375	500	6	6	760	—	109	150	195	272	335	462	615	—	7.5
88	440	720	88	122	165	226	280	375	500	6	6	790	—	112	155	200	280	345	475	630	—	7.5
92	460	760	95	132	175	240	300	400	545	6	7.5	830	—	118	165	212	296	365	500	670	—	7.5
96	480	790	100	136	180	248	308	425	560	6	7.5	870	—	125	170	224	310	388	530	710	—	7.5
/500	500	830	106	145	190	264	325	450	600	7.5	7.5	920	—	136	185	243	336	412	560	750	—	7.5
/530	530	870	109	150	195	272	335	462	615	7.5	7.5	980	—	145	200	258	355	450	600	—	—	9.5
/560	560	920	115	160	206	280	355	488	650	7.5	7.5	1 030	—	150	206	272	365	475	630	—	—	9.5
/600	600	980	122	170	218	300	375	515	690	7.5	7.5	1 090	—	155	212	280	388	488	670	—	—	9.5
/630	630	1 030	128	175	230	315	400	545	710	7.5	7.5	1 150	—	165	230	300	412	515	710	—	—	12
/670	670	1 090	136	185	243	336	412	560	750	7.5	7.5	1 220	—	175	243	315	438	545	750	—	—	12
/710	710	1 150	140	195	250	345	438	600	800	9.5	9.5	1 280	—	180	250	325	450	560	775	—	—	12
/750	750	1 220	150	206	272	365	475	630	—	9.5	9.5	1 360	—	195	265	345	475	615	825	—	—	15
/800	800	1 280	155	212	272	375	475	650	—	9.5	9.5	1 420	—	200	272	355	488	615	—	—	—	15
/850	850	1 360	165	224	290	400	500	690	—	12	12	1 500	—	206	280	375	515	650	—	—	—	15
/900	900	1 420	165	230	300	412	515	710	—	12	12	1 580	—	218	300	388	515	670	—	—	—	15
/950	950	1 500	175	243	315	438	545	750	—	12	12	1 660	—	230	315	412	530	710	—	—	—	15
/1000	1 000	1 580	185	258	335	462	580	775	—	12	12	1 750	—	243	330	425	560	750	—	—	—	15
/1060	1 060	1 660	190	265	345	475	600	800	—	12	15	—	—	—	—	—	—	—			—	—
/1120	1 120	1 750	—	280	365	475	630	—	—	—	15	—	—	—	—	—	—	—			—	—
/1180	1 180	1 850	—	290	388	500	670	—	—	—	15	—	—	—	—	—	—	—			—	—
/1250	1 250	1 950	—	308	400	530	710	—	—	—	15	—	—	—	—	—	—	—			—	—
/1320	1 320	2 060	—	325	425	560	750	—	—	—	15	—	—	—	—	—	—	—			—	—
/1400	1 400	2 180	—	345	450	580	775	—	—	—	19	—	—	—	—	—	—	—			—	—
/1500	1 500	2 300	—	355	462	600	800	—	—	—	19	—	—	—	—	—	—	—			—	—

Appendix table - 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-8

Unit: mm

Single row radial ball bearings		63 73		623	633				64 74		
Double row radial ball bearings		13		43 23	53 33						
Cylindrical roller bearings		N3		N23	N33				N4		
Needle roller bearings											
Spherical roller bearings		213		223							

Nominal bearing bore diameter d		Diameter series 3							Diameter series 4			
		Nominal bearing outside diameter D	Dimension series						Nominal bearing outside diameter D	Dimension series		
			83	03	13	23	33	83	03-33		04	24	
			Nominal width B					Chamfer dimension $r_{s\,min}$			Nominal width B		Chamfer dimension $r_{s\,min}$
Number	Dimension												
30	150	320	—	65	75	108	128	—	4	380	85	138	5
32	160	340	—	68	79	114	136	—	4	400	88	142	5
34	170	360	—	72	84	120	140	—	4	420	92	145	5
36	180	380	—	75	88	126	150	—	4	440	95	150	6
38	190	400	—	78	92	132	155	—	5	460	98	155	6
40	200	420	—	80	97	138	165	—	5	480	102	160	6
44	220	460	—	88	106	145	180	—	5	540	115	180	6
48	240	500	—	95	114	155	195	—	5	580	122	190	6
52	260	540	—	102	123	165	206	—	6	620	132	206	7.5
56	280	580	—	108	132	175	224	—	6	670	140	224	7.5
60	300	620	—	109	140	185	236	—	7.5	710	150	236	7.5
64	320	670	—	112	155	200	258	—	7.5	750	155	250	9.5
68	340	710	—	118	165	212	272	—	7.5	800	164	265	9.5
72	360	750	—	125	170	224	290	—	7.5	850	180	280	9.5
76	380	780	—	128	175	230	300	—	7.5	900	190	300	9.5
80	400	820	—	136	185	243	308	—	7.5	950	200	315	12
84	420	850	—	136	190	250	315	—	9.5	980	206	325	12
88	440	900	—	145	200	265	345	—	9.5	1 030	212	335	12
92	460	950	—	155	212	280	365	—	9.5	1 060	218	345	12
96	480	980	—	160	218	290	375	—	9.5	1 120	230	365	15
/500	500	1 030	—	170	230	300	388	—	12	1 150	236	375	15
/530	530	1 090	—	180	243	325	412	—	12	1 220	250	400	15
/560	560	1 150	—	190	258	335	438	—	12	1 280	258	412	15
/600	600	1 220	—	200	272	355	462	—	15	1 360	272	438	15
/630	630	1 280	—	206	280	375	488	—	15	1 420	280	450	15
/670	670	1 360	—	218	300	400	515	—	15	1 500	290	475	15
/710	710	1 420	—	224	308	412	530	—	15	—	—	—	—
/750	750	1 500	—	236	325	438	560	—	15	—	—	—	—
/800	800	1 600	—	258	355	462	600	—	15	—	—	—	—
/850	850	1 700	—	272	375	488	630	—	19	—	—	—	—
/900	900	1 780	—	280	388	500	650	—	19	—	—	—	—
/950	950	1 850	—	290	400	515	670	—	19	—	—	—	—
/1000	1 000	1 950	—	300	412	545	710	—	19	—	—	—	—
/1060	1 060	—	—	—	—	—	—	—	—	—	—	—	—
/1120	1 120	—	—	—	—	—	—	—	—	—	—	—	—
/1180	1 180	—	—	—	—	—	—	—	—	—	—	—	—
/1250	1 250	—	—	—	—	—	—	—	—	—	—	—	—
/1320	1 320	—	—	—	—	—	—	—	—	—	—	—	—
/1400	1 400	—	—	—	—	—	—	—	—	—	—	—	—
/1500	1 500	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 2: Boundary dimensions of tapered roller bearings-1

Unit: mm

Tapered roller bearings		329						320X						330					
Bore diameter No.	Bearing bore diameter	Bearing outside diameter	Diameter series 9					Bearing outside diameter	Diameter series 0					Bearing outside diameter	Diameter series 0				
			Dimension series 29						Dimension series 20						Dimension series 30				
			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension	
						Inner ring	Outer ring					Inner ring	Outer ring					Inner ring	Outer ring
	d	*D*	*T*	*B*	*C*	*r* (min.)		*D*	*T*	*B*	*C*	*r* (min.)		*D*	*T*	*B*	*C*	*r* (min.)	
02	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
03	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
04	20	—	—	—	—	—	—	42	15	15	12	0.6	0.6	—	—	—	—	—	—
/22	22	—	—	—	—	—	—	44	15	15	11.5	0.6	0.6	—	—	—	—	—	—
05	25	—	—	—	—	—	—	47	15	15	11.5	0.6	0.6	47	17	17	14	0.6	0.6
/28	28	—	—	—	—	—	—	52	16	16	12	1	1	—	—	—	—	—	—
06	30	47	12	12	9	0.3	0.3	55	17	17	13	1	1	55	20	20	16	1	1
/32	32	—	—	—	—	—	—	58	17	17	13	1	1	—	—	—	—	—	—
07	35	55	14	14	11.5	0.6	0.6	62	18	18	14	1	1	62	21	21	17	1	1
08	40	62	15	15	12	0.6	0.6	68	19	19	14.5	1	1	68	22	22	18	1	1
09	45	68	15	15	12	0.6	0.6	75	20	20	15.5	1	1	75	24	24	19	1	1
10	50	72	15	15	12	0.6	0.6	80	20	20	15.5	1	1	80	24	24	19	1	1
11	55	80	17	17	14	1	1	90	23	23	17.5	1.5	1.5	90	27	27	21	1.5	1.5
12	60	85	17	17	14	1	1	95	23	23	17.5	1.5	1.5	95	27	27	21	1.5	1.5
13	65	90	17	17	14	1	1	100	23	23	17.5	1.5	1.5	100	27	27	21	1.5	1.5
14	70	100	20	20	16	1	1	110	25	25	19	1.5	1.5	110	31	31	25.5	1.5	1.5
15	75	105	20	20	16	1	1	115	25	25	19	1.5	1.5	115	31	31	25.5	1.5	1.5
16	80	110	20	20	16	1	1	125	29	29	22	1.5	1.5	125	36	36	29.5	1.5	1.5
17	85	120	23	23	18	1.5	1.5	130	29	29	22	1.5	1.5	130	36	36	29.5	1.5	1.5
18	90	125	23	23	18	1.5	1.5	140	32	32	24	2	1.5	140	39	39	32.5	2	1.5
19	95	130	23	23	18	1.5	1.5	145	32	32	24	2	1.5	145	39	39	32.5	2	1.5
20	100	140	25	25	20	1.5	1.5	150	32	32	24	2	1.5	150	39	39	32.5	2	1.5
21	105	145	25	25	20	1.5	1.5	160	35	35	26	2.5	2	160	43	43	34	2.5	2
22	110	150	25	25	20	1.5	1.5	170	38	38	29	2.5	2	170	47	47	37	2.5	2
24	120	165	29	29	23	1.5	1.5	180	38	38	29	2.5	2	180	48	48	38	2.5	2
26	130	180	32	32	25	2	1.5	200	45	45	34	2.5	2	200	55	55	43	2.5	2
28	140	190	32	32	25	2	1.5	210	45	45	34	2.5	2	210	56	56	44	2.5	2
30	150	210	38	38	30	2.5	2	225	48	48	36	3	2.5	225	59	59	46	3	2.5
32	160	220	38	38	30	2.5	2	240	51	51	38	3	2.5	—	—	—	—	—	—
34	170	230	38	38	30	2.5	2	260	57	57	43	3	2.5	—	—	—	—	—	—
36	180	250	45	45	34	2.5	2	280	64	64	48	3	2.5	—	—	—	—	—	—
38	190	260	45	45	34	2.5	2	290	64	64	48	3	2.5	—	—	—	—	—	—
40	200	280	51	51	39	3	2.5	310	70	70	53	3	2.5	—	—	—	—	—	—
44	220	300	51	51	39	3	2.5	340	76	76	57	4	3	—	—	—	—	—	—
48	240	320	51	51	39	3	2.5	360	76	76	57	4	3	—	—	—	—	—	—
52	260	360	63.5	63.5	48	3	2.5	400	87	87	65	5	4	—	—	—	—	—	—
56	280	380	63.5	63.5	48	3	2.5	420	87	87	65	5	4	—	—	—	—	—	—
60	300	420	76	76	57	4	3	460	100	100	74	5	4	—	—	—	—	—	—
64	320	440	76	76	57	4	3	480	100	100	74	5	4	—	—	—	—	—	—
68	340	460	76	76	57	4	3	—	—	—	—	—	—	—	—	—	—	—	—
72	360	480	76	76	57	4	3	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 2: Boundary dimensions of tapered roller bearings-2

Unit: mm

Tapered roller bearings		331						302						322					
Bore diameter No.	Bearing bore diameter	Bearing outside diameter	Diameter series 1					Bearing outside diameter	Diameter series 2					Bearing outside diameter	Diameter series 2				
			Dimension series 31						Dimension series 02						Dimension series 22				
			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension	
						Inner ring	Outer ring					Inner ring	Outer ring					Inner ring	Outer ring
	d	*D*	*T*	*B*	*C*	*r* (min.)		*D*	*T*	*B*	*C*	*r* (min.)		*D*	*T*	*B*	*C*	*r* (min.)	
02	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
03	17	—	—	—	—	—	—	40	13.25	12	11	1	1	40	17.25	16	14	1	1
04	20	—	—	—	—	—	—	47	15.25	14	12	1	1	47	19.25	18	15	1	1
/22	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
05	25	—	—	—	—	—	—	52	16.25	15	13	1	1	52	19.25	18	16	1	1
/28	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
06	30	—	—	—	—	—	—	62	17.25	16	14	1	1	62	21.25	20	17	1	1
/32	32	—	—	—	—	—	—	65	18.25	17	15	1	1	—	—	—	—	—	—
07	35	—	—	—	—	—	—	72	18.25	17	15	1.5	1.5	72	24.25	23	19	1.5	1.5
08	40	75	26	26	20.5	1.5	1.5	80	19.75	18	16	1.5	1.5	80	24.75	23	19	1.5	1.5
09	45	80	26	26	20.5	1.5	1.5	85	20.75	19	16	1.5	1.5	85	24.75	23	19	1.5	1.5
10	50	85	26	26	20	1.5	1.5	90	21.75	20	17	1.5	1.5	90	24.75	23	19	1.5	1.5
11	55	95	30	30	23	1.5	1.5	100	22.75	21	18	2	1.5	100	26.75	25	21	2	1.5
12	60	100	30	30	23	1.5	1.5	110	23.75	22	19	2	1.5	110	29.75	28	24	2	1.5
13	65	110	34	34	26.5	1.5	1.5	120	24.75	23	20	2	1.5	120	32.75	31	27	2	1.5
14	70	120	37	37	29	2	1.5	125	26.25	24	21	2	1.5	125	33.25	31	27	2	1.5
15	75	125	37	37	29	2	1.5	130	27.25	25	22	2	1.5	130	33.25	31	27	2	1.5
16	80	130	37	37	29	2	1.5	140	28.25	26	22	2.5	2	140	35.25	33	28	2.5	2
17	85	140	41	41	32	2.5	2	150	30.5	28	24	2.5	2	150	38.5	36	30	2.5	2
18	90	150	45	45	35	2.5	2	160	32.5	30	26	2.5	2	160	42.5	40	34	2.5	2
19	95	160	49	49	38	2.5	2	170	34.5	32	27	3	2.5	170	45.5	43	37	3	2.5
20	100	165	52	52	40	2.5	2	180	37	34	29	3	2.5	180	49	46	39	3	2.5
21	105	—	—	—	—	—	—	190	39	36	30	3	2.5	190	53	50	43	3	2.5
22	110	180	56	56	43	2.5	2	200	41	38	32	3	2.5	200	56	53	46	3	2.5
24	120	200	62	62	48	2.5	2	215	43.5	40	34	3	2.5	215	61.5	58	50	3	2.5
26	130	—	—	—	—	—	—	230	43.75	40	34	4	3	230	67.75	64	54	4	3
28	140	—	—	—	—	—	—	250	45.75	42	36	4	3	250	71.75	68	58	4	3
30	150	—	—	—	—	—	—	270	49	45	38	4	3	270	77	73	60	4	3
32	160	—	—	—	—	—	—	290	52	48	40	4	3	290	84	80	67	4	3
34	170	—	—	—	—	—	—	310	57	52	43	5	4	310	91	86	71	5	4
36	180	—	—	—	—	—	—	320	57	52	43	5	4	320	91	86	71	5	4
38	190	—	—	—	—	—	—	340	60	55	46	5	4	340	97	92	75	5	4
40	200	—	—	—	—	—	—	360	64	58	48	5	4	360	104	98	82	5	4
44	220	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	240	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	260	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
56	280	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64	320	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
68	340	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
72	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 2: Boundary dimensions of tapered roller bearings-3

Unit: mm

Tapered roller bearings		332						303						303D					
Bore diameter No.	Bearing bore diameter	Bearing outside diameter	Diameter series 2					Bearing outside diameter	Diameter series 3					Bearing outside diameter	Diameter series 3				
			Dimension series 32						Dimension series 03						Dimension series 03				
			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension	
						Inner ring	Outer ring					Inner ring	Outer ring					Inner ring	Outer ring
	d	D	T	B	C	r (min.)		D	T	B	C	r (min.)		D	T	B	C	r (min.)	
02	15	—	—	—	—	—	—	42	14.25	13	11	1	1	—	—	—	—	—	—
03	17	—	—	—	—	—	—	47	15.25	14	12	1	1	—	—	—	—	—	—
04	20	—	—	—	—	—	—	52	16.25	15	13	1.5	1.5	—	—	—	—	—	—
/22	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
05	25	52	22	22	18	1	1	62	18.25	17	15	1.5	1.5	62	18.25	17	13	1.5	1.5
/28	28	58	24	24	19	1	1	—	—	—	—	—	—	—	—	—	—	—	—
06	30	62	25	25	19.5	1	1	72	20.75	19	16	1.5	1.5	72	20.75	19	14	1.5	1.5
/32	32	65	26	26	20.5	1	1	—	—	—	—	—	—	—	—	—	—	—	—
07	35	72	28	28	22	1.5	1.5	80	22.75	21	18	2	1.5	80	22.75	21	15	2	1.5
08	40	80	32	32	25	1.5	1.5	90	25.25	23	20	2	1.5	90	25.25	23	17	2	1.5
09	45	85	32	32	25	1.5	1.5	100	27.25	25	22	2	1.5	100	27.25	25	18	2	1.5
10	50	90	32	32	24.5	1.5	1.5	110	29.25	27	23	2.5	2	110	29.25	27	19	2.5	2
11	55	100	35	35	27	2	1.5	120	31.5	29	25	2.5	2	120	31.5	29	21	2.5	2
12	60	110	38	38	29	2	1.5	130	33.5	31	26	3	2.5	130	33.5	31	22	3	2.5
13	65	120	41	41	32	2	1.5	140	36	33	28	3	2.5	140	36	33	23	3	2.5
14	70	125	41	41	32	2	1.5	150	38	35	30	3	2.5	150	38	35	25	3	2.5
15	75	130	41	41	31	2	1.5	160	40	37	31	3	2.5	160	40	37	26	3	2.5
16	80	140	46	46	35	2.5	2	170	42.5	39	33	3	2.5	170	42.5	39	27	3	2.5
17	85	150	49	49	37	2.5	2	180	44.5	41	34	4	3	180	44.5	41	28	4	3
18	90	160	55	55	42	2.5	2	190	46.5	43	36	4	3	190	46.5	43	30	4	3
19	95	170	58	58	44	3	2.5	200	49.5	45	38	4	3	200	49.5	45	32	4	3
20	100	180	63	63	48	3	2.5	215	51.5	47	39	4	3	—	—	—	—	—	—
21	105	190	68	68	52	3	2.5	225	53.5	49	41	4	3	—	—	—	—	—	—
22	110	—	—	—	—	—	—	240	54.5	50	42	4	3	—	—	—	—	—	—
24	120	—	—	—	—	—	—	260	59.5	55	46	4	3	—	—	—	—	—	—
26	130	—	—	—	—	—	—	280	63.75	58	49	5	4	—	—	—	—	—	—
28	140	—	—	—	—	—	—	300	67.75	62	53	5	4	—	—	—	—	—	—
30	150	—	—	—	—	—	—	320	72	65	55	5	4	—	—	—	—	—	—
32	160	—	—	—	—	—	—	340	75	68	58	5	4	—	—	—	—	—	—
34	170	—	—	—	—	—	—	360	80	72	62	5	4	—	—	—	—	—	—
36	180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	220	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	240	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	260	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
56	280	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64	320	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
68	340	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
72	360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 2: Boundary dimensions of tapered roller bearings-4

Unit: mm

Tapered roller bearings		313						323					
Bore diameter No.	Bearing bore diameter	Bearing outside diameter	Diameter series 3					Bearing outside diameter	Diameter series 3				
			Dimension series 13						Dimension series 23				
			Assembly width	Inner ring width	Outer ring width	Chamfer dimension			Assembly width	Inner ring width	Outer ring width	Chamfer dimension	
						Inner ring	Outer ring					Inner ring	Outer ring
	d	D	T	B	C	r (min.)		D	T	B	C	r (min.)	
02	15	—	—	—	—	—	—	—	—	—	—	—	—
03	17	—	—	—	—	—	—	47	20.25	19	16	1	1
04	20	—	—	—	—	—	—	52	22.25	21	18	1.5	1.5
/22	22	—	—	—	—	—	—	—	—	—	—	—	—
05	25	—	—	—	—	—	—	62	25.25	24	20	1.5	1.5
/28	28	—	—	—	—	—	—	—	—	—	—	—	—
06	30	—	—	—	—	—	—	72	28.75	27	23	1.5	1.5
/32	32	—	—	—	—	—	—	—	—	—	—	—	—
07	35	—	—	—	—	—	—	80	32.75	31	25	2	1.5
08	40	—	—	—	—	—	—	90	35.25	33	27	2	1.5
09	45	—	—	—	—	—	—	100	38.25	36	30	2	1.5
10	50	—	—	—	—	—	—	110	42.25	40	33	2.5	2
11	55	—	—	—	—	—	—	120	45.5	43	35	2.5	2
12	60	—	—	—	—	—	—	130	48.5	46	37	3	2.5
13	65	—	—	—	—	—	—	140	51	48	39	3	2.5
14	70	—	—	—	—	—	—	150	54	51	42	3	2.5
15	75	—	—	—	—	—	—	160	58	55	45	3	2.5
16	80	—	—	—	—	—	—	170	61.5	58	48	3	2.5
17	85	—	—	—	—	—	—	180	63.5	60	49	4	3
18	90	—	—	—	—	—	—	190	67.5	64	53	4	3
19	95	—	—	—	—	—	—	200	71.5	67	55	4	3
20	100	215	56.5	51	35	4	3	215	77.5	73	60	4	3
21	105	225	58	53	36	4	3	225	81.5	77	63	4	3
22	110	240	63	57	38	4	3	240	84.5	80	65	4	3
24	120	260	68	62	42	4	3	260	90.5	86	69	4	3
26	130	280	72	66	44	5	4	—	—	—	—	—	—
28	140	300	77	70	47	5	4	—	—	—	—	—	—
30	150	320	82	75	50	5	4	—	—	—	—	—	—
32	160	—	—	—	—	—	—	—	—	—	—	—	—
34	170	—	—	—	—	—	—	—	—	—	—	—	—
36	180	—	—	—	—	—	—	—	—	—	—	—	—
38	190	—	—	—	—	—	—	—	—	—	—	—	—
40	200	—	—	—	—	—	—	—	—	—	—	—	—
44	220	—	—	—	—	—	—	—	—	—	—	—	—
48	240	—	—	—	—	—	—	—	—	—	—	—	—
52	260	—	—	—	—	—	—	—	—	—	—	—	—
56	280	—	—	—	—	—	—	—	—	—	—	—	—
60	300	—	—	—	—	—	—	—	—	—	—	—	—
64	320	—	—	—	—	—	—	—	—	—	—	—	—
68	340	—	—	—	—	—	—	—	—	—	—	—	—
72	360	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 3: Boundary dimensions of single direction thrust bearings-1

Unit: mm

Thrust ball bearings										511					512	522			
Thrust spherical roller bearings														292					
		Diameter series 0					Diameter series 1						Diameter series 2						
			Dimension series					Dimension series					Dimension series						
			70	90	10			71	91	11			72	92	12	22	22		
Bore diameter No.	Nominal bearing bore diameter	Nominal bearing outside diameter	Nominal height			Chamfer dimension	Nominal bearing outside diameter	Nominal height			Chamfer dimension	Nominal bearing outside diameter	Nominal height				Central raceway washer		Chamfer dimension	Chamfer dimension
																	Nominal bore diameter	Nominal height		
	d	D	T			r (min.)	D	T			r (min.)	D	T				d_2	B	r (min.)	r_1 (min.)
4	4	12	4	—	6	0.3	—	—	—	—	—	16	6	—	8	—	—	—	0.3	—
6	6	16	5	—	7	0.3	—	—	—	—	—	20	6	—	9	—	—	—	0.3	—
8	8	18	5	—	7	0.3	—	—	—	—	—	22	6	—	9	—	—	—	0.3	—
00	10	20	5	—	7	0.3	24	6	—	9	0.3	26	7	—	11	—	—	—	0.6	—
01	12	22	5	—	7	0.3	26	6	—	9	0.3	28	7	—	11	—	—	—	0.6	—
02	15	26	5	—	7	0.3	28	6	—	9	0.3	32	8	—	12	22	10	5	0.6	0.3
03	17	28	5	—	7	0.3	30	6	—	9	0.3	35	8	—	12	—	—	—	0.6	—
04	20	32	6	—	8	0.3	35	7	—	10	0.3	40	9	—	14	26	15	6	0.6	0.3
05	25	37	6	—	8	0.3	42	8	—	11	0.6	47	10	—	15	28	20	7	0.6	0.3
06	30	42	6	—	8	0.3	47	8	—	11	0.6	52	10	—	16	29	25	7	0.6	0.3
07	35	47	6	—	8	0.3	52	8	—	12	0.6	62	12	—	18	34	30	8	1	0.3
08	40	52	6	—	9	0.3	60	9	—	13	0.6	68	13	—	19	36	30	9	1	0.6
09	45	60	7	—	10	0.3	65	9	—	14	0.6	73	13	—	20	37	35	9	1	0.6
10	50	65	7	—	10	0.3	70	9	—	14	0.6	78	13	—	22	39	40	9	1	0.6
11	55	70	7	—	10	0.3	78	10	—	16	0.6	90	16	21	25	45	45	10	1	0.6
12	60	75	7	—	10	0.3	85	11	—	17	1	95	16	21	26	46	50	10	1	0.6
13	65	80	7	—	10	0.3	90	11	—	18	1	100	16	21	27	47	55	10	1	0.6
14	70	85	7	—	10	0.3	95	11	—	18	1	105	16	21	27	47	55	10	1	1
15	75	90	7	—	10	0.3	100	11	—	19	1	110	16	21	27	47	60	10	1	1
16	80	95	7	—	10	0.3	105	11	—	19	1	115	16	21	28	48	65	10	1	1
17	85	100	7	—	10	0.3	110	11	—	19	1	125	18	24	31	55	70	12	1	1
18	90	105	7	—	10	0.3	120	14	—	22	1	135	20	27	35	62	75	14	1.1	1
20	100	120	9	—	14	0.6	135	16	21	25	1	150	23	30	38	67	85	15	1.1	1
22	110	130	9	—	14	0.6	145	16	21	25	1	160	23	30	38	67	95	15	1.1	1
24	120	140	9	—	14	0.6	155	16	21	25	1	170	23	30	39	68	100	15	1.1	1.1
26	130	150	9	—	14	0.6	170	18	24	30	1	190	27	36	45	80	110	18	1.5	1.1
28	140	160	9	—	14	0.6	180	18	24	31	1	200	27	36	46	81	120	18	1.5	1.1
30	150	170	9	—	14	0.6	190	18	24	31	1	215	29	39	50	89	130	20	1.5	1.1
32	160	180	9	—	14	0.6	200	18	24	31	1	225	29	39	51	90	140	20	1.5	1.1
34	170	190	9	—	14	0.6	215	20	27	34	1.1	240	32	42	55	97	150	21	1.5	1.1
36	180	200	9	—	14	0.6	225	20	27	34	1.1	250	32	42	56	98	150	21	1.5	2
38	190	215	11	—	17	1	240	23	30	37	1.1	270	36	48	62	109	160	24	2	2
40	200	225	11	—	17	1	250	23	30	37	1.1	280	36	48	62	109	170	24	2	2
44	220	250	14	—	22	1	270	23	30	37	1.1	300	36	48	63	110	190	24	2	2
48	240	270	14	—	22	1	300	27	36	45	1.5	340	45	60	78	—	—	—	2.1	—
52	260	290	14	—	22	1	320	27	36	45	1.5	360	45	60	79	—	—	—	2.1	—
56	280	310	14	—	22	1	350	32	42	53	1.5	380	45	60	80	—	—	—	2.1	—
60	300	340	18	24	30	1	380	36	48	62	2	420	54	73	95	—	—	—	3	—
64	320	360	18	24	30	1	400	36	48	63	2	440	54	73	95	—	—	—	3	—

Note: 1. Dimension series **22**, **23**, and **24** are double row bearing series. For double row bearings, d_2 becomes the nominal bearing bore diameter.
2. For the outside diameter of the shaft raceway washer and the bore diameter of the housing raceway washer, see the dimension table of thrust bearings.

Appendix table - 3: Boundary dimensions of single direction thrust bearings-2

Unit: mm

Thrust ball bearings				513	523						514	524							
Thrust spherical roller bearings			293								294								
		Diameter series 3									Diameter series 4								Diameter series 5
			Dimension series									Dimension series							Dimension series
			73	93	13	23	23				74	94	14	24	24				95
Bore diameter No.	Nominal bearing bore diameter	Nominal bearing outside diameter	Nominal height				Central raceway washer	Chamfer dimension	Chamfer dimension	Nominal bearing outside diameter	Nominal height				Central raceway washer	Chamfer dimension	Chamfer dimension	Nominal bearing outside diameter	Nominal height
							Nominal bore diameter	Nominal height											
	d	D	T				d_2	B	r (min.)	r_1 (min.)	D	T			d_2	B	r (min.)	r_1 (min.)	D	T
4	4	20	7	—	11	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
6	6	24	8	—	12	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
8	8	26	8	—	12	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
00	10	30	9	—	14	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
01	12	32	9	—	14	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
02	15	37	10	—	15	—	—	—	0.6	—	—	—	—	—	—	—	—	—	—	—
03	17	40	10	—	16	—	—	—	0.6	—	—	—	—	—	—	—	—	—	52	21
04	20	47	12	—	18	—	—	—	1	—	—	—	—	—	—	—	—	—	60	24
05	25	52	12	—	18	34	20	8	1	0.3	60	16	21	24	45	15	11	1	0.6	73	29
06	30	60	14	—	21	38	25	9	1	0.3	70	18	24	28	52	20	12	1	0.6	85	34
07	35	68	15	—	24	44	30	10	1	0.3	80	20	27	32	59	25	14	1.1	0.6	100	39
08	40	78	17	22	26	49	30	12	1	0.6	90	23	30	36	65	30	15	1.1	0.6	110	42
09	45	85	18	24	28	52	35	12	1	0.6	100	25	34	39	72	35	17	1.1	0.6	120	45
10	50	95	20	27	31	58	40	14	1.1	0.6	110	27	36	43	78	40	18	1.5	0.6	135	51
11	55	105	23	30	35	64	45	15	1.1	0.6	120	29	39	48	87	45	20	1.5	0.6	150	58
12	60	110	23	30	35	64	50	15	1.1	0.6	130	32	42	51	93	50	21	1.5	0.6	160	60
13	65	115	23	30	36	65	55	15	1.1	0.6	140	34	45	56	101	50	23	2	1	170	63
14	70	125	25	34	40	72	55	16	1.1	1	150	36	48	60	107	55	24	2	1	180	67
15	75	135	27	36	44	79	60	18	1.5	1	160	38	51	65	115	60	26	2	1	190	69
16	80	140	27	36	44	79	65	18	1.5	1	170	41	54	68	120	65	27	2.1	1	200	73
17	85	150	29	39	49	87	70	19	1.5	1	180	42	58	72	128	65	29	2.1	1.1	215	78
18	90	155	29	39	50	88	75	19	1.5	1	190	45	60	77	135	70	30	2.1	1.1	225	82
20	100	170	32	42	55	97	85	21	1.5	1	210	50	67	85	150	80	33	3	1.1	250	90
22	110	190	36	48	63	110	95	24	2	1	230	54	73	95	166	90	37	3	1.1	270	95
24	120	210	41	54	70	123	100	27	2.1	1.1	250	58	78	102	177	95	40	4	1.5	300	109
26	130	225	42	58	75	130	110	30	2.1	1.1	270	63	85	110	192	100	42	4	2	320	115
28	140	240	45	60	80	140	120	31	2.1	1.1	280	63	85	112	196	110	44	4	2	340	122
30	150	250	45	60	80	140	130	31	2.1	1.1	300	67	90	120	209	120	46	4	2	360	125
32	160	270	50	67	87	153	140	33	3	1.1	320	73	95	130	226	130	50	5	2	380	132
34	170	280	50	67	87	153	150	33	3	1.1	340	78	103	135	236	135	50	5	2.1	400	140
36	180	300	54	73	95	165	150	37	3	2	360	82	109	140	245	140	52	5	3	420	145
38	190	320	58	78	105	183	160	40	4	2	380	85	115	150	—	—	—	5	—	440	150
40	200	340	63	85	110	192	170	42	4	2	400	90	122	155	—	—	—	5	—	460	155
44	220	360	63	85	112	—	—	—	4	—	420	90	122	160	—	—	—	6	—	500	170
48	240	380	63	85	112	—	—	—	4	—	440	90	122	160	—	—	—	6	—	540	180
52	260	420	73	95	130	—	—	—	5	—	480	100	132	175	—	—	—	6	—	580	190
56	280	440	73	95	130	—	—	—	5	—	520	109	145	190	—	—	—	6	—	620	206
60	300	480	82	109	140	—	—	—	5	—	540	109	145	190	—	—	—	6	—	670	224
64	320	500	82	109	140	—	—	—	5	—	580	118	155	205	—	—	—	7.5	—	710	236

Nominal bearing outside diameter	Chamfer dimension	Chamfer dimension
D	r (min.)	r_1 (min.)
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
73	0.6	0.3
85	1	0.6
100	1	0.6
120	1	0.6
135	1.1	0.6
150	1.1	0.6
160	2	1
170	2	1
180	2	1
190	2	1
200	2.1	1
215	2.1	1.1
225	2.1	1.1
250	3	1.1
270	3	1.1
300	4	1.5
320	4	2
340	4	2
360	4	2
380	5	2
400	5	2.1
420	5	3
440	5	—
460	5	—
500	6	—
540	6	—
580	6	—
620	6	—
670	6	—
710	7.5	—

Appendix table - 3: Boundary dimensions of single direction thrust bearings-3

Unit: mm

Thrust ball bearings										511	
Thrust spherical roller bearings											
Bore diameter No.	Nominal bearing bore diameter d	Diameter series 0: Nominal bearing outside diameter D	Dimension series 70: Nominal height T	Dimension series 90: Nominal height T	Dimension series 10: Nominal height T	Chamfer dimension r (min.)	Diameter series 1: Nominal bearing outside diameter D	Dimension series 71: Nominal height T	Dimension series 91: Nominal height T	Dimension series 11: Nominal height T	Chamfer dimension r (min.)
68	340	380	18	24	30	1	420	36	48	64	2
72	360	400	18	24	30	1	440	36	48	65	2
76	380	420	18	24	30	1	460	36	48	65	2
80	400	440	18	24	30	1	480	36	48	65	2
84	420	460	18	24	30	1	500	36	48	65	2
88	440	480	18	24	30	1	540	45	60	80	2.1
92	460	500	18	24	30	1	560	45	60	80	2.1
96	480	520	18	24	30	1	580	45	60	80	2.1
/500	500	540	18	24	30	1	600	45	60	80	2.1
/530	530	580	23	30	38	1.1	640	50	67	85	3
/560	560	610	23	30	38	1.1	670	50	67	85	3
/600	600	650	23	30	38	1.1	710	50	67	85	3
/630	630	680	23	30	38	1.1	750	54	73	95	3
/670	670	730	27	36	45	1.5	800	58	78	105	4
/710	710	780	32	42	53	1.5	850	63	85	112	4
/750	750	820	32	42	53	1.5	900	67	90	120	4
/800	800	870	32	42	53	1.5	950	67	90	120	4
/850	850	920	32	42	53	1.5	1 000	67	90	120	4
/900	900	980	36	48	63	2	1 060	73	95	130	5
/950	950	1 030	36	48	63	2	1 120	78	103	135	5
/1000	1 000	1 090	41	54	70	2.1	1 180	82	109	140	5
/1060	1 060	1 150	41	54	70	2.1	1 250	85	115	150	5
/1120	1 120	1 220	45	60	80	2.1	1 320	90	122	160	5
/1180	1 180	1 280	45	60	80	2.1	1 400	100	132	175	6
/1250	1 250	1 360	50	67	85	3	1 460	—	—	175	6
/1320	1 320	1 440	—	—	95	3	1 540	—	—	175	6
/1400	1 400	1 520	—	—	95	3	1 630	—	—	180	6
/1500	1 500	1 630	—	—	105	4	1 750	—	—	195	6
/1600	1 600	1 730	—	—	105	4	1 850	—	—	195	6
/1700	1 700	1 840	—	—	112	4	1 970	—	—	212	7.5
/1800	1 800	1 950	—	—	120	4	2 080	—	—	220	7.5
/1900	1 900	2 060	—	—	130	5	2 180	—	—	220	7.5
/2000	2 000	2 160	—	—	130	5	2 300	—	—	236	7.5
/2120	2 120	2 300	—	—	140	5	2 430	—	—	243	7.5
/2240	2 240	2 430	—	—	150	5	2 670	—	—	258	9.5
/2360	2 360	2 550	—	—	150	5	2 700	—	—	265	9.5
/2500	2 500	2 700	—	—	160	5	2 850	—	—	272	9.5

Note: 1. Dimension series **22**, **23**, and **24** are double row bearing series.
2. For the outside diameter of the shaft raceway washer and the bore diameter of the housing raceway washer, see the dimension table of thrust bearings.

Appendix table - 3: Boundary dimensions of single direction thrust bearings-4

Unit: mm

Thrust ball bearings					512	522				
Thrust spherical roller bearings				292						
Bore diameter No.	Nominal bearing bore diameter d	Diameter series 2: Nominal bearing outside diameter D	Dimension series 72: Nominal height T	Dimension series 92: Nominal height T	Dimension series 12: Nominal height T	Dimension series 22: Nominal height T	22: Central raceway washer: Nominal bore diameter d_2	22: Central raceway washer: Nominal height B	Chamfer dimension r (min.)	Chamfer dimension r_1(min.)
68	340	460	54	73	96	—	—	—	3	—
72	360	500	63	85	110	—	—	—	4	—
76	380	520	63	85	112	—	—	—	4	—
80	400	540	63	85	112	—	—	—	4	—
84	420	580	73	95	130	—	—	—	5	—
88	440	600	73	95	130	—	—	—	5	—
92	460	620	73	95	130	—	—	—	5	—
96	480	650	78	103	135	—	—	—	5	—
/500	500	670	78	103	135	—	—	—	5	—
/530	530	710	82	109	140	—	—	—	5	—
/560	560	750	85	115	150	—	—	—	5	—
/600	600	800	90	122	160	—	—	—	5	—
/630	630	850	100	132	175	—	—	—	6	—
/670	670	900	103	140	180	—	—	—	6	—
/710	710	950	109	145	190	—	—	—	6	—
/750	750	1 000	112	150	195	—	—	—	6	—
/800	800	1 060	118	155	205	—	—	—	7.5	—
/850	850	1 120	122	160	212	—	—	—	7.5	—
/900	900	1 180	125	170	220	—	—	—	7.5	—
/950	950	1 250	136	180	236	—	—	—	7.5	—
/1000	1 000	1 320	145	190	250	—	—	—	9.5	—
/1060	1 060	1 400	155	206	265	—	—	—	9.5	—
/1120	1 120	1 460	—	206	—	—	—	—	9.5	—
/1180	1 180	1 520	—	206	—	—	—	—	9.5	—
/1250	1 250	1 610	—	216	—	—	—	—	9.5	—
/1320	1 320	1 700	—	228	—	—	—	—	9.5	—
/1400	1 400	1 790	—	234	—	—	—	—	12	—
/1500	1 500	1 920	—	252	—	—	—	—	12	—
/1600	1 600	2 040	—	264	—	—	—	—	15	—
/1700	1 700	2 160	—	276	—	—	—	—	15	—
/1800	1 800	2 280	—	288	—	—	—	—	15	—
/1900	1 900	—	—	—	—	—	—	—	—	—
/2000	2 000	—	—	—	—	—	—	—	—	—
/2120	2 120	—	—	—	—	—	—	—	—	—
/2240	2 240	—	—	—	—	—	—	—	—	—
/2360	2 360	—	—	—	—	—	—	—	—	—
/2500	2 500	—	—	—	—	—	—	—	—	—

Appendix table - 3: Boundary dimensions of single direction thrust bearings-5

Unit: mm

Thrust ball bearings					513	523				
Thrust spherical roller bearings				293						
Bore diameter No.	Nominal bearing bore diameter d	Diameter series 3: Nominal bearing outside diameter D	Dimension series 73: Nominal height T	Dimension series 93: Nominal height T	Dimension series 13: Nominal height T	Dimension series 23: Nominal height T	Dimension series 23: Central raceway washer: Nominal bore diameter d_2	Dimension series 23: Central raceway washer: Nominal height B	Chamfer dimension r (min.)	Chamfer dimension r_1(min.)
68	340	540	90	122	160	—	—	—	5	—
72	360	560	90	122	160	—	—	—	5	—
76	380	600	100	132	175	—	—	—	6	—
80	400	620	100	132	175	—	—	—	6	—
84	420	650	103	140	180	—	—	—	6	—
88	440	680	109	145	190	—	—	—	6	—
92	460	710	112	150	195	—	—	—	6	—
96	480	730	112	150	195	—	—	—	6	—
/500	500	750	112	150	195	—	—	—	6	—
/530	530	800	122	160	212	—	—	—	7.5	—
/560	560	850	132	175	224	—	—	—	7.5	—
/600	600	900	136	180	236	—	—	—	7.5	—
/630	630	950	145	190	250	—	—	—	9.5	—
/670	670	1 000	150	200	258	—	—	—	9.5	—
/710	710	1 060	160	212	272	—	—	—	9.5	—
/750	750	1 120	165	224	290	—	—	—	9.5	—
/800	800	1 180	170	230	300	—	—	—	9.5	—
/850	850	1 250	180	243	315	—	—	—	12	—
/900	900	1 320	190	250	335	—	—	—	12	—
/950	950	1 400	200	272	355	—	—	—	12	—
/1000	1 000	1 460	—	276	—	—	—	—	12	—
/1060	1 060	1 540	—	288	—	—	—	—	15	—
/1120	1 120	1 630	—	306	—	—	—	—	15	—
/1180	1 180	1 710	—	318	—	—	—	—	15	—
/1250	1 250	1 800	—	330	—	—	—	—	19	—
/1320	1 320	1 900	—	348	—	—	—	—	19	—
/1400	1 400	2 000	—	360	—	—	—	—	19	—
/1500	1 500	2 140	—	384	—	—	—	—	19	—
/1600	1 600	2 270	—	402	—	—	—	—	19	—
/1700	1 700	—	—	—	—	—	—	—	—	—
/1800	1 800	—	—	—	—	—	—	—	—	—
/1900	1 900	—	—	—	—	—	—	—	—	—
/2000	2 000	—	—	—	—	—	—	—	—	—
/2120	2 120	—	—	—	—	—	—	—	—	—
/2240	2 240	—	—	—	—	—	—	—	—	—
/2360	2 360	—	—	—	—	—	—	—	—	—
/2500	2 500	—	—	—	—	—	—	—	—	—

Note: 1. Dimension series **22**, **23**, and **24** are double row bearing series.
2. For the outside diameter of the shaft raceway washer and the bore diameter of the housing raceway washer, see the dimension table of thrust bearings.

Appendix table - 3: Boundary dimensions of single direction thrust bearings-6

Unit: mm

Thrust ball bearings				514	524								
Thrust spherical roller bearings			294										
Bore diameter No.	Nominal bearing bore diameter d	Diameter series 4: Nominal bearing outside diameter D	Dimension series 74: Nominal height T	Dimension series 94: Nominal height T	Dimension series 14: Nominal height T	Dimension series 24: Nominal height T	Dimension series 24: Central raceway washer: Nominal bore diameter d_2	Dimension series 24: Central raceway washer: Nominal height B	Chamfer dimension r (min.)	Chamfer dimension r_1(min.)	Diameter series 5: Nominal bearing outside diameter D	Dimension series 95: Nominal height T	Chamfer dimension r (min.)
68	340	620	125	170	220	—	—	—	7.5	—	750	243	12
72	360	640	125	170	220	—	—	—	7.5	—	780	250	12
76	380	670	132	175	224	—	—	—	7.5	—	820	265	12
80	400	710	140	185	243	—	—	—	7.5	—	850	272	12
84	420	730	140	185	243	—	—	—	7.5	—	900	290	15
88	440	780	155	206	265	—	—	—	9.5	—	950	308	15
92	460	800	155	206	265	—	—	—	9.5	—	980	315	15
96	480	850	165	224	290	—	—	—	9.5	—	1 000	315	15
/500	500	870	165	224	290	—	—	—	9.5	—	1 060	335	15
/530	530	920	175	236	308	—	—	—	9.5	—	1 090	335	15
/560	560	980	190	250	335	—	—	—	12	—	1 150	355	15
/600	600	1 030	195	258	335	—	—	—	12	—	1 220	375	15
/630	630	1 090	206	280	365	—	—	—	12	—	1 280	388	15
/670	670	1 150	218	290	375	—	—	—	15	—	1 320	388	15
/710	710	1 220	230	308	400	—	—	—	15	—	1 400	412	15
/750	750	1 280	236	315	412	—	—	—	15	—	—	—	—
/800	800	1 360	250	335	438	—	—	—	15	—	—	—	—
/850	850	1 440	—	354	—	—	—	—	15	—	—	—	—
/900	900	1 520	—	372	—	—	—	—	15	—	—	—	—
/950	950	1 600	—	390	—	—	—	—	15	—	—	—	—
/1000	1 000	1 670	—	402	—	—	—	—	15	—	—	—	—
/1060	1 060	1 770	—	426	—	—	—	—	15	—	—	—	—
/1120	1 120	1 860	—	444	—	—	—	—	15	—	—	—	—
/1180	1 180	1 950	—	462	—	—	—	—	19	—	—	—	—
/1250	1 250	2 050	—	480	—	—	—	—	19	—	—	—	—
/1320	1 320	2 160	—	505	—	—	—	—	19	—	—	—	—
/1400	1 400	2 280	—	530	—	—	—	—	19	—	—	—	—
/1500	1 500	—	—	—	—	—	—	—	—	—	—	—	—
/1600	1 600	—	—	—	—	—	—	—	—	—	—	—	—
/1700	1 700	—	—	—	—	—	—	—	—	—	—	—	—
/1800	1 800	—	—	—	—	—	—	—	—	—	—	—	—
/1900	1 900	—	—	—	—	—	—	—	—	—	—	—	—
/2000	2 000	—	—	—	—	—	—	—	—	—	—	—	—
/2120	2 120	—	—	—	—	—	—	—	—	—	—	—	—
/2240	2 240	—	—	—	—	—	—	—	—	—	—	—	—
/2360	2 360	—	—	—	—	—	—	—	—	—	—	—	—
/2500	2 500	—	—	—	—	—	—	—	—	—	—	—	—

Appendix table - 4: Comparison table of SI and CGS series gravity units-1

Quantity / Unit system	Length L	Mass M	Time T	Acceleration	Force	Stress	Pressure	Energy
SI	m	kg	s	m/s^2	N	Pa	Pa	J
CGS system	cm	g	s	Gal	dyn	dyn/cm^2	dyn/cm^2	erg
Gravitation system	m	$kgf \cdot s^2/m$	s	m/s^2	kgf	kgf/m^2	kgf/m^2	$kgf \cdot m$

Appendix table - 5: SI-customary unit conversion table-1

Quantity	Unit designation	Code	Conversion rate to SI	SI unit designation	Code
Angle	Degree	°	$\pi/180$	Radian	rad
	Minute	′	$\pi/10\,800$		
	Second	″(sec)	$\pi/648\,000$		
Length	Meter	m	1	Meter	m
	Micron	μ	10^{-6}		
	Angstrom	Å	10^{-10}		
Area	Square meter	m^2	1	Square meter	m^2
	Are	a	10^2		
	Hectare	ha	10^4		
Volume	Cubic meter	m^3	1	Cubic meter	m^3
	Liter	ℓ.L	10^{-3}		
Mass	Kilogram	kg	1	Kilogram	kg
	Ton	t	10^3		
	Kilogram force / square second per meter	$kgf \cdot s^2/m$	9.806 65		
Time	Second	s	1	Second	s
	Minute	min	60		
	Hour	h	3 600		
	Day	d	86 400		
Speed	Meters per second	m/s	1	Meters per second	m/s
	Knot	kn	1 852/3 600		
Frequency and vibration	Cycle	s^{-1}(pps)	1	Hertz	Hz
Revolutions (rotational speed)	Revolutions per minute (rpm)	rpm(r/min)	1/60	Per second	s^{-1}
Angular velocity	Radians per second	rad/s	1	Radians per second	rad/s
Acceleration	Meters per square second	m/s^2	1	Meters per square second	m/s^2
	G	G	9.806 65		
Force	Kilogram force	kgf	9.806 65	Newton	N
	Ton force	tf	9 806.65		
	Dyne	dyn	10^{-5}		
Force moment	Kilogram force / meter	$kgf \cdot m$	9.806 65	Newton meter	$N \cdot m$
Inertia moment	Kilogram force / meter / square second	$kgf \cdot m \cdot s^2$	9.806 65	Kilogram / square meter	$kg \cdot m^2$
Stress	Kilogram force per square meter	kgf/m^2	9.806 65	Pascal or newton per square meter	Pa or N/m^2
Pressure	Kilogram force per square meter	kgf/m^2	9.806 65	Pascal	Pa
	Meter water column	mH_2O	9 806.65		
	Meter of mercury	mHg	101 325/0.76		
	Torr	Torr	101 325/760		
	Atmosphere	atm	101 325		
	Bar	bar	10^5		
Energy	Erg	erg	10^{-7}	Joule	J
	IT calorie	cal_{IT}	4.186 8		
	Kilogram force / meter	$kgf \cdot m$	9.806 65		
	Kilowatt hour	$kW \cdot h$	3.600×10^6		
	Metric horsepower per hour	$PS \cdot h$	$2.647\,79\times10^6$		
Power rate and power	Watt	W	1	Watt	W
	Metric horsepower	PS	735.5		
	Kilogram force / meter per second	$kgf \cdot m/s$	9.806 65		

Appendix table - 4: Comparison table of SI and CGS series gravity units-2

Quantity / Unit system	Power rate	Temperature	Viscosity	Dynamic viscosity	Magnetic flux	Flux density	Magnetic field strength
SI	W	K	$Pa \cdot s$	m^2/s	Wb	T	A/m
CGS system	erg/s	℃	P	St	Mx	Gs	Oe
Gravitation system	$kgf \cdot m/s$	℃	$kgf \cdot s/m^2$	m^2/s	—	—	—

Appendix table - 5: SI-customary unit conversion table-2

Quantity	Unit designation	Code	Conversion rate to SI	SI unit designation	Code
Viscosity	Poise	P	10^{-1}	Pascal second	Pa · s
	Centipoise	cP	10^{-3}		
	Kilogram force / square second per meter	$kgf \cdot s/m^2$	9.806 65		
Dynamic viscosity	Stoke	St	10^{-4}	Square meter per second	m^2/s
	Centistoke	cSt	10^{-6}		
Temperature	Degree	℃	+273.15	Kelvin	K
Radioactivity	Curie	Ci	3.7×10^{10}	Becquerel	Bq
Dosage	Roentgen	R	2.58×10^{-4}	Coulombs per kilogram	C/kg
Absorption dosage	Rad	rad	10^{-2}	Gray	Gy
Dosage equivalent	Rem	rem	10^{-2}	Sievert	Sv
Magnetic flux	Maxwell	Mx	10^{-8}	Weber	Wb
Flux density	Gamma	γ	10^{-9}	Tesla	T
	Gauss	Gs	10^{-4}		
Magnetic field strength	Oersted	Oe	$10^3/4\pi$	Amperes per meter	A/m
Electric charge	Coulomb	C	1	Coulomb	C
Potential difference	Volt	V	1	Volt	V
Electric resistance	Ohm	Ω	1	Ohm	Ω
Current	Ampere	A	1	Ampere	A

Appendix table - 6: Tenth power multiples of SI unit

Multiples of unit	Prefix		Multiples of unit	Prefix	
	Designation	Code		Designation	Code
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}	Atto	a

Appendix table - 7: Dimensional tolerance for shafts

Unit: μm

Diameter division mm Over	Incl.	a13 Upper	a13 Lower	c12 Upper	c12 Lower	d6 Upper	d6 Lower	e6 Upper	e6 Lower	e13 Upper	e13 Lower	f5 Upper	f5 Lower	f6 Upper	f6 Lower	g5 Upper	g5 Lower	g6 Upper	g6 Lower
—	3[1)]	- 270	- 410	- 60	- 160	- 20	- 26	- 14	- 20	- 14	- 154	- 6	-10	- 6	- 12	- 2	- 6	- 2	- 8
3	6	- 270	- 450	- 70	- 190	- 30	- 38	- 20	- 28	- 20	- 200	-10	-15	- 10	- 18	- 4	- 9	- 4	- 12
6	10	- 280	- 500	- 80	- 230	- 40	- 49	- 25	- 34	- 25	- 245	-13	-19	- 13	- 22	- 5	-11	- 5	- 14
10	18	- 290	- 560	- 95	- 275	- 50	- 61	- 32	- 43	- 32	- 302	-16	-24	- 16	- 27	- 6	-14	- 6	- 17
18	30	- 300	- 630	-110	- 320	- 65	- 78	- 40	- 53	- 40	- 370	-20	-29	- 20	- 33	- 7	-16	- 7	- 20
30	40	- 310	- 700	-120	- 370	- 80	- 96	- 50	- 66	- 50	- 440	-25	-36	- 25	- 41	- 9	-20	- 9	- 25
40	50	- 320	- 710	-130	- 380														
50	65	- 340	- 800	-140	- 440	-100	-119	- 60	- 79	- 60	- 520	-30	-43	- 30	- 49	-10	-23	-10	- 29
65	80	- 360	- 820	-150	- 450														
80	100	- 380	- 920	-170	- 520	-120	-142	- 72	- 94	- 72	- 612	-36	-51	- 36	- 58	-12	-27	-12	- 34
100	120	- 410	- 950	-180	- 530														
120	140	- 460	-1 090	-200	- 600	-145	-170	- 85	-110	- 85	- 715	-43	-61	- 43	- 68	-14	-32	-14	- 39
140	160	- 520	-1 150	-210	- 610														
160	180	- 580	-1 210	-230	- 630														
180	200	- 660	-1 380	-240	- 700	-170	-199	-100	-129	-100	- 820	-50	-70	- 50	- 79	-15	-35	-15	- 44
200	225	- 740	-1 460	-260	- 720														
225	250	- 820	-1 540	-280	- 740														
250	280	- 920	-1 730	-300	- 820	-190	-222	-110	-142	-110	- 920	-56	-79	- 56	- 88	-17	-40	-17	- 49
280	315	-1 050	-1 860	-330	- 850														
315	355	-1 200	-2 090	-360	- 930	-210	-246	-125	-161	-125	-1 015	-62	-87	- 62	- 98	-18	-43	-18	- 54
355	400	-1 350	-2 240	-400	- 970														
400	450	-1 500	-2 470	-440	-1 070	-230	-270	-135	-175	-135	-1 105	-68	-95	- 68	-108	-20	-47	-20	- 60
450	500	-1 650	-2 620	-480	-1 110														
500	560	—	—	—	—	-260	-304	-145	-189	-145	-1 245	—	—	- 76	-120	—	—	-22	- 66
560	630																		
630	710	—	—	—	—	-290	-340	-160	-210	-160	-1 410	—	—	- 80	-130	—	—	-24	- 74
710	800																		
800	900	—	—	—	—	-320	-376	-170	-226	-170	-1 570	—	—	- 86	-142	—	—	-26	- 82
900	1 000																		
1 000	1 120	—	—	—	—	-350	-416	-195	-261	-195	-1 845	—	—	- 98	-164	—	—	-28	- 94
1 120	1 250																		
1 250	1 400	—	—	—	—	-390	-468	-220	-298	-220	-2 170	—	—	-110	-188	—	—	-30	-108
1 400	1 600																		
1 600	1 800	—	—	—	—	—	—	-240	-332	-240	-2 540	—	—	-120	-212	—	—	-32	-124
1 800	2 000																		
2 000	2 240	—	—	—	—	—	—	-260	-370	-260	-3 060	—	—	-130	-240	—	—	-34	-144
2 240	2 500																		
2 500	2 800	—	—	—	—	—	—	-290	-425	-290	-3 590	—	—	-145	-280	—	—	-38	-173
2 800	3 150																		

1) Basic tolerance **a** is not used for the basic size tolerance with respect to the size of 1 mm or below shown in drawings.

Diameter division mm Over	Incl.	j5 Upper	j5 Lower	js5 Upper	js5 Lower	j6 Upper	j6 Lower	js6 Upper	js6 Lower	j7 Upper	j7 Lower	k4 Upper	k4 Lower	k5 Upper	k5 Lower	k6 Upper	k6 Lower	m5 Upper	m5 Lower
—	3	+2	- 2	+ 2	- 2	+ 4	- 2	+ 3	- 3	+ 6	- 4	+ 3	0	+ 4	0	+ 6	0	+ 6	+ 2
3	6	+3	- 2	+ 2.5	- 2.5	+ 6	- 2	+ 4	- 4	+ 8	- 4	+ 5	+1	+ 6	+1	+ 9	+1	+ 9	+ 4
6	10	+4	- 2	+ 3	- 3	+ 7	- 2	+ 4.5	- 4.5	+10	- 5	+ 5	+1	+ 7	+1	+ 10	+1	+12	+ 6
10	18	+5	- 3	+ 4	- 4	+ 8	- 3	+ 5.5	- 5.5	+12	- 6	+ 6	+1	+ 9	+1	+ 12	+1	+15	+ 7
18	30	+5	- 4	+ 4.5	- 4.5	+ 9	- 4	+ 6.5	- 6.5	+13	- 8	+ 8	+2	+11	+2	+ 15	+2	+17	+ 8
30	40	+6	- 5	+ 5.5	- 5.5	+11	- 5	+ 8	- 8	+15	-10	+ 9	+2	+13	+2	+ 18	+2	+20	+ 9
40	50																		
50	65	+6	- 7	+ 6.5	- 6.5	+12	- 7	+ 9.5	- 9.5	+18	-12	+10	+2	+15	+2	+ 21	+2	+24	+11
65	80																		
80	100	+6	- 9	+ 7.5	- 7.5	+13	- 9	+11	-11	+20	-15	+13	+3	+18	+3	+ 25	+3	+28	+13
100	120																		
120	140	+7	-11	+ 9	- 9	+14	-11	+12.5	-12.5	+22	-18	+15	+3	+21	+3	+ 28	+3	+33	+15
140	160																		
160	180																		
180	200	+7	-13	+10	-10	+16	-13	+14.5	-14.5	+25	-21	+18	+4	+24	+4	+ 33	+4	+37	+17
200	225																		
225	250																		
250	280	+7	-16	+11.5	-11.5	+16	-16	+16	-16	+26	-26	+20	+4	+27	+4	+ 36	+4	+43	+20
280	315																		
315	355	+7	-18	+12.5	-12.5	+18	-18	+18	-18	+29	-28	+22	+4	+29	+4	+ 40	+4	+46	+21
355	400																		
400	450	+7	-20	+13.5	-13.5	+20	-20	+20	-20	+31	-32	+25	+5	+32	+5	+ 45	+5	+50	+23
450	500																		
500	560	—	—	+16	-16	—	—	+22	-22	—	—	—	—	—	—	+ 44	0	—	—
560	630																		
630	710	—	—	+18	-18	—	—	+25	-25	—	—	—	—	—	—	+ 50	0	—	—
710	800																		
800	900	—	—	+20	-20	—	—	+28	-28	—	—	—	—	—	—	+ 56	0	—	—
900	1 000																		
1 000	1 120	—	—	+23.5	-23.5	—	—	+33	-33	—	—	—	—	—	—	+ 66	0	—	—
1 120	1 250																		
1 250	1 400	—	—	+27.5	-27.5	—	—	+39	-39	—	—	—	—	—	—	+ 78	0	—	—
1 400	1 600																		
1 600	1 800	—	—	+32.5	-32.5	—	—	+46	-46	—	—	—	—	—	—	+ 92	0	—	—
1 800	2 000																		
2 000	2 240	—	—	+39	-39	—	—	+55	-55	—	—	—	—	—	—	+110	0	—	—
2 240	2 500																		
2 500	2 800	—	—	+48	-48	—	—	+67.5	-67.5	—	—	—	—	—	—	+135	0	—	—
2 800	3 150																		

Unit: μm

h4 Upper	h4 Lower	h5 Upper	h5 Lower	h6 Upper	h6 Lower	h7 Upper	h7 Lower	h8 Upper	h8 Lower	h9 Upper	h9 Lower	h10 Upper	h10 Lower	h11 Upper	h11 Lower	h13 Upper	h13 Lower	js4 Upper	js4 Lower	Diameter division mm Over	Incl.
0	- 3	0	- 4	0	- 6	0	- 10	0	- 14	0	- 25	0	- 40	0	- 60	0	- 140	+ 1.5	- 1.5	—	3
0	- 4	0	- 5	0	- 8	0	- 12	0	- 18	0	- 30	0	- 48	0	- 75	0	- 180	+ 2	- 2	3	6
0	- 4	0	- 6	0	- 9	0	- 15	0	- 22	0	- 36	0	- 58	0	- 90	0	- 220	+ 2	- 2	6	10
0	- 5	0	- 8	0	- 11	0	- 18	0	- 27	0	- 43	0	- 70	0	- 110	0	- 270	+ 2.5	- 2.5	10	18
0	- 6	0	- 9	0	- 13	0	- 21	0	- 33	0	- 52	0	- 84	0	- 130	0	- 330	+ 3	- 3	18	30
0	- 7	0	-11	0	- 16	0	- 25	0	- 39	0	- 62	0	-100	0	- 160	0	- 390	+ 3.5	- 3.5	30	40
																				40	50
0	- 8	0	-13	0	- 19	0	- 30	0	- 46	0	- 74	0	-120	0	- 190	0	- 460	+ 4	- 4	50	65
																				65	80
0	-10	0	-15	0	- 22	0	- 35	0	- 54	0	- 87	0	-140	0	- 220	0	- 540	+ 5	- 5	80	100
																				100	120
0	-12	0	-18	0	- 25	0	- 40	0	- 63	0	-100	0	-160	0	- 250	0	- 630	+ 6	- 6	120	140
																				140	160
																				160	180
0	-14	0	-20	0	- 29	0	- 46	0	- 72	0	-115	0	-185	0	- 290	0	- 720	+ 7	- 7	180	200
																				200	225
																				225	250
0	-16	0	-23	0	- 32	0	- 52	0	- 81	0	-130	0	-210	0	- 320	0	- 810	+ 8	- 8	250	280
0	-18	0	-25	0	- 36	0	- 57	0	- 89	0	-140	0	-230	0	- 360	0	- 890	+ 9	- 9	280	315
0	-18	0	-25	0	- 36	0	- 57	0	- 89	0	-140	0	-230	0	- 360	0	- 890	+ 9	- 9	315	355
0	-20	0	-27	0	- 40	0	- 63	0	- 97	0	-155	0	-250	0	- 400	0	- 970	+10	-10	355	400
0	-20	0	-27	0	- 40	0	- 63	0	- 97	0	-155	0	-250	0	- 400	0	- 970	+10	-10	400	450
																				450	500
0	-22	0	-32	0	- 44	0	- 70	0	-110	0	-175	0	-280	0	- 440	0	-1 100	+11	-11	500	560
																				560	630
0	-25	0	-36	0	- 50	0	- 80	0	-125	0	-200	0	-320	0	- 500	0	-1 250	+12.5	-12.5	630	710
																				710	800
0	-28	0	-40	0	- 56	0	- 90	0	-140	0	-230	0	-360	0	- 560	0	-1 400	+14	-14	800	900
																				900	1 000
0	-33	0	-47	0	- 66	0	-105	0	-165	0	-260	0	-420	0	- 660	0	-1 650	+16.5	-16.5	1 000	1 120
																				1 120	1 250
0	-39	0	-55	0	- 78	0	-125	0	-195	0	-310	0	-500	0	- 780	0	-1 950	+19.5	-19.5	1 250	1 400
																				1 400	1 600
0	-46	0	-65	0	- 92	0	-150	0	-230	0	-370	0	-600	0	- 920	0	-2 300	+23	-23	1 600	1 800
																				1 800	2 000
0	-55	0	-78	0	-110	0	-175	0	-280	0	-440	0	-700	0	-1 100	0	-2 800	+27.5	-27.5	2 000	2 240
																				2 240	2 500
0	-68	0	-96	0	-135	0	-210	0	-330	0	-540	0	-860	0	-1 350	0	-3 300	+34	-34	2 500	2 800
																				2 800	3 150

Unit: μm

m6 Upper	m6 Lower	n5 Upper	n5 Lower	n6 Upper	n6 Lower	p5 Upper	p5 Lower	p6 Upper	p6 Lower	r6 Upper	r6 Lower	r7 Upper	r7 Lower	Basic tolerance IT2	IT3	IT5	IT7	Diameter division mm Over	Incl.
+ 8	+ 2	+ 8	+ 4	+ 10	+ 4	+10	+ 6	+ 12	+ 6	+ 16	+ 10	+ 20	+ 10	1.2	2	4	10	—	3
+ 12	+ 4	+13	+ 8	+ 16	+ 8	+17	+12	+ 20	+ 12	+ 23	+ 15	+ 27	+ 15	1.5	2.5	5	12	3	6
+ 15	+ 6	+16	+10	+ 19	+ 10	+21	+15	+ 24	+ 15	+ 28	+ 19	+ 34	+ 19	1.5	2.5	6	15	6	10
+ 18	+ 7	+20	+12	+ 23	+ 12	+26	+18	+ 29	+ 18	+ 34	+ 23	+ 41	+ 23	2	3	8	18	10	18
+ 21	+ 8	+24	+15	+ 28	+ 15	+31	+22	+ 35	+ 22	+ 41	+ 28	+ 49	+ 28	2.5	4	9	21	18	30
+ 25	+ 9	+28	+17	+ 33	+ 17	+37	+26	+ 42	+ 26	+ 50	+ 34	+ 59	+ 34	2.5	4	11	25	30	40
																		40	50
+ 30	+11	+33	+20	+ 39	+ 20	+45	+32	+ 51	+ 32	+ 60	+ 41	+ 71	+ 41	3	5	13	30	50	65
										+ 62	+ 43	+ 73	+ 43					65	80
+ 35	+13	+38	+23	+ 45	+ 23	+52	+37	+ 59	+ 37	+ 73	+ 51	+ 86	+ 51	4	6	15	35	80	100
										+ 76	+ 54	+ 89	+ 54					100	120
+ 40	+15	+45	+27	+ 52	+ 27	+61	+43	+ 68	+ 43	+ 88	+ 63	+103	+ 63	5	8	18	40	120	140
										+ 90	+ 65	+105	+ 65					140	160
										+ 93	+ 68	+108	+ 68					160	180
+ 46	+17	+51	+31	+ 60	+ 31	+70	+50	+ 79	+ 50	+106	+ 77	+123	+ 77	7	10	20	46	180	200
										+109	+ 80	+126	+ 80					200	225
										+113	+ 84	+130	+ 84					225	250
+ 52	+20	+57	+34	+ 66	+ 34	+79	+56	+ 88	+ 56	+126	+ 94	+146	+ 94	8	12	23	52	250	280
										+130	+ 98	+150	+ 98					280	315
+ 57	+21	+62	+37	+ 73	+ 37	+87	+62	+ 98	+ 62	+144	+108	+165	+108	9	13	25	57	315	355
										+150	+114	+171	+114					355	400
+ 63	+23	+67	+40	+ 80	+ 40	+95	+68	+108	+ 68	+166	+126	+189	+126	10	15	27	63	400	450
										+172	+132	+195	+132					450	500
+ 70	+26	—	—	+ 88	+ 44	—	—	+122	+ 78	+194	+150	+220	+150	11	16	30	70	500	560
										+199	+155	+225	+155					560	630
+ 80	+30	—	—	+100	+ 50	—	—	+138	+ 88	+225	+175	+255	+175	13	18	35	80	630	710
										+235	+185	+265	+185					710	800
+ 90	+34	—	—	+112	+ 56	—	—	+156	+100	+266	+210	+300	+210	15	21	40	90	800	900
										+276	+220	+310	+220					900	1 000
+106	+40	—	—	+132	+ 66	—	—	+186	+120	+316	+250	+355	+250	18	24	46	105	1 000	1 120
										+326	+260	+365	+260					1 120	1 250
+126	+48	—	—	+156	+ 78	—	—	+218	+140	+378	+300	+425	+300	21	29	54	125	1 250	1 400
										+408	+330	+455	+330					1 400	1 600
+150	+58	—	—	+184	+ 92	—	—	+262	+170	+462	+370	+520	+370	25	35	65	150	1 600	1 800
										+492	+400	+550	+400					1 800	2 000
+178	+68	—	—	+220	+110	—	—	+305	+195	+550	+440	+615	+440	30	41	77	175	2 000	2 240
										+570	+460	+635	+460					2 240	2 500
+211	+76	—	—	+270	+135	—	—	+375	+240	+685	+550	+760	+550	36	50	93	210	2 500	2 800
										+715	+580	+790	+580					2 800	3 150

Appendix table - 8: Dimensional tolerance for housing bore

Unit: μm

Diameter division mm Over	Incl.	E7 Upper	E7 Lower	E10 Upper	E10 Lower	E11 Upper	E11 Lower	E12 Upper	E12 Lower	F6 Upper	F6 Lower	F7 Upper	F7 Lower	F8 Upper	F8 Lower	G6 Upper	G6 Lower
—	3	+ 24	+ 14	+ 54	+ 14	+ 74	+ 14	+ 114	+ 14	+ 12	+ 6	+ 16	+ 6	+ 20	+ 6	+ 8	+ 2
3	6	+ 32	+ 20	+ 68	+ 20	+ 95	+ 20	+ 140	+ 20	+ 18	+ 10	+ 22	+ 10	+ 28	+ 10	+ 12	+ 4
6	10	+ 40	+ 25	+ 83	+ 25	+ 115	+ 25	+ 175	+ 25	+ 22	+ 13	+ 28	+ 13	+ 35	+ 13	+ 14	+ 5
10	18	+ 50	+ 32	+ 102	+ 32	+ 142	+ 32	+ 212	+ 32	+ 27	+ 16	+ 34	+ 16	+ 43	+ 16	+ 17	+ 6
18	30	+ 61	+ 40	+ 124	+ 40	+ 170	+ 40	+ 250	+ 40	+ 33	+ 20	+ 41	+ 20	+ 53	+ 20	+ 20	+ 7
30	40	+ 75	+ 50	+ 150	+ 50	+ 210	+ 50	+ 300	+ 50	+ 41	+ 25	+ 50	+ 25	+ 64	+ 25	+ 25	+ 9
40	50																
50	65	+ 90	+ 60	+ 180	+ 60	+ 250	+ 60	+ 360	+ 60	+ 49	+ 30	+ 60	+ 30	+ 76	+ 30	+ 29	+10
65	80																
80	100	+107	+ 72	+ 212	+ 72	+ 292	+ 72	+ 422	+ 72	+ 58	+ 36	+ 71	+ 36	+ 90	+ 36	+ 34	+12
100	120																
120	140	+125	+ 85	+ 245	+ 85	+ 335	+ 85	+ 485	+ 85	+ 68	+ 43	+ 83	+ 43	+106	+ 43	+ 39	+14
140	160																
160	180																
180	200	+146	+100	+ 285	+100	+ 390	+100	+ 560	+100	+ 79	+ 50	+ 96	+ 50	+122	+ 50	+ 44	+15
200	225																
225	250																
250	280	+162	+110	+ 320	+110	+ 430	+110	+ 630	+110	+ 88	+ 56	+108	+ 56	+137	+ 56	+ 49	+17
280	315																
315	355	+182	+125	+ 355	+125	+ 485	+125	+ 695	+125	+ 98	+ 62	+119	+ 62	+151	+ 62	+ 54	+18
355	400																
400	450	+198	+135	+ 385	+135	+ 535	+135	+ 765	+135	+108	+ 68	+131	+ 68	+165	+ 68	+ 60	+20
450	500																
500	560	+215	+145	+ 425	+145	+ 585	+145	+ 845	+145	+120	+ 76	+146	+ 76	+186	+ 76	+ 66	+22
560	630																
630	710	+240	+160	+ 480	+160	+ 660	+160	+ 960	+160	+130	+ 80	+160	+ 80	+205	+ 80	+ 74	+24
710	800																
800	900	+260	+170	+ 530	+170	+ 730	+170	+1 070	+170	+142	+ 86	+176	+ 86	+226	+ 86	+ 82	+26
900	1 000																
1 000	1 120	+300	+195	+ 615	+195	+ 855	+195	+1 245	+195	+164	+ 98	+203	+ 98	+263	+ 98	+ 94	+28
1 120	1 250																
1 250	1 400	+345	+220	+ 720	+220	+1 000	+220	+1 470	+220	+188	+110	+235	+110	+305	+110	+108	+30
1 400	1 600																
1 600	1 800	+390	+240	+ 840	+240	+1 160	+240	+1 740	+240	+212	+120	+270	+120	+350	+120	+124	+32
1 800	2 000																
2 000	2 240	+435	+260	+ 960	+260	+1 360	+260	+2 010	+260	+240	+130	+305	+130	+410	+130	+144	+34
2 240	2 500																
2 500	2 800	+500	+290	+1 150	+290	+1 640	+290	+2 390	+290	+280	+145	+355	+145	+475	+145	+173	+38
2 800	3 150																

Diameter division mm Over	Incl.	J6 Upper	J6 Lower	JS6 Upper	JS6 Lower	J7 Upper	J7 Lower	JS7 Upper	JS7 Lower	K5 Upper	K5 Lower	K6 Upper	K6 Lower	K7 Upper	K7 Lower	M6 Upper	M6 Lower
—	3	+ 2	−4	+ 3	− 3	+ 4	− 6	+ 5	− 5	0	− 4	0	− 6	0	− 10	− 2	− 8
3	6	+ 5	−3	+ 4	− 4	+ 6	− 6	+ 6	− 6	0	− 5	+2	− 6	+ 3	− 9	− 1	− 9
6	10	+ 5	−4	+ 4.5	− 4.5	+ 8	− 7	+ 7.5	− 7.5	+1	− 5	+2	− 7	+ 5	− 10	− 3	− 12
10	18	+ 6	−5	+ 5.5	− 5.5	+10	− 8	+ 9	− 9	+2	− 6	+2	− 9	+ 6	− 12	− 4	− 15
18	30	+ 8	−5	+ 6.5	− 6.5	+12	− 9	+ 10.5	− 10.5	+1	− 8	+2	− 11	+ 6	− 15	− 4	− 17
30	40	+10	−6	+ 8	− 8	+14	−11	+ 12.5	− 12.5	+2	− 9	+3	− 13	+ 7	− 18	− 4	− 20
40	50																
50	65	+13	−6	+ 9.5	− 9.5	+18	−12	+ 15	− 15	+3	−10	+4	− 15	+ 9	− 21	− 5	− 24
65	80																
80	100	+16	−6	+11	−11	+22	−13	+ 17.5	− 17.5	+2	−13	+4	− 18	+10	− 25	− 6	− 28
100	120																
120	140	+18	−7	+12.5	−12.5	+26	−14	+ 20	− 20	+3	−15	+4	− 21	+12	− 28	− 8	− 33
140	160																
160	180																
180	200	+22	−7	+14.5	−14.5	+30	−16	+ 23	− 23	+2	−18	+5	− 24	+13	− 33	− 8	− 37
200	225																
225	250																
250	280	+25	−7	+16	−16	+36	−16	+ 26	− 26	+3	−20	+5	− 27	+16	− 36	− 9	− 41
280	315																
315	355	+29	−7	+18	−18	+39	−18	+ 28.5	− 28.5	+3	−22	+7	− 29	+17	− 40	−10	− 46
355	400																
400	450	+33	−7	+20	−20	+43	−20	+ 31.5	− 31.5	+2	−25	+8	− 32	+18	− 45	−10	− 50
450	500																
500	560	—	—	+22	−22	—	—	+ 35	− 35	—	—	0	− 44	0	− 70	−26	− 70
560	630																
630	710	—	—	+25	−25	—	—	+ 40	− 40	—	—	0	− 50	0	− 80	−30	− 80
710	800																
800	900	—	—	+28	−28	—	—	+ 45	− 45	—	—	0	− 56	0	− 90	−34	− 90
900	1 000																
1 000	1 120	—	—	+33	−33	—	—	+ 52.5	− 52.5	—	—	0	− 66	0	−105	−40	−106
1 120	1 250																
1 250	1 400	—	—	+39	−39	—	—	+ 62.5	− 62.5	—	—	0	− 78	0	−125	−48	−126
1 400	1 600																
1 600	1 800	—	—	+46	−46	—	—	+ 75	− 75	—	—	0	− 92	0	−150	−58	−150
1 800	2 000																
2 000	2 240	—	—	+55	−55	—	—	+ 87.5	− 87.5	—	—	0	−110	0	−175	−68	−178
2 240	2 500																
2 500	2 800	—	—	+67.5	−67.5	—	—	+105	−105	—	—	0	−135	0	−210	−76	−211
2 800	3 150																

Unit: μm

G7 Upper	G7 Lower	H6 Upper	H6 Lower	H7 Upper	H7 Lower	H8 Upper	H8 Lower	H9 Upper	H9 Lower	H10 Upper	H10 Lower	H11 Upper	H11 Lower	H13 Upper	H13 Lower	Diameter division mm Over	Incl.
+ 12	+ 2	+ 6	0	+ 10	0	+ 14	0	+ 25	0	+ 40	0	+ 60	0	+ 140	0	—	3
+ 16	+ 4	+ 8	0	+ 12	0	+ 18	0	+ 30	0	+ 48	0	+ 75	0	+ 180	0	3	6
+ 20	+ 5	+ 9	0	+ 15	0	+ 22	0	+ 36	0	+ 58	0	+ 90	0	+ 220	0	6	10
+ 24	+ 6	+ 11	0	+ 18	0	+ 27	0	+ 43	0	+ 70	0	+ 110	0	+ 270	0	10	18
+ 28	+ 7	+ 13	0	+ 21	0	+ 33	0	+ 52	0	+ 84	0	+ 130	0	+ 330	0	18	30
+ 34	+ 9	+ 16	0	+ 25	0	+ 39	0	+ 62	0	+100	0	+ 160	0	+ 390	0	30	40
																40	50
+ 40	+10	+ 19	0	+ 30	0	+ 46	0	+ 74	0	+120	0	+ 190	0	+ 460	0	50	65
																65	80
+ 47	+12	+ 22	0	+ 35	0	+ 54	0	+ 87	0	+140	0	+ 220	0	+ 540	0	80	100
																100	120
+ 54	+14	+ 25	0	+ 40	0	+ 63	0	+100	0	+160	0	+ 250	0	+ 630	0	120	140
																140	160
																160	180
+ 61	+15	+ 29	0	+ 46	0	+ 72	0	+115	0	+185	0	+ 290	0	+ 720	0	180	200
																200	225
																225	250
+ 69	+17	+ 32	0	+ 52	0	+ 81	0	+130	0	+210	0	+ 320	0	+ 810	0	250	280
																280	315
+ 75	+18	+ 36	0	+ 57	0	+ 89	0	+140	0	+230	0	+ 360	0	+ 890	0	315	355
																355	400
+ 83	+20	+ 40	0	+ 63	0	+ 97	0	+155	0	+250	0	+ 400	0	+ 970	0	400	450
																450	500
+ 92	+22	+ 44	0	+ 70	0	+110	0	+175	0	+280	0	+ 440	0	+1 100	0	500	560
																560	630
+104	+24	+ 50	0	+ 80	0	+125	0	+200	0	+320	0	+ 500	0	+1 250	0	630	710
																710	800
+116	+26	+ 56	0	+ 90	0	+140	0	+230	0	+360	0	+ 560	0	+1 400	0	800	900
																900	1 000
+133	+28	+ 66	0	+105	0	+165	0	+260	0	+420	0	+ 660	0	+1 650	0	1 000	1 120
																1 120	1 250
+155	+30	+ 78	0	+125	0	+195	0	+310	0	+500	0	+ 780	0	+1 950	0	1 250	1 400
																1 400	1 600
+182	+32	+ 92	0	+150	0	+230	0	+370	0	+600	0	+ 920	0	+2 300	0	1 600	1 800
																1 800	2 000
+209	+34	+110	0	+175	0	+280	0	+440	0	+700	0	+1 100	0	+2 800	0	2 000	2 240
																2 240	2 500
+248	+38	+135	0	+210	0	+330	0	+540	0	+860	0	+1 350	0	+3 300	0	2 500	2 800
																2 800	3 150

Unit: μm

M7 Upper	M7 Lower	N6 Upper	N6 Lower	N7 Upper	N7 Lower	P6 Upper	P6 Lower	P7 Upper	P7 Lower	R6 Upper	R6 Lower	R7 Upper	R7 Lower	Diameter division mm Over	Incl.
− 2	− 12	− 4	− 10	− 4	− 14	− 6	− 12	− 6	− 16	− 10	− 16	− 10	− 20	—	3
0	− 12	− 5	− 13	− 4	− 16	− 9	− 17	− 8	− 20	− 12	− 20	− 11	− 23	3	6
0	− 15	− 7	− 16	− 4	− 19	− 12	− 21	− 9	− 24	− 16	− 25	− 13	− 28	6	10
0	− 18	− 9	− 20	− 5	− 23	− 15	− 26	− 11	− 29	− 20	− 31	− 16	− 34	10	18
0	− 21	− 11	− 24	− 7	− 28	− 18	− 31	− 14	− 35	− 24	− 37	− 20	− 41	18	30
0	− 25	− 12	− 28	− 8	− 33	− 21	− 37	− 17	− 42	− 29	− 45	− 25	− 50	30	40
														40	50
0	− 30	− 14	− 33	− 9	− 39	− 26	− 45	− 21	− 51	− 35 − 37	− 54 − 56	− 30 − 32	− 60 − 62	50 65	65 80
0	− 35	− 16	− 38	− 10	− 45	− 30	− 52	− 24	− 59	− 44 − 47	− 66 − 69	− 38 − 41	− 73 − 76	80 100	100 120
0	− 40	− 20	− 45	− 12	− 52	− 36	− 61	− 28	− 68	− 56 − 58 − 61	− 81 − 83 − 86	− 48 − 50 − 53	− 88 − 90 − 93	120 140 160	140 160 180
0	− 46	− 22	− 51	− 14	− 60	− 41	− 70	− 33	− 79	− 68 − 71 − 75	− 97 −100 −104	− 60 − 63 − 67	−106 −109 −113	180 200 225	200 225 250
0	− 52	− 25	− 57	− 14	− 66	− 47	− 79	− 36	− 88	− 85 − 89	−117 −121	− 74 − 78	−126 −130	250 280	280 315
0	− 57	− 26	− 62	− 16	− 73	− 51	− 87	− 41	− 98	− 97 −103	−133 −139	− 87 − 93	−144 −150	315 355	355 400
0	− 63	− 27	− 67	− 17	− 80	− 55	− 95	− 45	−108	−113 −119	−153 −159	−103 −109	−166 −172	400 450	450 500
−26	− 96	− 44	− 88	− 44	−114	− 78	−122	− 78	−148	−150 −155	−194 −199	−150 −155	−220 −225	500 560	560 630
−30	−110	− 50	−100	− 50	−130	− 88	−138	− 88	−168	−175 −185	−225 −235	−175 −185	−225 −265	630 710	710 800
−34	−124	− 56	−112	− 56	−146	−100	−156	−100	−190	−210 −220	−266 −276	−210 −220	−300 −310	800 900	900 1 000
−40	−145	− 66	−132	− 66	−171	−120	−186	−120	−225	−250 −260	−316 −326	−250 −260	−355 −365	1 000 1 120	1 120 1 250
−48	−173	− 78	−156	− 78	−203	−140	−218	−140	−265	−300 −330	−378 −408	−300 −330	−425 −455	1 250 1 400	1 400 1 600
−58	−208	− 92	−184	− 92	−242	−170	−262	−170	−320	−370 −400	−462 −492	−370 −400	−520 −550	1 600 1 800	1 800 2 000
−68	−243	−110	−220	−110	−285	−195	−305	−195	−370	−440 −460	−550 −570	−440 −460	−615 −635	2 000 2 240	2 240 2 500
−76	−286	−135	−270	−135	−345	−240	−375	−240	−450	−550 −580	−685 −715	−550 −580	−760 −790	2 500 2 800	2 800 3 150

Appendix table - 9: Basic tolerance

Unit: mm

Basic dimension mm		IT basic tolerance class									
Over	Incl.	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10
—	3	0.8	1.2	2	3	4	6	10	14	25	40
3	6	1	1.5	2.5	4	5	8	12	18	30	48
6	10	1	1.5	2.5	4	6	9	15	22	36	58
10	18	1.2	2	3	5	8	11	18	27	43	70
18	30	1.5	2.5	4	6	9	13	21	33	52	84
30	50	1.5	2.5	4	7	11	16	25	39	62	100
50	80	2	3	5	8	13	19	30	46	74	120
80	120	2.5	4	6	10	15	22	35	54	87	140
120	180	3.5	5	8	12	18	25	40	63	100	160
180	250	4.5	7	10	14	20	29	46	72	115	185
250	315	6	8	12	16	23	32	52	81	130	210
315	400	7	9	13	18	25	36	57	89	140	230
400	500	8	10	15	20	27	40	63	97	155	250
500	630	9	11	16	22	30	44	70	110	175	280
630	800	10	13	18	25	35	50	80	125	200	320
800	1 000	11	15	21	29	40	56	90	140	230	360
1 000	1 250	13	18	24	34	46	66	105	165	260	420
1 250	1 600	15	21	29	40	54	78	125	195	310	500
1 600	2 000	18	25	35	48	65	92	150	230	370	600
2 000	2 500	22	30	41	57	77	110	175	280	440	700
2 500	3 150	26	36	50	69	93	135	210	330	540	860

Appendix table -10: Viscosity conversion table

Dynamic viscosity mm^2/s	Saybolt SUS (second)	Redwood R (second)	Engler E (degree)
2.7	35	32.2	1.18
4.3	40	36.2	1.32
5.9	45	40.6	1.46
7.4	50	44.9	1.60
8.9	55	49.1	1.75
10.4	60	53.5	1.88
11.8	65	57.9	2.02
13.1	70	62.3	2.15
14.5	75	67.6	2.31
15.8	80	71.0	2.42
17.0	85	75.1	2.55
18.2	90	79.6	2.68
19.4	95	84.2	2.81
20.6	100	88.4	2.95
23.0	110	97.1	3.21
25.0	120	105.9	3.49
27.5	130	114.8	3.77
29.8	140	123.6	4.04
32.1	150	132.4	4.32
34.3	160	141.1	4.59
36.5	170	150.0	4.88
38.8	180	158.8	5.15
41.0	190	167.5	5.44
43.2	200	176.4	5.72
47.5	220	194.0	6.28
51.9	240	212	6.85
56.5	260	229	7.38
60.5	280	247	7.95
64.9	300	265	8.51
70.3	325	287	9.24
75.8	350	309	9.95
81.2	375	331	10.7
86.8	400	353	11.4
92.0	425	375	12.1
97.4	450	397	12.8

Dynamic viscosity mm^2/s	Saybolt SUS (second)	Redwood R (second)	Engler E (degree)
103	475	419	13.5
108	500	441	14.2
119	550	485	15.6
130	600	529	17.0
141	650	573	18.5
152	700	617	19.9
163	750	661	21.3
173	800	705	22.7
184	850	749	24.2
195	900	793	25.6
206	950	837	27.0
217	1 000	882	28.4
260	1 200	1 058	34.1
302	1 400	1 234	39.8
347	1 600	1 411	45.5
390	1 800	1 587	51
433	2 000	1 763	57
542	2 500	2 204	71
650	3 000	2 646	85
758	3 500	3 087	99
867	4 000	3 526	114
974	4 500	3 967	128
1 082	5 000	4 408	142
1 150	5 500	4 849	156
1 300	6 000	5 290	170
1 400	6 500	5 730	185
1 510	7 000	6 171	199
1 630	7 500	6 612	213
1 740	8 000	7 053	227
1 850	8 500	7 494	242
1 960	9 000	7 934	256
2 070	9 500	8 375	270
2 200	10 000	8 816	284

Appendix table -11: Kgf to N conversion table

kgf		N	kgf		N	kgf		N
0.1020	1	9.8066	3.4670	34	333.43	6.8321	67	657.04
0.2039	2	19.613	3.5690	35	343.23	6.9341	68	666.85
0.3059	3	29.420	3.6710	36	353.04	7.0361	69	676.66
0.4079	4	39.227	3.7730	37	362.85	7.1380	70	686.46
0.5099	5	49.033	3.8749	38	372.65	7.2400	71	696.27
0.6118	6	58.840	3.9769	39	382.46	7.3420	72	706.08
0.7138	7	68.646	4.0789	40	392.27	7.4440	73	715.88
0.8158	8	78.453	4.1808	41	402.07	7.5459	74	725.69
0.9177	9	88.260	4.2828	42	411.88	7.6479	75	735.50
1.0197	10	98.066	4.3848	43	421.68	7.7499	76	745.30
1.1217	11	107.87	4.4868	44	431.49	7.8518	77	755.11
1.2237	12	117.68	4.5887	45	441.30	7.9538	78	764.92
1.3256	13	127.49	4.6907	46	451.10	8.0558	79	774.72
1.4276	14	137.29	4.7927	47	460.91	8.1578	80	784.53
1.5296	15	147.10	4.8946	48	470.72	8.2597	81	794.34
1.6316	16	156.91	4.9966	49	480.52	8.3617	82	804.14
1.7335	17	166.71	5.0986	50	490.33	8.4637	83	813.95
1.8355	18	176.52	5.2006	51	500.14	8.5656	84	823.76
1.9375	19	186.33	5.3025	52	509.94	8.6676	85	833.56
2.0394	20	196.13	5.4045	53	519.75	8.7696	86	843.37
2.1414	21	205.94	5.5065	54	529.56	8.8716	87	853.18
2.2434	22	215.75	5.6085	55	539.36	8.9735	88	862.98
2.3454	23	225.55	5.7104	56	549.17	9.0755	89	872.79
2.4473	24	235.36	5.8124	57	558.98	9.1775	90	882.60
2.5493	25	245.17	5.9144	58	568.78	9.2794	91	892.40
2.6513	26	254.97	6.0163	59	578.59	9.3814	92	902.21
2.7532	27	264.78	6.1183	60	588.40	9.4834	93	912.02
2.8552	28	274.59	6.2203	61	598.20	9.5854	94	921.82
2.9572	29	284.39	6.3223	62	608.01	9.6873	95	931.63
3.0592	30	294.20	6.4242	63	617.82	9.7893	96	941.44
3.1611	31	304.01	6.5262	64	627.62	9.8913	97	951.24
3.2631	32	313.81	6.6282	65	637.43	9.9932	98	961.05
3.3651	33	323.62	6.7302	66	647.24	10.0952	99	970.86

[How to read the table] If for example you want to convert 10 kgf to N, find "10" in the middle column of the first set of columns on the right. Look in the N column directly to the right of "10," and you will see that 10 kgf equals 98.066 N. Also, to convert 10 N to kgf, look in the kgf column to the right of "10" and you will see that 10 N equals 1.0197 kgf.

1 kgf = 9.80665 N
1 N = 0.101972 kgf

Appendix table -12: Inch / millimeter conversion table

Inch		0″	1″	2″	3″	4″	5″	6″	7″	8″	9″
Fraction	Decimal										
			25.400	50.800	76.200	101.600	127.000	152.400	177.800	203.200	228.600
1/64	0.015625	0.397	25.797	51.197	76.597	101.997	127.397	152.797	178.197	203.597	228.997
1/32	0.031250	0.794	26.194	51.594	76.994	102.394	127.794	153.194	178.594	203.994	229.394
3/64	0.046875	1.191	26.591	51.991	77.391	102.791	128.191	153.591	178.991	204.391	229.791
1/16	0.062500	1.588	26.988	52.388	77.788	103.188	128.588	153.988	179.388	204.788	230.188
5/64	0.078125	1.984	27.384	52.784	78.184	103.584	128.984	154.384	179.784	205.184	230.584
3/32	0.093750	2.381	27.781	53.181	78.581	103.981	129.381	154.781	180.181	205.581	230.981
7/64	0.109375	2.778	28.178	53.578	78.978	104.378	129.778	155.178	180.578	205.978	231.378
1/ 8	0.125000	3.175	28.575	53.975	79.375	104.775	130.175	155.575	180.975	206.375	231.775
9/64	0.140625	3.572	28.972	54.372	79.772	105.172	130.572	155.972	181.372	206.772	232.172
5/32	0.156250	3.969	29.369	54.769	80.169	105.569	130.969	156.369	181.769	207.169	232.569
11/64	0.171875	4.366	29.766	55.166	80.566	105.966	131.366	156.766	182.166	207.566	232.966
3/16	0.187500	4.762	30.162	55.562	80.962	106.362	131.762	157.162	182.562	207.962	233.362
13/64	0.203125	5.159	30.559	55.959	81.359	106.759	132.159	157.559	182.959	208.359	233.759
7/32	0.218750	5.556	30.956	56.356	81.756	107.156	132.556	157.956	183.356	208.756	234.156
15/64	0.234375	5.953	31.353	56.753	82.153	107.553	132.953	158.353	183.753	209.153	234.553
1/ 4	0.250000	6.350	31.750	57.150	82.550	107.950	133.350	158.750	184.150	209.550	234.950
17/64	0.265625	6.747	32.147	57.547	82.947	108.347	133.747	159.147	184.547	209.947	235.347
9/32	0.281250	7.144	32.544	57.944	83.344	108.744	134.144	159.544	184.944	210.344	235.744
19/64	0.296875	7.541	32.941	58.341	83.741	109.141	134.541	159.941	185.341	210.741	236.141
5/16	0.312500	7.938	33.338	58.738	84.138	109.538	134.938	160.338	185.738	211.138	236.538
21/64	0.328125	8.334	33.734	59.134	84.534	109.934	135.334	160.734	186.134	211.534	236.934
11/32	0.343750	8.731	34.131	59.531	84.931	110.331	135.731	161.131	186.531	211.931	237.331
23/64	0.359375	9.128	34.528	59.928	85.328	110.728	136.128	161.528	186.928	212.328	237.728
3/ 8	0.375000	9.525	34.925	60.325	85.725	111.125	136.525	161.925	187.325	212.725	238.125
25/64	0.390625	9.922	35.322	60.722	86.122	111.522	136.922	162.322	187.722	213.122	238.522
13/32	0.406250	10.319	35.719	61.119	86.519	111.919	137.319	162.719	188.119	213.519	238.919
27/64	0.421875	10.716	36.116	61.516	86.916	112.316	137.716	163.116	188.516	213.916	239.316
7/16	0.437500	11.112	36.512	61.912	87.312	112.721	138.112	163.512	188.912	214.312	239.712
29/64	0.453125	11.509	36.909	62.309	87.709	113.109	138.509	163.909	189.309	214.709	240.109
15/32	0.468750	11.906	37.306	62.706	88.106	113.506	138.906	164.306	189.706	215.106	240.506
31/64	0.484375	12.303	37.703	63.103	88.503	113.903	139.303	164.703	190.103	215.503	240.903
1/ 2	0.500000	12.700	38.100	63.500	88.900	114.300	139.700	165.100	190.500	215.900	241.300
33/64	0.515625	13.097	38.497	63.897	89.297	114.697	140.097	165.497	190.897	216.297	241.697
17/32	0.531250	13.494	38.894	64.294	89.694	115.094	140.494	165.894	191.294	216.694	242.094
35/64	0.546875	13.891	39.291	64.691	90.091	115.491	140.891	166.291	191.691	217.091	242.491
9/16	0.562500	14.288	39.688	65.088	90.488	115.888	141.283	166.688	192.088	217.488	242.888
37/64	0.578125	14.684	40.084	65.484	90.884	116.284	141.684	167.084	192.484	217.884	243.284
19/32	0.593750	15.081	40.481	65.881	91.281	116.681	142.081	167.481	192.881	218.281	243.681
39/64	0.609375	15.478	40.878	66.278	91.678	117.078	142.478	167.878	193.278	218.678	244.078
5/ 8	0.625000	15.875	41.275	66.675	92.075	117.475	142.875	168.275	193.675	219.075	244.475
41/64	0.640625	16.272	41.672	67.072	92.472	117.872	143.272	168.672	194.072	219.472	244.872
21/32	0.656250	16.669	42.069	67.469	92.869	118.269	143.669	169.069	194.469	219.869	245.269
43/64	0.671875	17.066	42.466	67.866	93.266	118.666	144.066	169.466	194.866	220.266	245.666
11/16	0.687500	17.462	42.862	68.262	93.662	119.062	144.462	169.862	195.262	220.662	246.062
45/64	0.703125	17.859	43.259	68.659	94.059	119.459	144.859	170.259	195.659	221.056	246.459
23/32	0.718750	18.256	43.656	69.056	94.456	119.856	145.256	170.656	196.056	221.456	246.856
47/64	0.734375	18.653	44.053	69.453	94.853	120.253	145.653	171.053	196.453	221.853	247.253
3/ 4	0.750000	19.050	44.450	69.850	95.250	120.650	146.050	171.450	196.850	222.250	247.650
49/64	0.765625	19.447	44.847	70.247	95.647	121.047	146.447	171.847	197.247	222.647	248.047
25/32	0.781250	19.844	45.244	70.644	96.044	121.444	146.844	172.244	197.644	223.044	248.444
51/64	0.796875	20.241	45.641	71.041	96.441	121.841	147.241	172.641	198.041	223.441	248.841
13/16	0.812500	20.638	46.038	71.438	96.838	122.238	147.638	173.038	198.438	223.838	249.238
53/64	0.828125	21.034	46.434	71.834	97.234	122.634	148.034	173.434	198.834	224.234	249.634
27/32	0.843750	21.431	46.831	72.231	97.631	123.031	148.431	173.831	199.231	224.631	250.031
55/64	0.859375	21.828	47.228	72.628	98.028	123.428	148.828	174.228	199.628	225.028	250.428
7/ 8	0.875000	22.225	47.625	73.025	98.425	123.825	149.225	174.625	200.025	225.425	250.825
57/64	0.890625	22.622	48.022	73.422	98.822	124.222	149.622	175.022	200.422	225.822	251.222
29/32	0.906250	23.019	48.419	73.819	99.219	124.619	150.019	175.419	200.819	226.219	251.619
59/64	0.921875	23.416	48.816	74.216	99.616	125.016	150.416	175.816	201.216	226.616	252.016
15/16	0.937500	23.812	49.212	74.612	100.012	125.412	150.812	176.212	201.612	227.012	252.412
61/64	0.953125	24.209	49.609	75.009	100.409	125.809	151.209	176.609	202.009	227.409	252.809
31/32	0.968750	24.606	50.006	75.406	100.806	126.206	151.606	177.006	202.406	227.806	253.206
63/64	0.984375	25.003	50.403	75.803	101.203	126.603	152.003	177.403	202.803	228.203	253.603

Appendix table -13: Hardness conversion table (reference)-1

Rockwell hardness	Vickers hardness	Brinell hardness		Rockwell hardness		Shore hardness
C scale 1 471.0 N		Standard steel balls	Tungsten carbide steel balls	A scale 588.4 N	B scale 980.7 N	
68	940			85.6		97
67	900			85.0		95
66	865			84.5		92
65	832		739	83.9		91
64	800		722	83.4		88
63	772		705	82.8		87
62	746		688	82.3		85
61	720		670	81.8		83
60	697		654	81.2		81
59	674		634	80.7		80
58	653		615	80.1		78
57	633		595	79.6		76
56	613		577	79.0		75
55	595	—	560	78.5		74
54	577	—	543	78.0		72
53	560	—	525	77.4		71
52	544	500	512	76.8		69
51	528	487	496	76.3		68
50	513	475	481	75.9		67
49	498	464	469	75.2		66
48	484	451	455	74.7		64
47	471	442	443	74.1		63
46	458	432	432	73.6		62
45	446	421	421	73.1		60
44	434	409	409	72.5		58
43	423	400	400	72.0		57
42	412	390	390	71.5		56
41	402	381	381	70.9		55
40	392	371	371	70.4	—	54
39	382	362	362	69.9	—	52
38	372	353	353	69.4	—	51
37	363	344	344	68.9	—	50
36	354	336	336	68.4	(109.0)	49
35	345	327	327	67.9	(108.5)	48
34	336	319	319	67.4	(108.0)	47
33	327	311	311	66.8	(107.5)	46

Note: Quoted from hardness conversion table (SAE J 417)

Appendix table -13: Hardness conversion table (reference)-2

Rockwell hardness	Vickers hardness	Brinell hardness		Rockwell hardness		Shore hardness
C scale 1 471.0 N		Standard steel balls	Tungsten carbide steel balls	A scale 588.4 N	B scale 980.7 N	
32	318	301	301	66.3	(107.0)	44
31	310	294	294	65.8	(106.0)	43
30	302	286	286	65.3	(105.5)	42
29	294	279	279	64.7	(104.5)	41
28	286	271	271	64.3	(104.0)	41
27	279	264	264	63.8	(103.0)	40
26	272	258	258	63.3	(102.5)	38
25	266	253	253	62.8	(101.5)	38
24	260	247	247	62.4	(101.0)	37
23	254	243	243	62.0	100.0	36
22	248	237	237	61.5	99.0	35
21	243	231	231	61.0	98.5	35
20	238	226	226	60.5	97.8	34
(18)	230	219	219	—	96.7	33
(16)	222	212	212	—	95.5	32
(14)	213	203	203	—	93.9	31
(12)	204	194	194	—	92.3	29
(10)	196	187	187		90.7	28
(8)	188	179	179		89.5	27
(6)	180	171	171		87.1	26
(4)	173	165	165		85.5	25
(2)	166	158	158		83.5	24
(0)	160	152	152		81.7	24

Note: Quoted from hardness conversion table (SAE J 417)

Appendix table -14: Kg to lb conversion table

kg		lb	kg		lb	kg		lb
0.454	1	2.205	15.422	34	74.957	30.391	67	147.71
0.907	2	4.409	15.876	35	77.162	30.844	68	149.91
1.361	3	6.614	16.329	36	79.366	31.298	69	152.12
1.814	4	8.818	16.783	37	81.571	31.751	70	154.32
2.268	5	11.023	17.237	38	83.776	32.205	71	156.53
2.722	6	13.228	17.690	39	85.980	32.659	72	158.73
3.175	7	15.432	18.144	40	88.185	33.112	73	160.94
3.629	8	17.637	18.597	41	90.390	33.566	74	163.14
4.082	9	19.842	19.051	42	92.594	34.019	75	165.35
4.536	10	22.046	19.504	43	94.799	34.473	76	167.55
4.990	11	24.251	19.958	44	97.003	34.927	77	169.76
5.443	12	26.455	20.412	45	99.208	35.380	78	171.96
5.897	13	28.660	20.865	46	101.41	35.834	79	174.17
6.350	14	30.865	21.319	47	103.62	36.257	80	176.37
6.804	15	33.069	21.772	48	105.82	36.741	81	178.57
7.257	16	35.274	22.226	49	108.03	37.195	82	180.78
7.711	17	37.479	22.680	50	110.23	37.648	83	182.98
8.165	18	39.683	23.133	51	112.44	38.102	84	185.19
8.618	19	41.888	23.587	52	114.64	38.555	85	187.39
9.072	20	44.092	24.040	53	116.84	39.009	86	189.60
9.525	21	46.297	24.494	54	119.05	39.463	87	191.80
9.979	22	48.502	24.948	55	121.25	39.916	88	194.01
10.433	23	50.706	25.401	56	123.46	40.370	89	196.21
10.886	24	62.911	26.855	57	125.66	40.823	90	198.42
11.340	25	55.116	26.308	58	127.87	41.277	91	200.62
11.793	26	57.320	26.762	59	130.07	41.730	92	202.83
12.247	27	59.525	27.216	60	132.28	42.184	93	205.03
12.701	28	61.729	27.669	61	134.48	42.638	94	207.23
13.154	29	63.934	28.123	62	136.69	43.091	95	209.44
13.608	30	66.139	28.576	63	138.69	43.546	96	211.64
14.061	31	68.343	29.030	64	141.10	43.996	97	213.85
14.515	32	70.548	29.484	65	143.30	44.452	98	216.05
14.969	33	72.753	29.937	66	145.51	44.906	99	218.26

[How to read the table] If for example you want to convert 10 kg to lb, find "10" in the middle column of the first set of columns on the right. Look in the lb column directly to the right of "10," and you will see that 10 kg equals 22.046 lb. Also, to convert 10 lb to kg, look in the kg column to the left of "10" and you will see that 10 lb equals 4.536 kg.

1 kg = 2.2046226 lb
1 lb = 0.45359237 kg

Appendix table -15: °C to °F conversion table

°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	51.0	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	12.6	55	131.0	34.4	94	201.2	288	550	1 022
− 8.3	17	62.6	13.3	56	132.8	35.0	95	203.0	316	600	1 112
− 7.8	18	64.4	13.9	57	134.6	35.6	96	204.6	343	650	1 202
− 7.2	19	66.2	14.4	58	136.4	36.1	97	206.6	371	700	1 292
− 6.7	20	68.0	15.0	59	138.2	36.7	98	208.4	399	750	1 382
− 6.1	21	69.8	15.6	60	140.0	37.2	99	210.2	427	800	1 472
− 5.6	22	71.5	15.1	61	141.8	37.8	100	212.0	454	850	1 562
− 5.0	23	73.4	16.7	62	143.6	38.3	101	213.8	482	900	1 652
− 4.4	24	76.2	17.2	63	145.4	38.9	102	215.6	510	950	1 742
− 3.9	25	77.0	17.8	64	147.2	39.4	103	217.4	538	1000	1 832
− 3.3	26	78.8	18.3	65	149.0	40.0	104	219.2	593	1100	2 012
− 2.8	27	80.5	18.9	66	150.8	40.6	105	221.0	649	1200	2 192
− 2.2	28	82.4	19.4	67	152.6	41.1	106	222.6	704	1300	2 372
− 1.7	29	84.2	20.0	68	154.4	41.7	107	224.6	760	1400	2 562
− 1.1	30	86.0	20.6	69	156.2	42.2	108	226.4	816	1500	2 732
− 0.6	31	87.8	21.1	70	158.0	42.8	109	228.2	871	1600	2 912

[How to read the table] If for example you want to convert 10 °C to °F, find "10" in the middle column of the first set of columns. Look in the °F column directly to the right of "10", and you will see that 10 °C equals 50.0 °F. Also, to convert 10 °F to °C, look in the °C column to the left of "10" and you will see that 10 °F equals -12.2 °C.

[Conversion formula]

$℃ = \frac{5}{9}(℉ - 32)$

$℉ = 32 + \frac{9}{5}℃$

Appendix table -16: Greek alphabet list

Roman type (upright)	Italic type (slanted)		Name
Upper case	Upper case	Lower case	
Α	*Α*	*α*	Alpha
Β	*Β*	*β*	Beta
Γ	*Γ*	*γ*	Gamma
Δ	*Δ*	*δ*	Delta
Ε	*Ε*	*ε*	Epsilon
Ζ	*Ζ*	*ζ*	Zeta
Η	*Η*	*η*	Eta
Θ	*Θ*	*θ*	Theta
Ι	*Ι*	*ι*	Iota
Κ	*Κ*	*κ*	Kappa
Λ	*Λ*	*λ*	Lambda
Μ	*Μ*	*μ*	Mu
Ν	*Ν*	*ν*	Nu
Ξ	*Ξ*	*ξ*	Xi
Ο	*Ο*	*ο*	Omicron
Π	*Π*	*π*	Pi
Ρ	*Ρ*	*ρ*	Rho
Σ	*Σ*	*σ*	Sigma
Τ	*Τ*	*τ*	Tau
Υ	*Υ*	*υ*	Upsilon
Φ	*Φ*	*φ*	Phi
Χ	*Χ*	*χ*	Chi
Ψ	*Ψ*	*ψ*	Psi
Ω	*Ω*	*ω*	Omega

MEMO

MEMO

NTN corporation

◀ Sales Network

NOTE : The appearance and specifications may be changed without prior notice if required to improve performance. Although care has been taken to assure the accuracy of the data compiled in this catalog, **NTN** does not assume any liability to any company or person for errors or omissions.