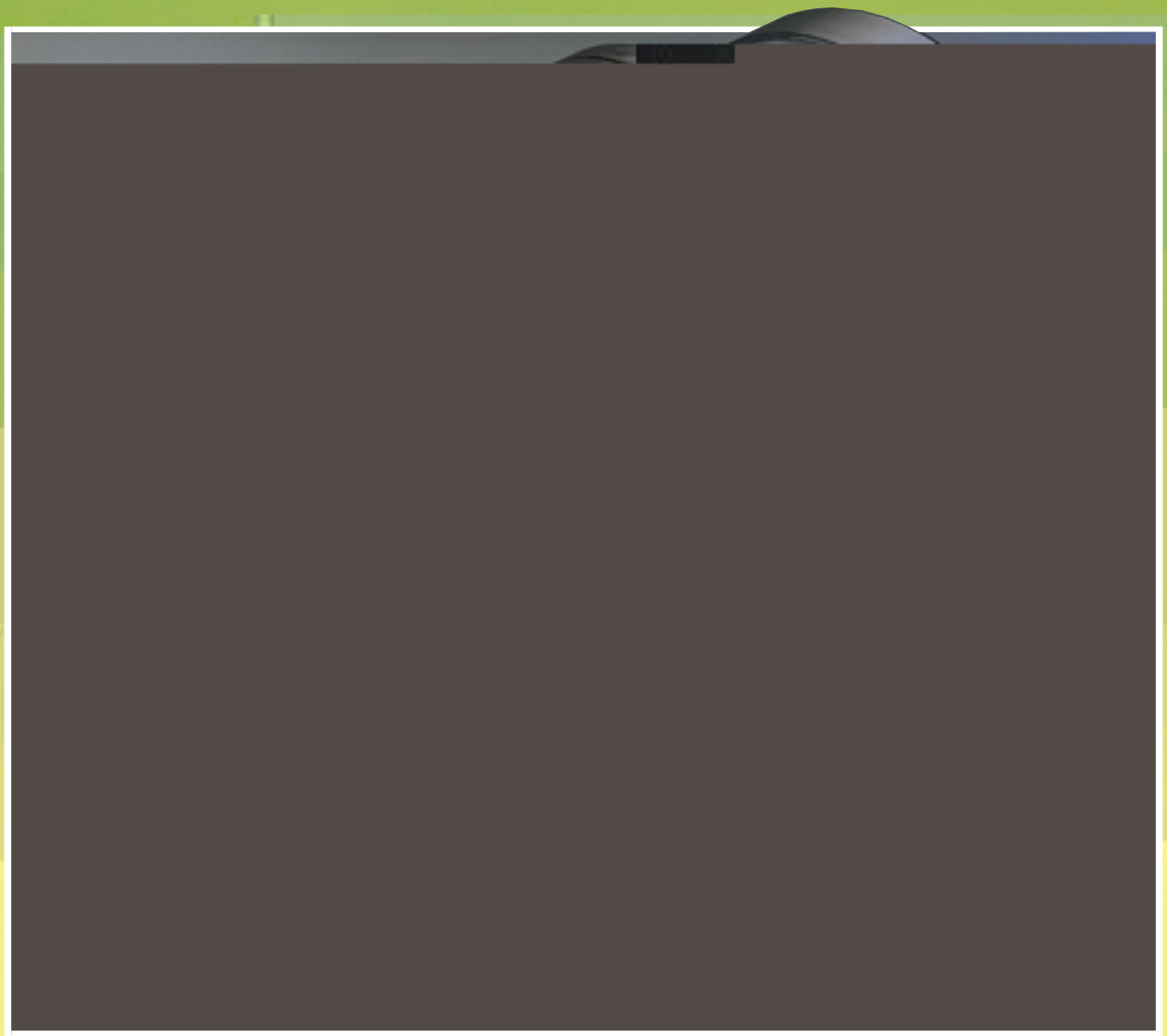
For New Technology Network

NTN®

NTN corporation

Ball and Roller Bearings



CAT. NO. 2202-Ⅷ/E

Technical Data A- 5

Deep Groove Ball Bearings B- 5

Miniature and Extra Small Bearings B- 31

Angular Contact Ball Bearings B- 43

Self-Aligning Ball Bearings B- 65

Cylindrical Roller Bearings B- 77

Tapered Roller Bearings B-119

Spherical Roller Bearings

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Ball and Roller Bearin2b

CAD data of model numbers given in the catalog is available as an electronic catalog. For information, please contact NTN Engineerin2.

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Classification and Characteristics of Rolling Bearings

Classification and Characteristics of Rolling Bearings

1.3 Characteristics of rolling bearings

1.3.1 Characteristics of rolling bearings

R

H

(1)

(2)

Angular contact ball bearings



Tapered roller bearings

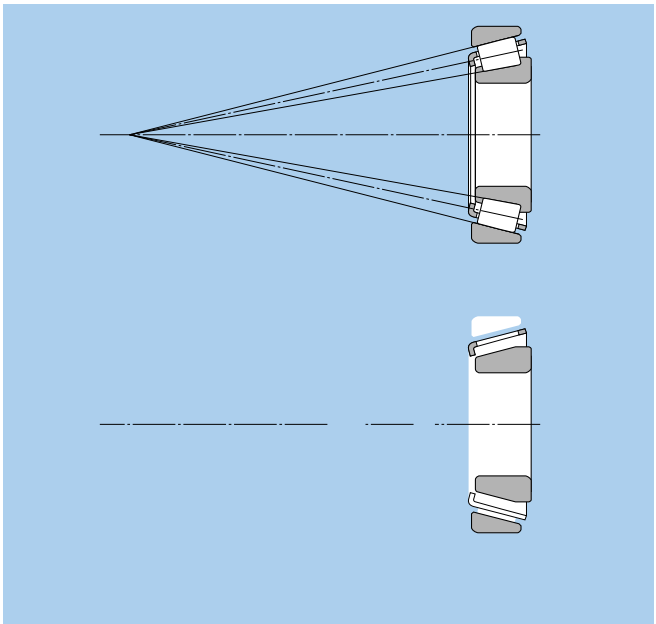
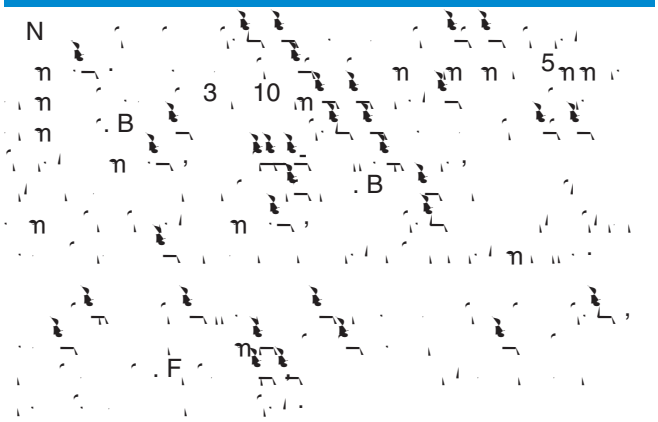


Fig. 1.3 Tapered roller bearings

Needle roller bearings



Bearing unit

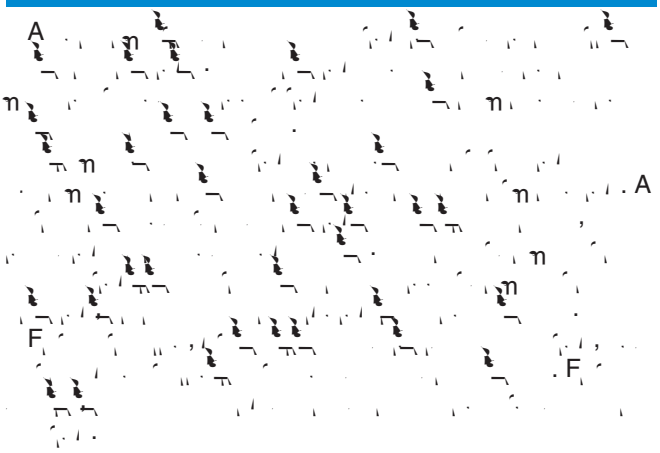
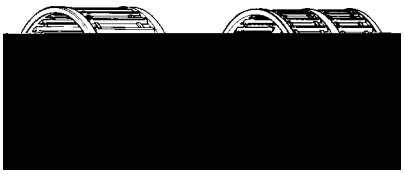
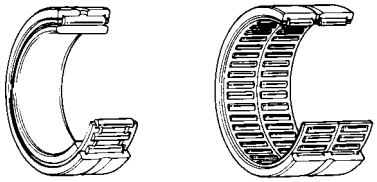
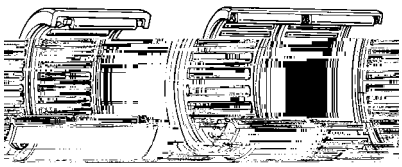
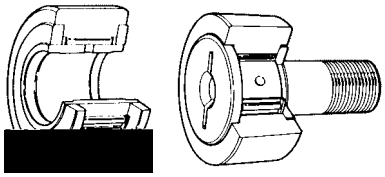


Table 1.9 Main types of needle roller bearings

Type	Needle roller bearing with cage
Configuration	
	Solid type needle roller bearings
	
	Shell type needle roller bearings
	
	Roller follower Cam follower
	

2. Bearing Selection

Rolling element bearings are available in a variety of types, configurations, and sizes. When selecting the correct bearing for your application, it is important to consider several factors, and analyse in various means.

A comparison of the performance characteristics for each bearing type is shown in **Table 2.1**. As a general guideline, the basic procedure for selecting the most appropriate bearing is shown in the following flow chart.

2.1 Bearing selection flow chart



(1) Dimensional limitations

The allowable space for bearings is generally limited. In most cases, shaft diameter (or the bearing bore diameter) has been determined according to the machine's other design specifications. Therefore, bearing's type and dimensions are determined according to bearing bore diameters. For this reason all dimension tables are organized according to standard bore diameters. There is a wide range of standardized bearing types and dimensions: the right one for a particular application can usually be found in these tables.

(2) Bearing load

The characteristics, magnitude, and direction of loads acting upon a bearing are extremely variable. In general, the basic load ratings shown in bearing dimension tables indicate their load capacity. However, in determining the appropriate bearing type, consideration must also be given to whether the acting load is a radial load only or combined radial and axial load, etc. When ball and roller bearings within the same dimension series are considered, the roller bearings have a larger load capacity and are also capable of withstanding greater vibration and shock loads.

(3) Rotational speed

The allowable speed of a bearing will differ depending upon bearing type, size, tolerances, cage type, load, lubricating conditions, and cooling conditions.

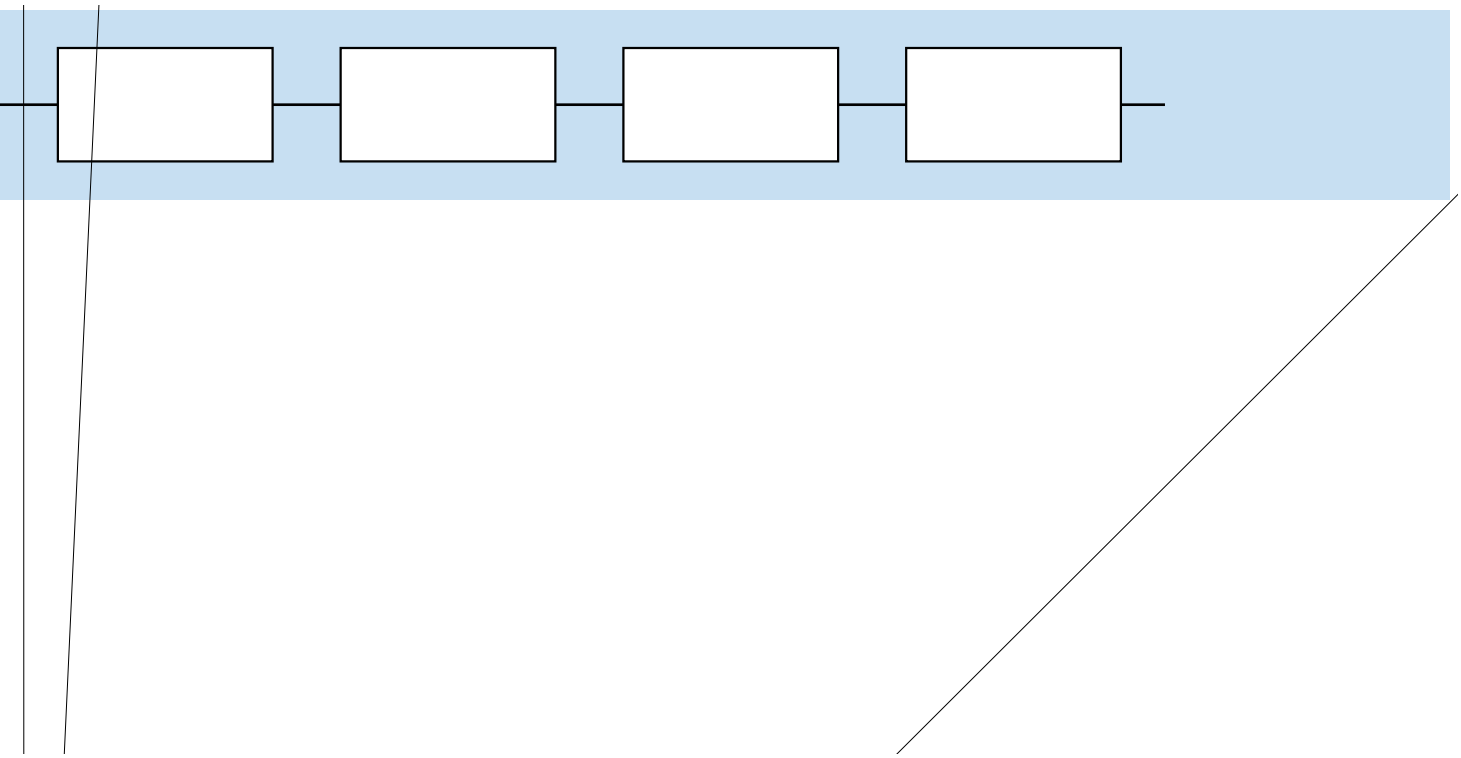
The allowable speeds listed in the bearing tables for grease and oil lubrication are for normal tolerance **NTN** bearings. In general, deep groove ball bearings, angular contact ball bearings, and cylindrical roller bearings are most suitable for high speed applications.

(4) Bearing tolerances

The dimensional accuracy and operating tolerances of bearings are regulated by ISO and JIS standards. For equipment requiring high tolerance shaft runout or high speed operation, bearings with Class 5 tolerance or higher are recommended. Deep groove ball bearings, angular contact ball bearings, and cylindrical roller bearings are recommended for high rotational tolerances.

(5) Rigidity

Elastic deformation occurs along the contact surfaces of a bearing's rolling elements and raceway surfaces under loading. With certain types of equipment it is necessary to reduce this deformation as much as



possible. Roller bearings exhibit less elastic deformation than ball bearings. Furthermore, in some cases, bearings are given a load in advance (preloaded) to increase their rigidity. This procedure is commonly applied to deep groove ball bearings, angular contact ball bearings, and tapered roller bearings.

(6) Misalignment of inner and outer rings

Shaft flexure, variations in shaft or housing accuracy, and fitting errors. result in a certain degree of misalignment between the bearing's inner and outer rings. In cases where the degree of misalignment is relatively large, self-aligning ball bearings, spherical roller bearings, or bearing units with self-aligning properties are the most appropriate choices. (Refer to **Fig. 2.1**)

(7) Noise and torque levels

Rolling bearings are manufactured and processed according to high precision standards, and therefore generally produce only slight amounts of noise and torque. For applications requiring particularly low-noise or low-torque operation, deep groove ball bearings and cylindrical roller bearings are most appropriate.

(8) Installation and disassembly

Some applications require frequent disassembly and reassembly to enable periodic inspections and repairs. For such applications, bearings with separable inner/outer rings, such as cylindrical roller bearings, needle roller bearings, and tapered roller bearings are most appropriate. Incorporation of adapter sleeves simplifies the installation and disassembly of self-aligning ball bearings and spherical roller bearings with tapered bores.

Fig. 2.1

2.3 Selection of bearing arrangement

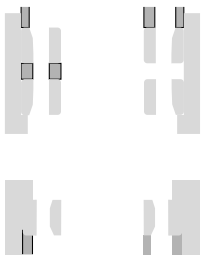
Shafts or axles are generally supported by a pair of bearings in the axial and radial directions. The bearing which prevents axial movement of the shaft relative to the housing is called the "**fixed side bearing**" and the bearing which allows axial movement relatively is called the "**floating-side bearing**". This allows for expansion and contraction of the shaft due to temperature variation and enables error in bearing mounting clearance to be absorbed.

The **fixed side bearing** is able to support radial and axial loads. A bearing which 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.

In applications with short distances between bearings, shaft expansion and contraction due to temperature fluctuations is slight, therefore the same type of bearing may be used for both the fixed-side and floating-side bearing. In such cases it is common to use a set of matching bearings, such as angular contact ball bearings, to guide and support the shaft in one axial direction only.

Table 2.2 (1) shows typical bearing arrangements where the bearing type differs on the fixed side and floating side. **Table 2.2 (2)** shows some common bearing arrangements where no distinction is made between the fixed side and floating side. Vertical shaft bearing arrangements are shown in **Table 2.2 (3)**.

	1. General arrangement for use in small machines. 2. Preload is sometimes applied by placing a spring on the outer ring side surface or inserting a shim. (can be floating-side bearings.)	
	1. Back to back arrangement is preferable to face to face arrangement when moment load applied. 2. Able to support axial and radial loads; suitable for high-speed rotation. 3. Rigidity of shaft can be enhanced by providing preload.	
	1. Capable of supporting extra heavy loads and impact loads. 2. Suitable if inner and outer ring tight fit is required. 3. Care must be taken that axial clearance does not become too small during operation.	
	1. Withstands heavy and shock loads. Wide range application. 2. Shaft rigidity can be enhanced by providing preload, but make sure preload is not excessive. 3. Back-to-back arrangement for moment loads, and face-to-face arrangement to alleviate fitting errors. 4. With face-to-face arrangement, inner ring tight fit is facilitated.	

	1. When fixing bearing is a duplex angular contact ball bearing, floating bearing should be a cylindrical roller bearing.	
	1. Most suitable arrangement for very heavy axial loads. 2. Shaft deflection and mounting error can be absorbed by matching the center of the spherical surface with the center of spherical roller thrust bearings.	

3. Load Rating and Life

3.1 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 causes flaking of these surfaces to occur. This flaking is due to material fatigue and will eventually cause the 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 flaking 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, scuffing, 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.

3.2 Basic rating 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 flaking due to material fatigue occurs. 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 under which the basic rating life of the bearing is 1 million revolutions. This is expressed as pure radial load for radial bearings and pure axial load for

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 life (see formula 3.3).

- Dynamic viscosity of lubricating oil is too low for bearing operating temperature
  (13 mm^2gmperature

The basic static load rating refers to a fixed static load limit at which a specified amount of permanent deformation occurs. It applies to pure radial loads for radial bearings and to pure axial loads for thrust bearings. The maximum applied load values for contact stress occurring at the rolling element and raceway contact points are given below.

For ball bearings	4,200 MPa {428kgf/mm^2}
For self-aligning ball bearings	4,600 MPa {469kgf/mm^2}
For roller bearings	4,000 MPa {408kgf/mm^2}

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

3.6 Allowable static equivalent load

Generally the static equivalent load which can be permitted (See page A-25) is limited by the basic static rating load as stated in **Section 3.5**. However, depending on requirements regarding friction and smooth operation, these limits may be greater or lesser than the basic static rating load.

This is generally determined by taking the safety factor So given in **Table 3.5** and formula (3.7) into account.

$$S_0 = C_0 / P_0 \cdots (3.7)$$

where,

S_0 : Safety factor
C_0 : Basic static load rating, N {kgf}
(radial bearings: C_{0r}, thrust bearings: C_{0a})
P_0 : Static equivalent load, N {kgf}
(radial: P_{0r}, thrust: C_{0a})

Table 3.5 Minimum safety factor values S_0

Operating conditions	Ball bearings	Roller bearings
High rotational accuracy demand	2	3
Normal rotating accuracy demand (Universal application)	1	1.5
Slight rotational accuracy deterioration permitted (Low speed, heavy loading, etc.)	0.5	1

Note 1: For spherical thrust roller bearings, min. S_0 value=4.
2: For shell needle roller bearings, min. S_0 value=3.
3: 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.
4: If a large axial load is applied to deep groove ball bearings or angular ball bearings, the contact oval may exceed the raceway surface. For more information, please contact **NTN** Engineering.

T c m e be i g l d he f ce hich c he h f bei g ed b he be i g m be de e mi ed. L d hich c he h f di el ed i cl de de d l d f he , l d d ced he he m chi e e f m k, d l d d ced b , mi i f d mic f ce. The e c he e ic ll be m he m ic ll c lc l ed, b c lc l i i diffic l i m c e .

A me h d f c lc l i g l d h c h f h c e d mic f ce, hich i he im , lic i f be i g , i ided he ei .

4.1 Load acting on shafts

4.1.1 Load factor

The e e m i ce he e he c l e i l h f l d i m ch g e e h he he e ic ll c lc l ed l d, d e m chi e ib i d/ , h ck. Thi c l h f l d c be f d b i g f m l (4.1).

$$K = {}_{w} \cdot K_c \quad \cdots\cdots (4.1)$$

he e,

K : Ac l h f l d N {kgf}

${}_{w}$: L d f c , (**Table 4.1**)

K_c : The e ic ll c lc l ed l e N {kgf}

Table 4.1 Load factor ${}_{w}$

Am f h ck	w	A lic i
Ve , li le , h ck	1.0～1.2	Elec ic m chi e , m chi e l , me i g i , me .
Ligh h ck	1.2～1.5	R il ehicle , m bile , lli g mill , me l ki g m chi e , e, m ki g m chi e , i c, f e ile m chi e , elec ic l i , ffice m chi e .
He h ck	1.5～3.0	C , he , g ic l , l e i me , c , c i e i me , c , e .

$$K_s = K_t \cdot \alpha \quad \text{(S ge)} \quad \cdots\cdots (4.3a)$$

$$= K_t \cdot \frac{\alpha}{\beta} \quad \text{(Helic l ge)} \quad \cdots\cdots (4.3b)$$

$$K_r = \sqrt{K_t^2 + K_s^2} \quad \cdots\cdots (4.4)$$

$$K_a = K_t \cdot \beta \quad \text{(Helic l ge)} \quad \cdots\cdots (4.5)$$

he e,

K_t : T ge i l ge , l d (ge i l f ce), N kgf

K_s : R di l ge , l d (e i g f ce), N kgf

K_r : Righ gle h f l d (e l f ce f ge i l f ce d e i g f ce), N kgf

K_a : P llel l d h f , N kgf

(2)Loads acting on cross shafts

Ge , l d c i g , igh , h be el ge , d i , l be el ge , c h f e h i **Figs. 4.4** d **4.5**. The c lc l i me h d f he e ge , l d e h i **Table 4.3**. He ei c lc l e ge , l d f , , igh be el ge , he heli gle **β** = 0.

The mb l d j ed i **Table 4.3** e f ll :

K_t : T ge i l ge , l d (ge i l f ce), N kgf
K_s : R di l ge , l d (e , i g f ce), N kgf
K_a : P , llel h f l d (i l d), N kgf
H : T , mi i f ce, k
n : R , i l eed, mi $^{-1}$
D_{pm} : Me j ch ci cle di me e , mm
α : Ge , e e gle, deg
β : Heli gle, deg
δ : Pi ch c e gle, deg

Bec e he h f i e , ec he el i hi f i i d ge , l d i f ll :

$$K_{sp} = K_{ag} \cdots\cdots (4.6)$$
$$K_{ap} = K_{sg} \cdots\cdots (4.7)$$

he e,
K_{sp}, K_{sg} : Pi i d

4.1.3 Chain / belt shaft load

The ge i l d cke , lle he e, (k d) i , mi ed b me f ch i , bel c be c lc l ed b f mul (4.8).

$$K_t = \frac{19.1 \times 10^6 \cdot H}{D_p \cdot n} \quad \text{N}$$
$$= \frac{1.95 \times 10^6 \cdot H}{D_p \cdot n} \quad \{\text{kgf}\} \qquad \cdots\cdots\cdots\cdots (4.8)$$

he e,

K_t : S cke / lle ge i l d, N kgf
H : T mi ed f ce, k
D_p : S cke / lle ich di me e, mm

F bel d i e , i i l e i lied gi e ffficie c e i g e i he bel d lle . T ki g hi e i i cc he , di l d ci g he lle e e ed b f mul (4.9). F ch i d i e he me f mul c l be ed if ib i d h ck l d e ke i c ide i .

$$K_r = {}_b \cdot K_t \cdots (4.9)$$

he e,

K_r : S cke , lle , di l d, N kgf
${}_b$: Ch i , bel f c , (**Table 4.4**)

Table. 4.4 chain or belt factor ${}_b$

Ch i , bel e	${}_b$
Ch i (i gle)	1.2～1.5
V-bel	1.5～2.0
Ti mi g bel	1.1～1.3
Fl bel (e i lle)	2.5～3.0
Fl bel	3.0～4.0

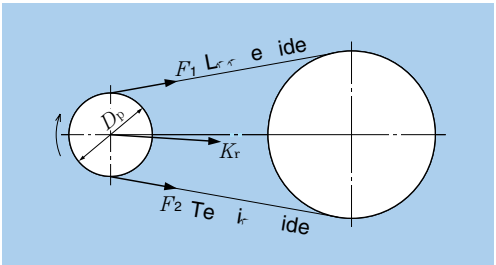


Fig. 4.6 Chain / belt loads

4.2 Bearing load distribution

F h f i g he ic e i i ide ed be ed b he be i g , d l d ci g he h f e di ib ed he be i g .

F e mul le, i he ge h f e mbl de ic ed i **Fig. 4.7** he lied be i g l d c be f d b i g f mul (4.10) d (4.11).

Thi e mul le i im le c e, b i e li , m f he c lc l i e ie c m lic ed.

$$F_{rA} = \frac{+}{} F_{\mathrm{I}} + \frac{P}{+P} F_{\mathrm{II}} \qquad \cdots\cdots\cdots\cdots (4.10)$$

$$F_{rB} = - \frac{}{} F_{\mathrm{I}} + \frac{}{+P} F_{\mathrm{II}} \qquad \cdots\cdots\cdots\cdots (4.11)$$

he e,

F_{rA} : R di l d be i g A, N kgf
F_{rB} : R di l d be i g B, N kgf
$F_{\mathrm{I}}, F_{\mathrm{II}}$: R di l d h f , N kgf

If di ec i f , di l d diffe he ec , m f e ch e ec i e l d m be de e mi ed.

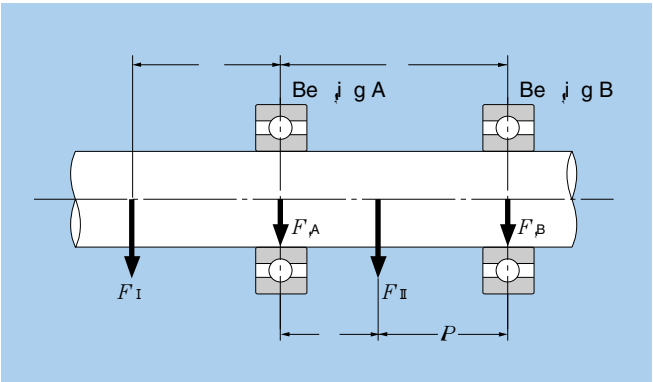


Fig. 4.7

4.3 Mean load

The l d be i g ed i n chi e de , n l ci c n ce ill, i n c e , fl c e cc di g fi ed i me e i d , l ed e i ched le. The l d be i g e i g de , ch c di i c be c e ed me l d (F_m) hi i l d hich gi e be i g he me life he ld h e de , c e i g c di i .

(1) Fluctuating stepped load

The me be i g l d, F_m, f , e ed l d i c lc l ed f n f n l (4.12). F_1 , F_2 ..... F_n e he l d c i g he be i g; n_1, n_2.....n_n d t_1, t_2..... t_n e he be i g eed d e i g i me e ec i el .

$$F_m = \left\{ \frac{\Sigma (F_i^{\,p} n_i t_i)}{\Sigma (n_i t_i)} \right\}^{1/p} \cdots\cdots\cdots\cdots\cdots\cdots (4.12)$$

he e:

p=3 F , b ll be i g
p=10/3 F , lle , be i g



(3) Linear fluctuating load

The me l d, F_m, c be i n ed b f n l (4.14).

$$F_m = \frac{F_{mi} + 2F_m}{3} \cdots (4.14)$$

4.4 Equivalent load

4.4.1 Dynamic equivalent load

he b h d mic , di l d d d mic i l l d c be i g he me i me he h he ic l l d c i g he ce e, f he be i g hich gi e he be i g he me life if he h d l , di l d , l i l di c lled he d mic e i le l d.

F , di l be i g hi l di e e ed e , di l d di c lled he d mic e i le , di l d. F h, be i g i e e ed e il d, di c lled he d mic e i le i l d.

(1) Dynamic equivalent radial load

The d mic e i le , di l di e e ed b f n l (4.17).

$$P_r = XF_r + F_a \cdots\cdots\cdots\cdots (4.17)$$

he e,

P_r : D mic e i le , di l d, N kgf
F_r : Ac l , di l d, N kgf
F_a : Ac l i l d, N kgf
X : R di l d f c ,
: A i l d f c ,

The l e f , X d e li ed i he be i g ble .

(2) Dynamic equivalent axial load

A , le, d d h, be i g l h c c gle f 90° c c ,, , di l d . H e e, elf- lig i c h, , lle, be i g c cce , me , di l d. T d mic e i le i l d f he e be i g gi e i f n l (4.18).

$$P_a = F_a + 1.2F_r \cdots\cdots\cdots\cdots (4.18)$$

he e,

P_a : D mic e i le
F_a : Ac l i l d,
F_r : Ac l , di l

P ided h $F_r / F_a \leqq 0.5$

4.4.2 Static equivalent

The ice i l
ld c e he
m he il
ele me
c di
i l

he e,

P_{or} : S ic e i le , di d, N kgf
F_r : Ac l , di l d, N gf
F_a : Ac l i l d, N gf
X_o : S ic , di l d f c
$_o$: S ic i l d f c

The l e f , X_o d $_o$ e gi e he e ec i e be i g ble .

(2) Static equivalent axial load

F , he ic l h, , lle, be i g e ic i l di e e ed b f n l 21).

$$P_{oa} = F_a + 2.7F_r \cdots (4.21)$$

he e,

P_{oa} : S ice i le
F_a : Ac l i l d
F_r : Ac l , di l

P ided h $F_r / F_a \leqq 0$

4.4.3 Load calculat bearings a

F , g l be i g h h be i

he be i g

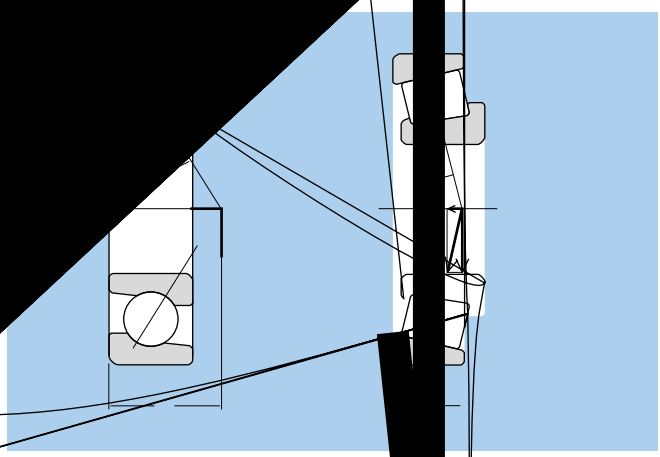
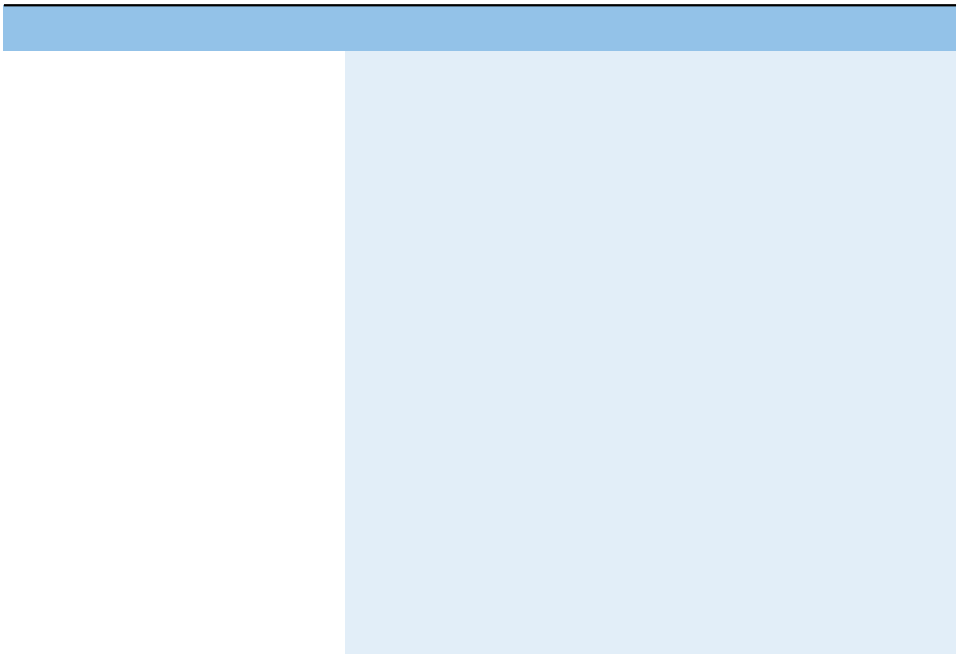


Fig. 4.12 Pressure cone apex and component force



4.5 Bearing rating life and load calculation examples

I he e m le gi e i hi ec i , f he , e f c lc l i , ll h he ic l d f c , ell ll c lc l ed d f c , m be e med be i cl ded i he e l d l e .

(Example 1)
h i he ig life i h , f e i (L_{10h}) f dee g e b ll be j g **6208** e i g i l eed n = 650 mi $^{-1}$, h , di l d F_r f 3.2 kN 326 kgf ?

F m f m l (4.17) he d mic e i le , di l d:

$$P_r = F_r = 3.2\text{kN} \{326\text{kgf}\}$$

B ic d mic l d ig C, f be j g 6208 gi e ge B-12 i 29.1 kN 2970 kgf , b ll be j g eed f c , f el i e i l eed n = 650 mi $^{-1}$ f m **Fig. 3.1** i = 0.37. Th life f c , h f m f m l (3.5) i :

$$_h = {}_n\frac{C_r}{P_r} = 0.37 \times \frac{29.1}{3.2} = 3.36$$

The ef e, h $_h$ = 3.36 f m **Fig. 3.1** he ed life, L_{10h}, i i m el 19,000 h , .

(Example 2)
h i he life ig L_{10h} f he me be j g d c di i i **Example 1**, b h ddi i l i l d F_a f 1.8 kN 184 kgf ?

T fi d he d mic e i le , di l d l e f P_r, he , di l d f c , X d i l d f c , e ed. B ic ic l d ig C_r, f be j g 6208 gi e ge B-12 i 17.8 kN 1820 kgf d i 14.0. The ef e:

$$\frac{\cdot F_a}{C_{or}} = \frac{14 \times 1.8}{17.8} = 1.42$$

C lc l i g b he i l i e, l i me h d gi e ge B-13, = 0.30.
F he e ig , di l d d i l d:

$$\frac{F_a}{F_r} = \frac{1.8}{3.2} = 0.56 > = 0.30$$

F m ge B-13 X = 0.56 d = 1.44, d f m f m l (4.17) he e i le , di l d, P_r, i :

$$P_r = XF_r + F_a = 0.56 \times 3.2 + 1.43 \times 1.8$$
$$= 4.38 \text{ kN } \{447\text{kgf}\}$$

F m Fig. 3.1 d f m l (3.1) he life f c , h, i :

$$_h = {}_n\frac{C_r}{P_r} = 0.37 \times \frac{29.1}{4.38} = 2.46$$

The ef e, h life f c , h = 2.46, f m **Fig. 3.1** he ed life, L_{10h}, i i m el 7,500 h , .

(Example 3)
De e mi e he i m m m del mbe , f , c li d ic l lle , be j g e i g he i l eed n = 450 mi $^{-1}$ h , di l d F_r f 200 kN 20,400kgf , d hich m h e life (L_{10h}) f e , 20,000 h , .

F m **Fig. 3.1** he life f c , h = 3.02 (L_{10h} 20,000), d he eed f c , n = 0.46 (n = 450 mi $^{-1}$). T fi d he e i ed b ic d mic l d ig, C_r, f m l (3.1) i ed.

$$C_r = {}_n\frac{h}{} P_r = \frac{3.02}{0.46} \times 200$$
$$= 1{,}313\text{kN } \{134{,}000\text{kgf}\}$$

F m ge B-92 he m lle be j g h f lfill ll he e i e me i **NU2336** (C_r = 1,380 kN 141,000kgf).

E ll he e i le , di ll df , be j g Ⅱi :

$$\frac{F_{a\text{Ⅱ}}}{F_{r\text{Ⅱ}}} = \frac{1.87}{4.18} = 0.45 < = 0.36$$

$$P_{r\text{Ⅱ}} = XF_{r\text{Ⅱ}} + \ _{\text{Ⅱ}}F_{a\text{Ⅱ}} = 0.4 \times 4.18 + 1.67 \times 1.87$$

$$= 4.79\text{kN} \ \{489\text{kgf}\}$$

F m f , n l (3.5) d **Fig. 3.1** he life f c , $_{h}$, f , e ch be j g i

$$_{h\text{I}} = \ _{n}\frac{C_{r\text{I}}}{P_{r\text{I}}} = 0.293 \times 54.5 / 5.98 = 2.67$$

$$_{h\text{Ⅱ}} = \ _{n}C_{r\text{Ⅱ}} = 0.293 \times 42.0 / 4.79 =$$

(Example 5)
Fi d he me l d f , he ig l lle , be i g **23932** (L_a = 320 kN 33,000 kgf) he e ed de he fl g i g c di i h i **Table 4.6**.

C di i N. i	O e i g i.me Φ_i %	R di l d F_{ri} kN { kgf }	A i l d F_{ai} kN {ヌほ	Re l i n_i mi -1
1	5	10 { 1020 }	2 { 204 }	1200
2	10	12 { 1220 }	4 { 408 }	1000
3	60	20 { 2040 }	6 { 612 }	暁ぜ
4	15	25 { 2550 }	7 { 714 }	600
5	10	30 { 3060 }	10 { 1020 }	400

The e i le , di l d, P_r, f , e ch e i g c di i i f d b i g f , n l (4.17) d h i **Table 4.7**.
Bec e l he l e f , F_{ri} d F_{ai} f , n he be j g ble e g e e h $F_a / F_r >$ = 0.18, X = 0.67, 2 = 5.50.

$$P_{ri} = XF_{ri} + {}_2F_{ai} = 0.67F_{ri} + 5.50F_{ai}$$

F , n f , n l (4.12) he me l d, F_m, i :

$$F_m = \left\{ \frac{\Sigma (P_{ri}^{10/3} \cdot n_i \cdot \Phi_i)}{\Sigma (n_i \cdot \Phi_i)} \right\}^{3/10} = 48.1\text{kN } \{4{,}906\text{kgf}\}$$

5.1 Boundary dimensions

A rolling bearing's major dimensions, known as "boundary dimensions," are shown in **Figs. 5.1** - **5.3**. To facilitate international bearing interchangeability and economical bearing production, bearing boundary dimensions have been standardized by the International Standards Organization (ISO). In Japan, rolling bearing boundary dimensions are regulated by Japanese Industrial Standards (JIS B 1512).

Those boundary dimensions which have been standardized include: bearing bore diameter, outside diameter, width/height, and chamfer dimensions - all important dimensions when considering the compatibility of shafts, bearings, and housings. However, as a general rule,

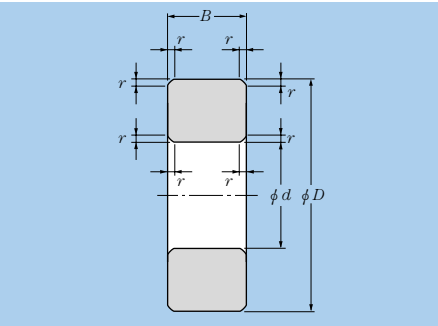


Fig. 5.1 Radial bearings (excluding tapered roller bearings)

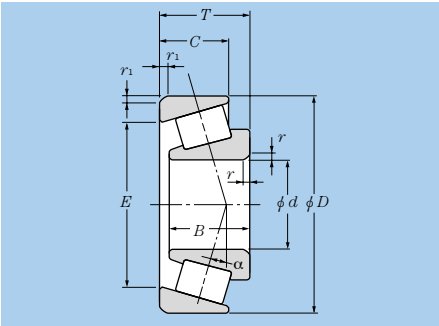


Fig. 5.2 Tapered roller bearings

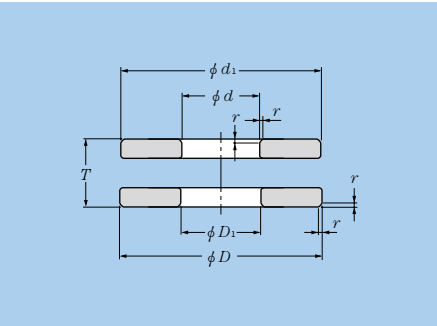


Fig. 5.3 Single direction thrust bearings

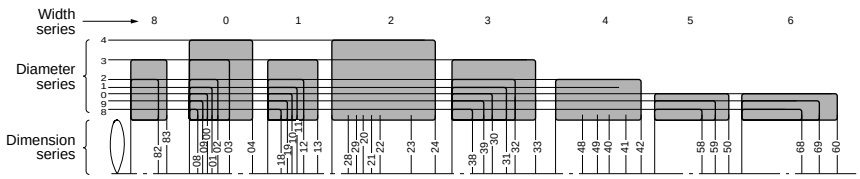


Fig. 5.4 Dimension series for radial bearings (excluding tapered roller bearings; diameter series 7 has been omitted)

Boundary Dimensions and Bearing Number Codes

Table 5.2 Bearing number composition and arrangement

Supplementary prefix code Special application/material/ heat treatment code	Basic number Bearing series Bearing series code	Dimension series code Width/height series	Diameter series
4T: 4T tapered roller bearings	**Deep groove ball bearings (type code 6)**		
ET: ET tapered roller bearings	68	(1)	8
ETA: ET+special heat treatment	69	(1)	9
E: Bearing using case hardened steel	60	(1)	0
EA: Bearing made of nitride-treated case hardened steel	62	(0)	2
TA: Bearing made of nitride-treated bearing steel (SUJ3)	63	(0)	3
TM: Bearing made of special heat-treated bearing steel (SUJ3)	**Angular contact ball bearings (type code 7)**		
F: Stainless steel bearings	78	(1)	8
N: High speed steel bearings	79	(1)	9
M: Plated bearings	70	(1)	0
5S: Ceramic rolling element bearings	72	(0)	2
HL: HL roller bearings	73	(0)	3
ECO: ECO-Top tapered roller bearings	**Self-aligning ball bearings (type code 1,2)**		
LH: Bearing made of bearing steel that provides long life at high temperatures (STJ2), which is treated to stabilize dimensions at temperatures up to 250°C	12	(0)	2
	13	(0)	3
	22	(2)	2
	23	(2)	3
TS3: Dimension stabilized bearing for high temperature use (to 200°C)	**Cylindrical roller bearings (type code NU, N, NF, NNU, NN, etc.)**		
TS4: Dimension stabilized bearing for high temperature use (to 250°C)	NU10	1	0
	NU2	(0)	2
	NU22	2	2
	NU3	(0)	3
	NU23	2	3
	NU4	(0)	4
	NNU49	4	9
	NN30	3	0
	Tapered roller bearings (type code 3)		
	329X	2	
	320X	2	
	302	0	
	322	2	
	303	0	
	303D	0	
	313X	1	
	323		

Supplementary suffix codes							
Internal modifications code	cage code	Seal / Shield code	External configuration code	Duplex arrangement code	Internal clearance /preload code	Tolerance code	Lubrication code
U: Internationally interchangeable tapered roller bearings R: Non-internationally interchangeable tapered roller bearings ST: Low torque tapered roller bearings HT: High axial load use cylindrical roller bearings	L1: High strength, machined brass cage F1: Machined carbon steel cage G1: High strength machined brass rivetless cage with square holes, G2: Pin type cage J: Pressed steel cage T2: Plastic mold cage	LLB: Synthetic rubber seal (non-contact type) LLU: Synthetic rubber seal (contact type) LLH: Synthetic rubber seal (low-torque type) ZZ: Steel shield	K: Tapered inner ring bore, standard taper ratio 1:12 K30: Tapered inner ring bore, standard taper ratio 1:30 N: With snap ring groove NR: With snap ring D: With oil hole D1: Lubrication hole/lubrication groove	DB: Back-to-back arrangement DF: Face-to-face arrangement DT: Tandem arrangement D2: Two matched, paired bearings G: Flush ground ＋α: Spacer (α= spacer's standard width dimensions)	C2: Internal clearance less than normal (CN): Normal clearance C3: Internal clearance greater than normal C4: Internal clearance greater than C3 C5: Internal clearance greater than C4 CM: Radial internal clearance for electric motor use /GL: Light preload /GN: Normal preload /GM: Medium preload /GH: Heavy preload	P6: JIS Class 6 P5: JIS Class 5 P4: JIS Class 4 P2: JIS Class 2 2: ABMA Class 2 3: ABMA Class 3 0: ABMA Class 0 00: ABMA Class 00	/2A: Shell Alvania 2 grease /3A: Shell Alvania 3 grease /8A: Shell Alvania EP2 grease /5K: MULTEMP SRL /LX11: Barierta JFE552 /LP03: Thermosetting grease (grease for poly-lube bearings)



.1

.1

.2

.3

.9

.10

.1

						.3
						.
						.
						.
						.
						.

.2

.3 (t t.)
.3 (1)

d	Δd						Vd		
4									

1

.3 (2) . . t

(1)

d	Δ_{d}	V_{d}	V_{d}	K_{i}	S_{d}
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1 [illegible]

(2)

D	D_{D}	V_{D}	V_{D}	K_{e}	S [2]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2 [illegible]
3 [illegible]

S_i	Δ_{Bs}	Δ_{Cs}	Δ_{Bs}	Δ_{Cs}
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(3)

. . t . . (. . .)

. (1) . . . .

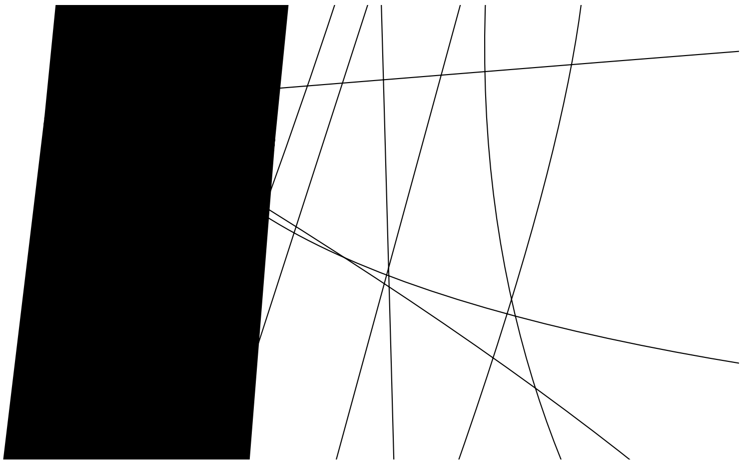
d	Δds									

. (2) . . t . . .

D	ΔDs									

. (3) . . - . t . . . . . t , . . . t . . . t . - . . . . , t . . t . . . . t . . . , t . . t . . . t . .

. ( ) . . . t . . . . t . . .



μ

ΔTs						ΔTs					
ss		ss		ss		ss		ss		ss	
5	5	8	8 [1]		[1]	—	—		[1]		[1]
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—

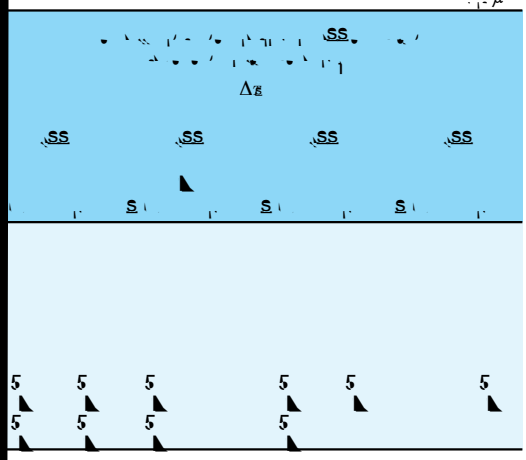
1 s d ss

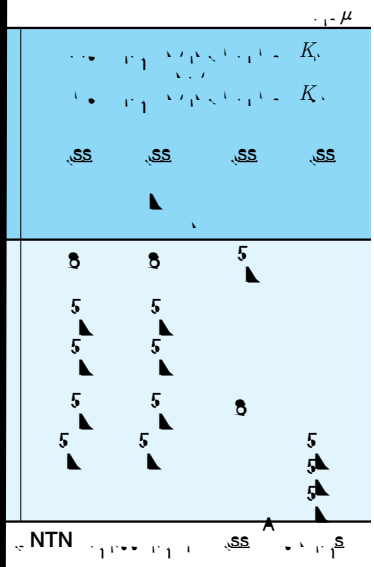
. . t (t)

. (1)

. (2) . t

. (3) t t t





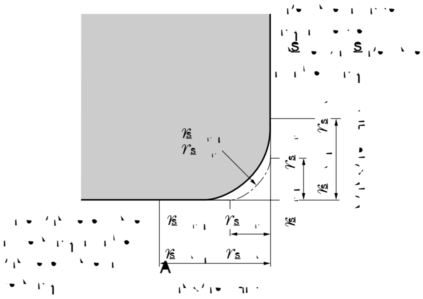
(1)

d	Δ_d	V_d	S_i	Δ_{S_i}
5 8	5	5	5 5	5 5
8	5		5	5 5
8 5	5		5	5 5
5	5		5	5

(2)

D	Δ_D
8 5	5
8 5	5
5	5
5	5 5
8	5
8	

.2



(1) ( )

r_s min [1]	d over	d incl.	r_s max radial	r_s max axial
5	—	—		
8	—	—		
	—	—		
5	—	—		
	—	—	5	8
	— / —		8	
	— / —			
	— / 5	5 / —	5	
	— / —		5	5
5	— / —			5
	— / 8	8 / —	5 / 8	5 / 5 / 5
	— / 8	8 / —	5	5
5	— / 8	8 / —	8 / 5 / 5	
	— / 8	8 / —	5 / 5 5 / 5	8 / 8
	—	—		
5	—	—	8	
	—	—		
5	—	—	5	
5	—	—	5	
	—	—	8	
5	—	—		
	—	—	5	8

1 "r" "r"

(2)

r_s min [2]	d / D over [3]	d / D incl.	r_s max radial	r_s max axial
	—	—		
	—	—		
	— / 5	5 / —		5
5	— / 5	5 / —	8 / 5 / 8	5
	— / 5	5 / —	5	5 / 5
5	— / 5	5 / —	5 / 5	5 / 5 5
	— / 5	5 / —	5 / 5 / 5 5	5 5 / 5 / 5
	— / 5	5 / —	5 / 5 5 / 5	5 / 8 / 8 5
5	— / 8	8 / —	5 / 5	8
	— / 8	8 / —	5	

2 "r" "r"

3 "d" "D"

NTN

.9 (3)

.10 (1)

d	Δ_d	Δ_{d} Δ_{d}	V_d
			—
			—
			—
			—

.10 (2)

d	Δ_d		V_d

7.1 Fitting

"tight fit."

7.3 Fit selection

7.3.1 "Tight fit" or "Loose fit"

(1)

Table 7.1)

(2)

7.3.2 Recommended Fits

0 Table 7.1.

Tables 7.2 - 7.7.

Table 7.2
Table 7.3
Table 7.4
Table 7.6
(4)
Table 7.7
(3 0)
Table 7.5

NTN

7.3.3 Interference minimum and maximum values

1)
2)
3)

1/1000

(1) Radial loads and required interference

(.1) (.2).

$$F \leqq 0.3\,C_r:\quad \Delta_{eff} = 0.0\ (d \cdot F_r / B)^{1/2} \\ = 0.25\ (d \cdot F_r / B)^{1/2} \quad \{\ \} \quad \cdots\cdots (.1)$$

$$F > 0.3\,C_r:\quad \Delta_{eff} = 0.02\ (F_r / B) \\ = 0.2\ (F_r / B) \quad \{\ \} \quad \cdots\cdots (.2)$$

Δ_{eff} .
μ
d .
B .
F_r . { }
C_r . { }

(2) Temperature difference and required interference

(ΔT)

(.3).

$$\Delta_d \quad 0.0015 \cdot d \cdot \Delta T \cdots\cdots (.3)$$

Δ_d .
μ
ΔT.
d .

(3) Fitting surface variation and required interference

( ).

1.0~2.5 μ
5.0 .0 μ

(4) Maximum interference

7.3.4 Other details

(1)
(2)
(3)
-5)

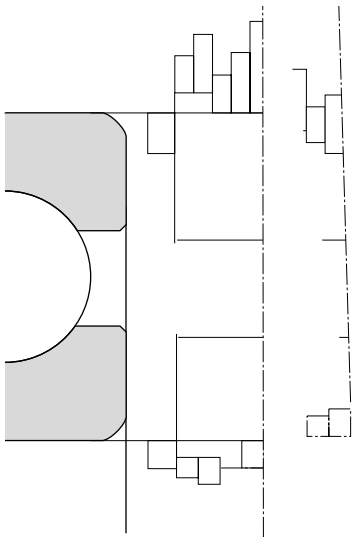


Table 7.2 (3) Tolerance class of housing bore commonly used for radial bearings (classes 0, 6X and 6)

			Outer ring axial direction movement	Toleration class of housing bore	Remarks

❶

❷

1

2

Table 7.3 Standard fits for thrust bearings (JIS Class 0 and 6)

Table 7.3 (1) Shaft fits

			～ 200 200 ～ 400 400 ～	

Table 7.3 (2) Housing fits

Table 7.4 Fits for electric motor bearings

	～ 1 1 ～100 100 ～1 0	5 5 5		
	～ 40 40 ～1 0 1 0 ～200	5 5		

3		0	-	4 ～	4 ～				
	10	0	-	3 ～11	3 ～				
10	1	0	-	2 ～14	2 ～				
1	30	0	-10	3 ～1	3 ～				
30	50	0	-12	3 ～20	3 ～				
50	0	0	-15	5 ～23	5 ～				
0	120	0	-20	～2	～				

Table 7.6 General fitting standards for tapered roller bearings using US customary unit (ANSI class 4)

		~ .2	+13	0	+ 3 + 25	3 ~ 12
		.2 ~ 304.	+25	0	+ 4 + 3	4 ~ 13
		304. ~ 0 .	+51	0	+12 +	12 ~ 25
		0 . ~ 14.4		0	+1 0 +114	1 0 ~ 3
		~ .2	+13	0	+ 4 + 3	3 ~ 12
		.2 ~ 304.	+25	0		
		304. ~ 0 .	+51	0		
		0 . ~ 14.4		0		
		~ .2	+13	0	+ 13 0	13 ~ 13
		.2 ~ 304.	+25	0	+ 25 0	25 ~ 25
		304. ~ 0 .	+51	0	+ 51 0	51 ~ 51
		0 . ~ 14.4		0	+ 0	~
		~ .2	+13	0	0 - 13	0 ~ 13
		.2 ~ 304.	+25	0	0 - 25	0 ~ 50
		304. ~ 0 .	+51	0	0 - 51	0 ~ 102
		0 . ~ 14.4		0	0	0 ~ 152

Table 7.7 General fitting standards for tapered roller bearings using US customary unit (ANSI classes 3 and 0)

		304. 0 . 14.4 .	

, mm mm
δ :
mm
mm
, mm mm

(1) Reduced clearance due to interference

; **thus reducing the bearings' internal clearance.** mm

, mm
, mm
mm .
mm mm **70% to 90% of the effective interference.**

$$\delta = (0.70 \sim 0.90)\ \Delta_d \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\ (8.2)$$

,
δ :
mm

Table 8.3 Radial internal clearance of deep groove ball bearings

μm

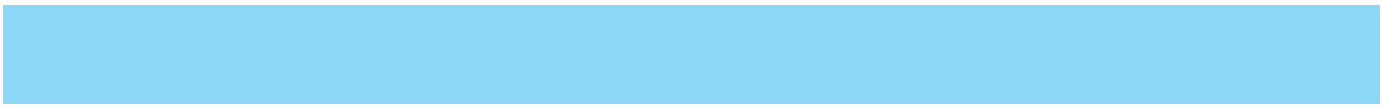
mm d mm		C2		C		C3		C4		C5	
.		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
—	2.5	0	6	4	11	10	20	—	—	—	—
2.5	6	0	7	2	13	8	23	—	—	—	—
6	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370
315	355	3	60	45	125	110	210	195	300	275	410
355	400	3	70	55	145	130	240	225	340	315	460
400	450	3	80	60	170	150	270	250	380	350	510
450	500	3	90	70	190	170	300	280	420	390	570
500	560	10	100	80	210	190	330	310	470	440	630
560	630	10	110	90	230	210	360	340	520	490	690

ท ท d ท ท	B พ C2		C	C3	C4	C5
2.5 6	1	8				
6 10	2	9				
10 14	2	10				
14 18	3	12				
18 24	4	14				
24 30	5	16				
30 40	6	18				
40	6	19				
50	7	21				
65	8	24				
80	9	27				
100	10	31				
120	10	38				
140	15	44				

μท

ท ท d ท ท .		้ D ท	ท	๊ C ท	ท
10 ( )	18	4	11	—	—
18	24	5	12	—	—
24	30	5	12	15	30
30	40	9	17	15	30
40	50	9	17	20	35
50	65	12	22	25	40
65	80	12	22	30	45
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

1: ๊ ท .
E ท : 6205 ๊
2: C ั .



¶ ¶ d ¶¶	B ¶											
	C1 A		C2 A		A[1]		C3 A		C4 A		C5 A	
—	5	10	10	20	30						—	—
10	5	10	10	20	30						65	75
	5	10	10	20	30						65	75
	5	10	10	25	35						70	80
	5	12	12	25	40						80	95
	5	15	15	30	45						95	110
	5	15	15	35	50						110	130
	10	20	20	40	60						130	150
	10	25	25	45	70						155	180
	10	25	25	50	80						180	205
	15	30	30	60	90						200	230
	15	35	35	65	100						225	260
	15	35	35	75	110						250	285
	20	40	40	80	120						275	315
	20	45	45	90	135						305	350
	25	50	50	100	150						330	380
	25	55	55	110	165						370	420
	30	60	60	120	180						410	470
	30	65	65	135	200						455	520
	35	75	75	150	225						510	585
	45	85	85	170	255						565	650
	50	95	95	190	285						625	720

B						
C9 A❷	C0 A❷		C1 A	C2 A	A❶	C3 A
5	7	17	20			
5	7	17	20			
5	7	17	20			
5	10	20	25			
	10	20	25			
	10	20	30			
	10	20	35			
	15	30	40			
	20	35	45			
	20	35	50			
	25	40	60			
	30	45	65			
	30	45	75			
	30	50	80			
	35	55	90			
	40	65	100			
	40	65	110			
	45	75	120			
	45	75	135			
	50	90	150			
	60	100	170			
	70	115	190			

C									
C2		C		C3		C4			
10	30	30	50	50	70	70	90	18	24
10	30	30	50	60	80	80	100	24	30
10	40	40	70	70	100	90	120	30	40
10	40	40	70	80	110	110	140	40	50
10	40	50	80	90	120	130	160	50	65
10	50	60	100	110	150	150	190	65	80
20	70	70	120	130	180	180	230	80	100
20	70	70	120	150	200	210	260	100	120
20	70	70	120	160	210	210	260	120	140
30	100	100	160	180	240	240	300	140	160
—	—	—	—	—	—	—	—	160	180
—	—	—	—	—	—	—	—	180	200
—	—	—	—	—	—	—	—	200	225
—	—	—	—	—	—	—	—	225	250
—	—	—	—	—	—	—	—	250	280
—	—	—	—	—	—	—	—	280	315
—	—	—	—	—	—	—	—	315	355
—	—	—	—	—	—	—	—	355	400
—	—	—	—	—	—	—	—	400	500

Table 8.10 Radial internal clearance of spherical roller bearings

㎜		B 形									
d ㎜		C2		C		C3		C4		C5	
超	以下	最小	最大	最小	最大	最小	最大	最小	最大	最小	最大
14	18	10	20	20	35	35	45	45	60	60	75
18	24	10	20	20	35	35	45	45	60	60	75
24	30	15	25	25	40	40	55	55	75	75	95
30	40	15	30	30	45	45	60	60	80	80	100
40	50	20	35	35	55	55	75	75	100	100	125
50	65	20	40	40	65	65	90	90	120	120	150
65	80	30	50	50	80	80	110	110	145	145	180
80	100	35	60	60	100	100	135	135	180	180	225
100	120	40	75	75	120	120	160	160	210	210	260
120	140	50	95	95	145	145	190	190	240	240	300
140	160	60	110	110	170	170	220	220	280	280	350
160	180	65	120	120	180	180	240	240	310	310	390
180	200	70	130	130	200	200	260	260	340	340	430
200	225	80	140	140	220	220	290	290	380	380	470
225	250	90	150	150	240	240	320	320	420	420	520
250	280	100	170	170	260	260	350	350	460	460	570
280	315	110	190	190	280	280	370	370	500	500	630
315	355	120	200	200	310	310	410	410	550	550	690
355	400	130	220	220	340	340	450	450	600	600	750
400	450	140	240	240	370	370	500	500	660	660	820
450	500	140	260	260	410	410	550	550	720	720	900
500	560	150	280	280	440	440	600	600	780	780	1,000
560	630	170	310	310	480	480	650	650	850	850	1,100
630	710	190	350	350	530	530	700	700	920	920	1,190
710	800	210	390	390	580	580	770	770	1,010	1,010	1,300
800	900	230	430	430	650	650	860	860	1,120	1,120	1,440
900	1,000	260	480	480	710	710	930	930	1,220	1,220	1,570
1,000	1,120	290	530	530	780	780	1,020	1,020	1,330	1,330	1,720
1,120	1,250	320	580	580	860	860	1,120	1,120	1,460	1,460	1,870
1,250	1,400	350	640	640	950	950	1,240	1,240	1,620	1,620	2,080

Table 8.11 Axial internal clearance of four points contact ball bearings

㎛

㎜		C2		C		C3		C4	
d ㎜									
超	以下	最小	最大	最小	最大	最小	最大	最小	最大
17	40	26	66	56	106	96	146	136	186
40	60	36	86	76	126	116	166	156	206
60	80	46	96	86	136	126	176	166	226
80	100	56	106	96	156	136	196	186	246
100	140	66	126	116	176	156	216	206	266
140	180	76	156	136	196	176	236	226	296
180	220	96	176	156	216	196	256	246	316

B					㎜	㎜
C2	C	C3	C4	C5	d	㎜㎜
	—	—			14	18
	35	45			18	24
	40	55			24	30
	50	65			30	40
	60	80			40	50
	75	95			50	65
	95	120			65	80
	110	140			80	100
	135	170			100	120
	160	200			120	140
	180	230			140	160
	200	260			160	180
	220	290			180	200
	250	320			200	225
	270	350			225	250
	300	390			250	280
	330	430			280	315
	360	470			315	355
	400	520			355	400
	440	570			400	450
	490	630			450	500
	540	680			500	560
	600	760			560	630
	670				630	710
	750				710	800
	840				800	900
	930				900	1,000
	1,030				1,000	1,120
	1,120				1,120	1,250
	1,230				1,250	1,400

8.3 Preload

8.3.1 Purpose of preload

(1) B

(2)

(3)

(4)

(5)

(6) F

Applying excessive preload could result in reduction of life, abnormal heating, or increase in turning torque. You should therefore consider the objectives before determining the amount of preload.

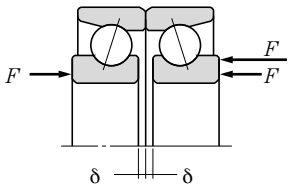
8.3.2 Preloading methods and amounts

Table 8.12.

Table 8.13.

8.3.3 Preload and rigidity

Fig. 8.2.



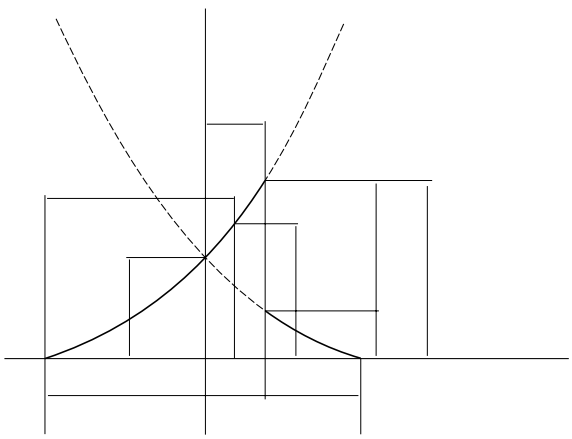
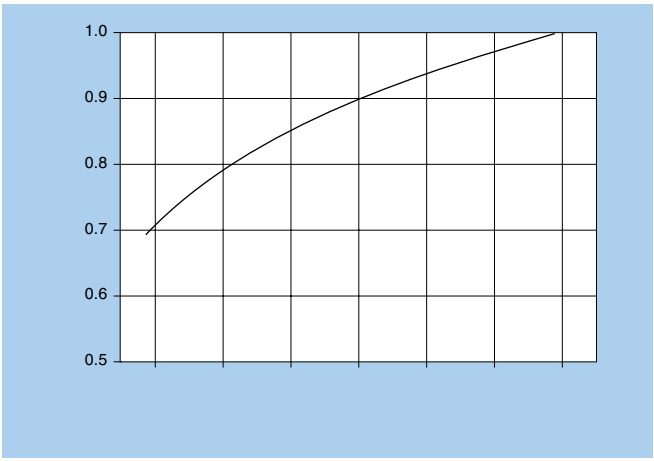


Table 8.13 The normal preload of duplex angular contact ball bearings

			B	
–	12		147 { 15}	196 { 20}
12	18		147 { 15}	294 { 30}
18	32		294 { 30}	490 { 50}
32	40		590 { 60}	885 { 90}
40	50		590 { 60}	980 { 100}
50	65		880 { 90}	1,470 { 150}
65	80		1,470 {150}	1,960 { 200}
80	90		1,960 {200}	2,940 { 300}
90	95		1,960 {200}	2,940 { 300}
95	100		1,960 {200}	2,940 { 300}
100	105		2,450 {250}	3,900 { 400}
105	110		2,450 {250}	3,900 { 400}
110	120		2,450 {250}	3,900 { 400}
120	140		3,450 {350}	5,900 { 600}
140	150		3,450 {350}	5,900 { 600}
150	160		4,900 {500}	8,850 { 900}
160	170		4,900 {500}	8,850 { 900}
170	180		4,900 {500}	8,850 { 900}
180	190			9,800 {1,000}
190	200			9,800 {1,000}

29 { 3}	98 { 10}		390 { 40}
29 { 3}	98 { 10}		490 { 50}
78 { 8}	196 { 20}		980 { 100}
98 { 10}	390 { 40}		1,960 { 200}
147 { 15}	590 { 60}		2,450 { 250}
196 { 20}	785 { 80}		3,900 { 400}
294 { 30}	980 {100}		4,900 { 500}
490 { 50}	1,470 {150}		5,900 { 600}
490 { 50}	1,960 {200}		6,850 { 700}
490 { 50}	1,960 {200}		6,850 { 700}
590 { 60}	2,450 {250}		8,850 { 900}
590 { 60}	2,450 {250}		8,850 { 900}
590 { 60}	2,450 {250}		8,850 {
785 { 80}	2,940 {300}		
785 { 80}	2,940 {300}		
885 { 90}	3,900 {400}		
885 { 90}	3,900 {400}		
885 { 90}	3,900 {400}		
980 {100}	4,400 {450}		
980 {100}	4,400 {450}		


1.0
0.9
0.8
0.7
0.6
0.5

10. Friction and Temperature Rise

10.1 Friction

O e f he ai f c , e i ed f a bea i g i ha i ha e f ic . U de al e ai g di , lli g bea i g ha e a ch alle f ic , efficie ba he lide bea i g , e eciall a i g f ic , .

The f ic , efficie f lli g bea i g i e e ed b la (10.1).

$$\mu = \frac{2M}{Pd} \quad \cdots\cdots (10.1)$$

he e,
μ : F ic , efficie
M : F ic , e N · {kgf · f }
P : l ad, N {kgf}
d : Bea i g b e dia e ,

Al gh he d a ic f ic , efficie f lli g bea i g a ie i b he e f bea i g , ad, l b ica , eed, a d he fac ; al e a i g di , he a i a e f ic , efficie a bea i g e a e li ed i **Table 10.1**.

Table 10.1 Friction coefficient for bearings (reference)

Bea i g e	efficie $\mu \times 10^{-3}$
Dee g e ball bea i g	1.0～1.5
A g la ac ball bea i g	1.2～1.8
Self-alig i g ball bea i g	0.8～1.2
C li d ical lle bea i g	1.0～1.5
Needle lle bea i g	2.0～3.0
Ta e ed lle bea i g	1.7～2.5
S he ical lle bea i g	2.0～2.5
Th ball bea i g	1.0～1.5
Th lle bea i g	2.0～3.0

10.2 Temperature rise

Al all f ic , i a bea i g i a ed i hea i bi he bea i g i elf a d ca e he e e a e f he bea i g i e. The a , f he al ge e a , ca ed b f ic , e ca be calc la ed i g la (10.2).

$$\left.\begin{aligned} Q &= 0.105\times10^{-6} Mn \ \text{N} \\ &= 1.03\times10^{-6} Mn \ \{\text{kgf}\} \end{aligned}\right\} \quad \cdots\cdots (10.2)$$

he e,
Q : The al al e, kW
M : F ic , e N · {kgf · f }
n : Pi a , al eed, i $^{-1}$

Bea i g e a i g e e a e i de e i ed b he e ilib i bala ce be ee he a , f hea ge e a ed b he bea i g a d he a , f hea d c ed a a f he bea i g. I ca e he e e a e i e ha l d i g i ial e a , , he i c ea e l , il i eache a able d , a d he e ai , a The i e i ake ach bi able a e de e d , he a , f hea , d ced, hea ca aci /diff , f he haf a d bea i g h i g, a , f l b ica a d e d f l b ica , . If he e e a e , i e i ea d e , be e , a i he a ed ha he ei e i , e f c , .

Possible causes of abnormal temperature include bearing misalignment (due to moment load or incorrect installation), insufficient internal clearance, excessive preload, too much or too little lubricant, or heat produced from sealed units. Check the mechanical equipment, and if necessary, remove and inspect the bearing.

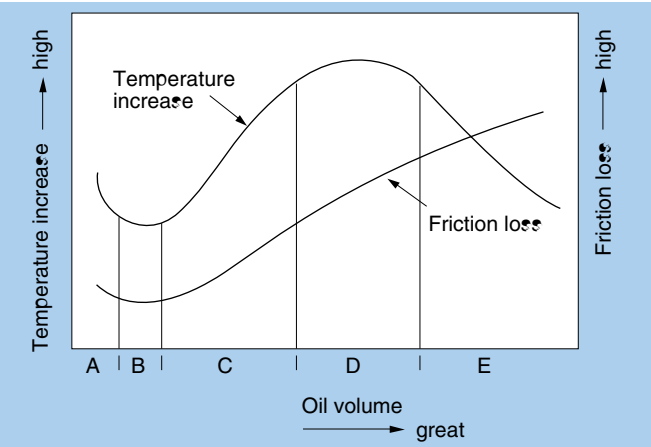
11. L U

11.1 P U U

The purpose of 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. However, for rolling bearings, lubrication has the following advantages:

(1)
(2) U
(3) P
(4) P
(5) P U U

In order to exhibit these effects, a lubrication method that matches service conditions. 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.



F . 11.1

11.1 O
(F . 11.1 , U

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 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 predominates and bearing temperature decreases.	Forced circulation lubrication, Oil jet lubrication

F . 11.1 shows the relationship between oil volume, friction loss, and bearing temperature. 11.1 details the characteristics of this relationship.

11.2 L U

Lubrication method 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.
The characteristic are shown in 11.2.

11.2 C U U

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

11.3 G U

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 a bearing that is pre-sealed with grease (sealed/shield 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.

11.3.1

Lubricating grease are composed of either a mineral oil base or a synthetic oil base. 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. 11.5 shows general grease varieties and characteristics, and 11.6 shows grease brand names and their natures. (See pages A-74 and A-75.) As performance characteristics of even the same type of grease will vary widely from brand to brand, U U

(1 B .
Mineral oil or synthetics such as ester or ether oil are used as the base of the grease.

Mainly, the properties of any grease is determined by the properties of the base oil. Generally, greases with low

viscosity base oil are best suited for low temperatures and high speeds; Grease using high-viscosity base oil has superior high-temperature and high-load characteristics.

(2

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 (poly-urea, 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, poly-urea and other non-metallic soaps as the thickening agent are generally superior in high temperature properties.

(3 A

Various additives are added to greases to improve various properties and efficiency. For example, there are anti-oxidents, high-pressure additives (EP additives), rust preventives, and anti-corrosives.

For bearings subject to heavy loads and/or shock loads, a grease containing high-pressure additives should be used. For comparatively high operating temperatures or in applications where the grease cannot be replenished for long periods, a grease with an oxidation stabilizer is best to use.

(4 C

Consistency is an index that indicates hardness and fluidity of grease. The higher the number, the softer the grease is. The consistency of a grease is determined by the amount of thickening agent used and the viscosity of the base oil. 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 **11.3**.

(5 M

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.

11.3 C

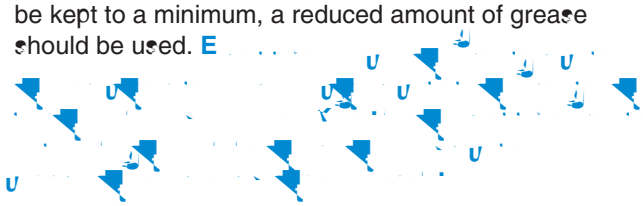
NLGI		

11.3.2 A

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 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. **E**



Moreover, the standard bearing space can be found by formula (11.1)

$$V = K \cdot W \quad \cdots\cdots (11.1)$$

where,

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

K : Bearing space factor (see value of K in **11.4**)

W : Mass of bearing, kg

G	L			(F	C
	Li soap			Na soap	Ca+Na soap Ca+Li soap
B	Mineral oil	Diester oil	Silicone oil	Mineral oil	Mineral oil
C	170 ~ 190	170 ~ 190	200 ~ 250	150 ~ 1 0	150 ~ 1 0
	-30 ~ +130	-50 ~ +130	-50 ~ +160	-20 ~ +130	-20 ~ +120
M	Excellent	Good	Good	Excellent ~ Good	Excellent ~ Good
P	Good	Good	Poor	Good	Excellent ~ Good
	Good	Good	Good	Good ~ Poor	Good ~ Poor
A	Widest range of applications. Grease used in all types of rolling bearings.	Excellent low temperature and wear characteristics. Suitable for small sized and miniature bearings.	Suitable for high and low temperatures. Unsuitable for heavy load applications due to low oil film strength.	Some emulsification when water is introduced. Excellent characteristics at relatively high temperatures.	Excellent pressure

A	N -		
Al soap	Bentone, silica gel, urea, carbon black, fluorine compounds, etc.		
Mineral oil	Mineral oil		Synthetic oil
70 ～ 90	250 or above		250 or above
-10 ～ + 0	-10 ～ +130		-50 ～ +200
Good ～ Poor	Good		Good
Good	Good		Good
Good	Good		Good
Excellent adhesion	Can be used in a wide range of low to high temperatures. Shows excellent heat resistance, cold resistance, chemical resistance, and other characteristics when matched with a suitable base oil and thickener.		
Suitable for bearings receiving vibration	Grease used in all types of rolling bearings.		

B					
140mm²/s	273				
140mm²/s	232				
15.3mm²/s	276				
3.1mm²/s	2				
15.3mm²/s	265～295				
26mm²/s	250				
72.3mm²/s	300				
113mm²/s	220～250				
11.5mm²/s	265～295				
gs 0mm²/s	265～295				
400mm²/s	2[illegible]1				
75mm²/s					
100mm²/s	300				
32mm²/s	260				
30.9mm²/s	265～295				
5 mm²/s	255				
40.6mm²/s	243				
50mm²/s	265～				
2 mm²/s 30.1mm²/s					
200mm²/s					

therefore, $\frac{n_o}{n} = \frac{10,560}{3,600} = 2.93$

The point where vertical line I intersects a horizontal line drawn from the point equivalent of d = 30 for the radial ball bearing shown in **F. 11.2** shall be point A. Find intersection point C where vertical line II intersects the straight line formed by joining point B (n_o/n = 2.93) with A with a straight line. It shows that grease life in this case is approximately 5,500 hours.

11.4 (F

"Solid grease" is a lubricant composed mainly of lubricating grease and ultra-high polymer polyethylene. Solid grease has the same viscosity as grease at normal temperature, If heated once and cooled (this process is referred to as "calcination") the grease hardens while maintaining a large quantity of lubricant. 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 empty space around the rolling elements is filled with solid grease.

Spot-pack solid grease is standard for deep groove ball bearings, small diameter ball bearings, and bearing units. Full-pack solid grease is standard for self-aligning ball bearings, spherical roller bearings, and needle roller bearings.

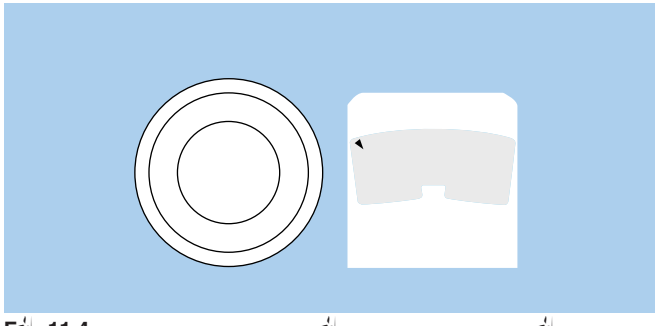
Primary advantages:

(1) Grease leakage is minimal.

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

For more details, please refer to **NTN** special catalog of

F. 11.3 (



F. 11.4 (

	E		E
		(● 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.	
		(O ● 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.	
● 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		(A - ● In this method, the required minimum amount of lubricating oil is measured and fed to each bearing at ideal intervals using compressed air. ● With fresh lubricating oil constantly being fed to the bearing, and with the cooling effect of the compressed air, bearing temperature rise can be minimized. ● Because the required oil quantity is infinitesimal, the working environment can be kept clean. Air-oil lubrication units are available from **NTN**.	
		(O ● 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 for machine tools is one example of this type of lubrication.	

11.5.2 O

In forced oil lubrication systems, the heat radiated away by the housing and surrounding parts plus the heat carried away by the lubricating oil is approximately equal to the amount of heat generated by the bearing and other sources.

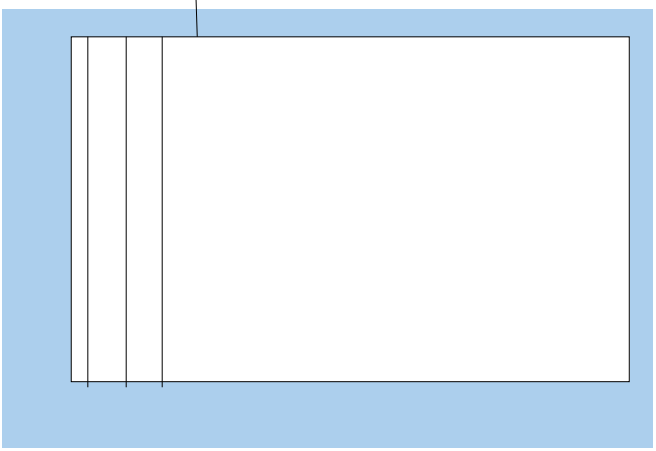
For general housing applications, the required quantity of oil can be found by formula (11.2).

$$Q = K \cdot q \quad \cdots\cdots (11.2)$$

where,

Q: Quantity of oil for one bearing cm^3/min.
K: Allowable oil temperature rise factor (. **11.10**)
q: Amount of lubrication determined by diagram cm^3/min. (**F**. **11.4**)

Because the amount of heat radiated will vary according to the type of housing, for actual operation it is advisable that the quantity of oil calculated by formula

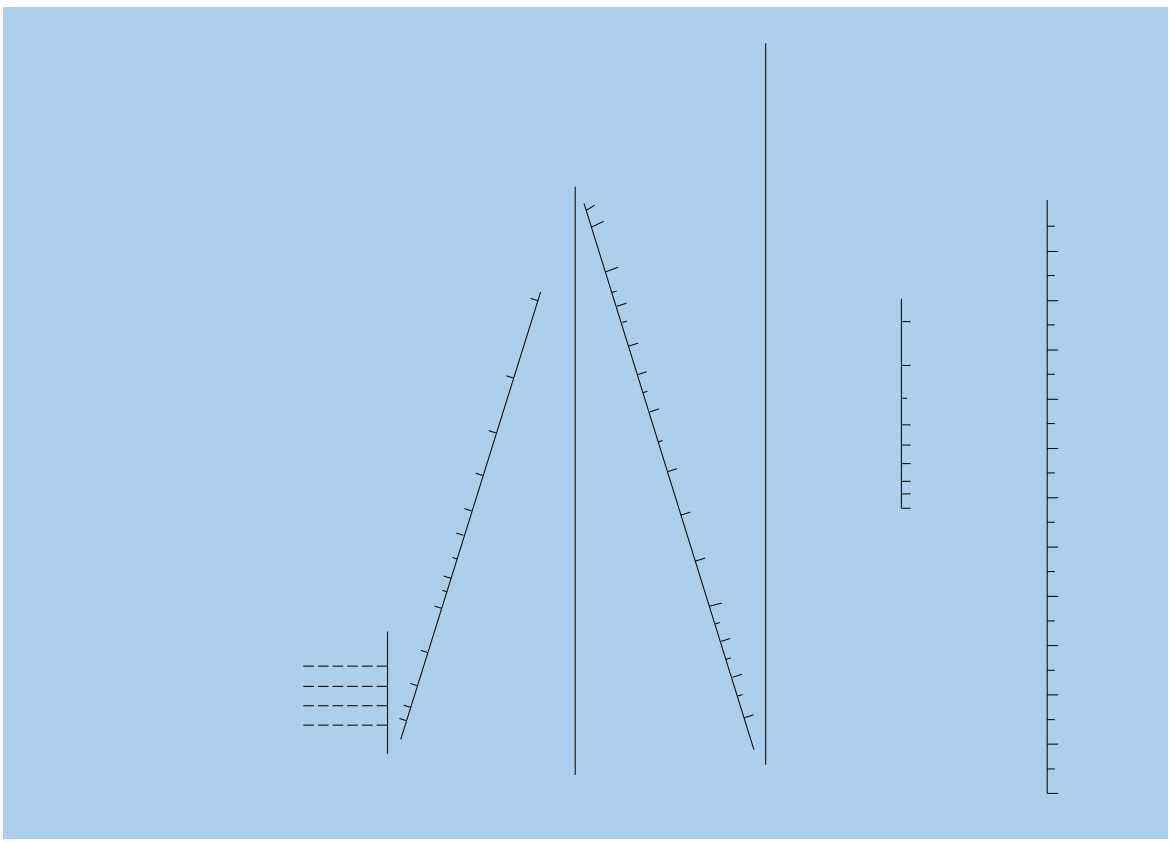


11.8 . (

Bearing operating temperature °C	d_n-value	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、6	100	All types
	15,000 ～ 0,000	32、46	6	All types
	0,000 ～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 ～ 0,000	100	150	All types
	0,000 ～150,000	6	100、150	All types but thrust ball bearings
	150,000～500,000	32	6	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、6		Self-aligning roller bearings
60～100	Up to allowable rotational speed	150		

Note 1: Applied when lubrication method is either oil bath or circulating lubrication.
2: Please consult **NTN** Engineering in cases where operating conditions fall outside the range covered by this table.

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

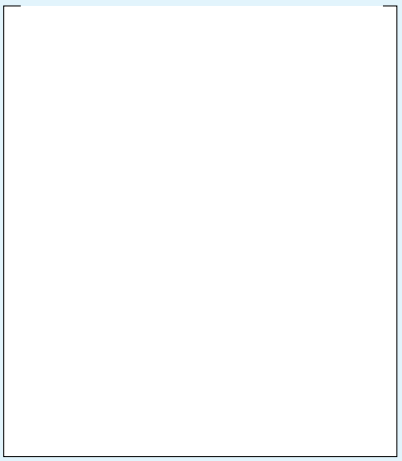


F. 11.6 O

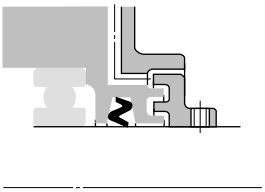
External seals have two main functions: to prevent lubricating oil from leaking out, and to prevent dust, water, and other contaminants from entering the bearing. When selecting a seal, the following factors need to be taken into consideration: the type of lubricant (oil or grease), seal peripheral speed, shaft fitting errors, space limitations, seal friction and resultant heat increase, and cost.

Sealing devices for rolling bearings fall into two main classifications: non-contact seals and contact seals.

- **Non-contact seals**: Non-contact seals utilize a small clearance between the shaft and the housing cover. Therefore friction is negligible, making them suitable for high speed applications.





Type	Seal construction	Name	Seal characteristics and selection considerations
Combination seals		**Z-seal + Labyrinth seal**	This is an example of an axial labyrinth seal which has been combined with a Z-seal to increase its sealing efficiency. The axial labyrinth seal is affixed to the shaft with a setting bolt or other method. In the diagram on the left, both the direction of the Z-seal and the labyrinth seal are oriented to keep dust and other contaminants out of the bearing. Because a Z-seal has been incorporated, the allowable peripheral speed should not exceed 6 m/s.
		Labyrinth seal + Oil groove seal + Slinger	This is an example of a combination of three different non-contact seals. It has the advantage of preventing both lubricant leakage from inside the bearing and infiltration of dust and other contaminants from the outside. It is widely used on mining equipment and as a sealing system with plummer blocks in extremely dusty application conditions.
		Oil groove seal + Slinger + Z-seal	This is an example where an oil groove seal and slinger have been combined with a Z-seal to increase its sealing efficiency. In the diagram on the left, all three seals have been oriented to keep dust and other contaminants out of the bearing. The combination is widely used on mining equipment and as a sealing system with plummer blocks in extremely dusty application conditions.

13.1 Raceway and rolling element materials

While the contact surfaces of a bearing's raceways and rolling elements are subjected to repeated heavy stress, they still must 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 impurities in the steel. Non-

Tables 13.5 and **13.6** give the chemical composition for these representative cage materials.

Besides high-strength brass, medium carbon nickel, chrome and molybdenum that has been hardened and tempered at high temperatures are also used for bearings used in aircraft. The materials are often plated with silver to enhance lubrication characteristics.

High polymer materials that can be injection molded are also widely used for cages. Polyamide resin reinforced with glass fibers is generally used. Cages made of high-polymer materials are lightweight and corrosion resistant. They also have superior damping and characteristics and lubrication performance. **Heat resistant polyimide resins now enable the production of cages that perform well in applications ranging between -40 C – 120 C.** However, they are not recommended for use at temperatures exceeding 120˚C.

Standard	Symbol	Chemical composition (%)							Remarks
		C	Si	Mn	P	S	Cr	Mo	
JIS G 4805	SUJ2	0.95～1.10	0.15～0.35	M ax. 0.50	M ax. 0.025	M ax. 0.025	1.30～1.60	M ax. 0.08	
	SUJ3	0.95～1.10	0.40～0.70	0.90～1.15	M ax. 0.025	M ax. 0.025	0.90～1.20	M ax. 0.08	
	SUJ5	0.95～1.10	0.40～0.70	0.90～1.15	M ax. 0.025	M ax. 0.025	0.90～1.20	0.10～0.25	
ASTM A295	52100	0.98～1.10	0.15～0.35	0.25～0.45	M ax. 0.025	M ax. 0.025	1.30～1.60	M ax. 0.10	SUJ2 equivalent
ASTM A485	Grade 1	0.90～1.05	0.45～0.75	0.95～1.25	M ax. 0.025	M ax. 0.025	0.90～1.20	M ax. 0.10	SUJ3 equivalent
	Grade 3	0.95～1.10	0.15～0.35	0.65～0.90	M ax. 0.025	M ax. 0.025	1.10～1.50	0.20～0.30	SUJ5 equivalent

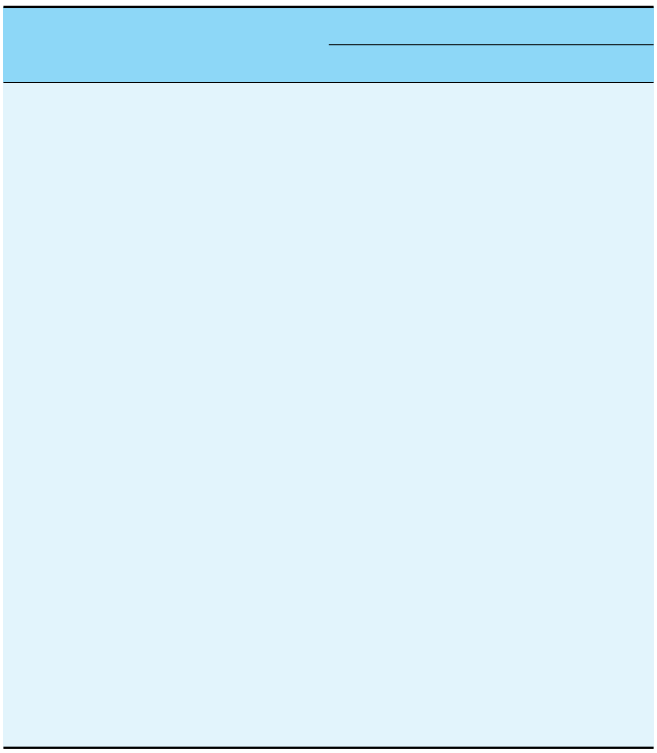
Standard	Symbol	Chemical composition (%)							
		C	Si	Mn	P	S	Ni	Cr	Mo
JIS G 4104	SCr420	0.18～0.23	0.15～0.35	0.60～0.85	M ax. 0.030	M ax. 0.030	—	0.90～1.20	—
JIS G 4105	SCM420	0.18～0.23	0.15～0.35	0.60～0.85	M ax. 0.030	M ax. 0.030	—	0.90～1.20	0.15～0.30
JIS G 4103	SNCM220	0.17～0.23	0.15～0.35	0.60～0.90	M ax. 0.030	M ax. 0.030	0.40～0.70	0.40～0.65	0.15～0.30
	SNCM420	0.17～0.23	0.15～0.35	0.40～0.70	M ax. 0.030	M ax. 0.030	1.60～2.00	0.40～0.65	0.15～0.30
	SNCM815	0.12～0.18	0.15～0.35	0.30～0.60	M ax. 0.030	M ax. 0.030	4.00～4.50	0.70～1.00	0.15～0.30
ASTM A534	5120	0.17～0.22	0.15～0.35	0.70～0.90	M ax. 0.030	M ax. 0.040	—	0.70～0.90	—
	4118	0.18～0.23	0.15～0.35	0.70～0.90	M ax. 0.030	M ax. 0.040	—	0.40～0.60	0.08～0.15
	8620	0.18～0.23	0.15～0.35	0.70～0.90	M ax. 0.030	M ax. 0.040	0.40～0.70	0.40～0.60	0.15～0.25
	4320	0.17～0.22	0.15～0.35	0.45～0.65	M ax. 0.030	M ax. 0.040	1.65～2.00	0.40～0.60	0.20～0.30
	9310	0.08～0.13	0.15～0.35	0.45～0.65	M ax. 0.025	M ax. 0.025	3.00～3.50	1.00～1.40	0.08～0.15

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 this reason, it is necessary to pay attention to the following when designing shaft and housing:

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

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 bearing or housing abutment against the ring end face.		Use of snap rings regulated under JIS B 2804, B 2805, and B 2806, makes construction very simple. 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 and where the snap ring receives large axial loads.

Adapter sleeve mounting	Withdrawal sleeve mounting	Split ring mounting



14.2.3 Thrust bearings and fitting dimensions

For thrust bearings, it is necessary to make the raceway disc back face sufficiently broad in relation to load and rigidity, and fitting dimensions from the dimension tables should be adopted. (**Figs. 14.2** and **14.3**)

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. 14.3

ıccurac

racies for shaft and housing
ɔ configurations, as well as
abutment squareness for

15. Bea ¦ g Ha d ¦ g

Bearings are precision parts and, in order to preserve their accuracy and reliability, care must be exercised in their handling.

I [a c a , bea ¦ g c ea ¦ e be a ¦ a ¦ ed, ha[¦ [ac a ¦ ded, a d [e e ed.

15.1 Bea ¦ g age

Most rolling bearings are coated with a rust prevent oil before being packed and shipped, and they should be stored at room temperature with a relative humidity of less than 60%.

15.2 I a a ¦

15.2.1 I a a ¦ [e a a ¦

Bearings should be fitted in a clean, dry work area. Especially for small and miniature bearings, a "clean room" should be provided as any contamination particles in the bearing will greatly affect bearing efficiency.

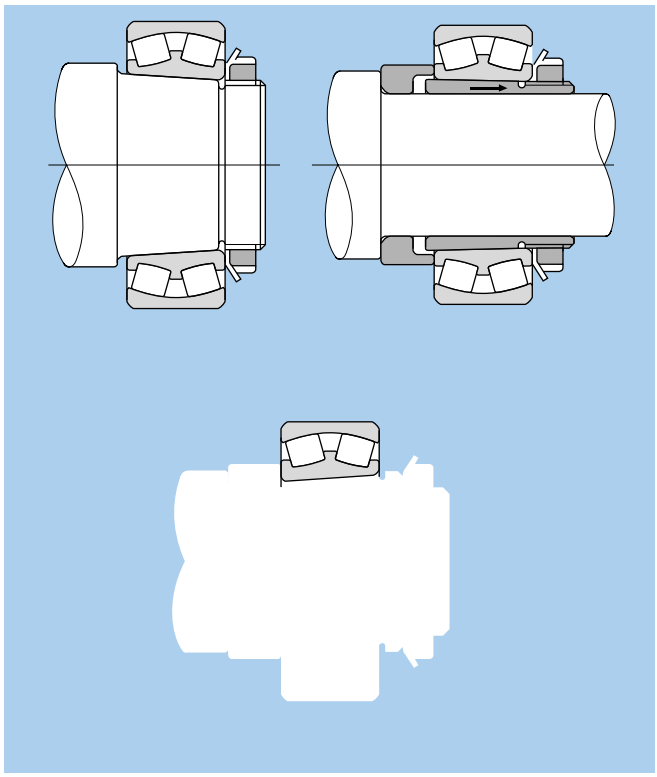
All dirt, burrs or metal filings must be removed from the shaft, housing and tools used for mounting the bearings. Shaft and housing fitting surfaces should also be checked for roughness, dimensional and design accuracy, and to ensure that they are within allowable tolerance limits.

Bearings should not be unwrapped until just prior to installation. Normally, bearings to be used with grease lubricant can be installed as is, without removing the rust prevent oil. However, for bearings which will use oil lubricant, or in cases where mixing the grease and rust prevent oil would result in loss of lubrication efficiency, the rust prevent oil should be removed by washing with benzene or petroleum solvent and dried before installation. Bearings should also be washed and dried before installation if the package has been damaged or there are other chances that the bearings have been contaminated. **D b e h e ded bea ¦ g a d ea ed bea ¦ g h d e e be a hed.**

15.2.2 I a ¦ g c ¦ d ¦ ca b e bea ¦ g

For bearings with relatively small interference, the entire circumference of the raceway can be uniformly press-fit at room temperature as shown in **F g. 15.3**. Usually, bearings are installed by striking the sleeve with a hammer; however, when installing a large number of bearings, a mechanical or hydraulic press should be used.

When installing non-separable bearings on a shaft and in a housing simultaneously, a pad which distributes the fitting pressure evenly over the inner and outer rings is used as shown in **F g. 15.4**. If the fitting is too tight or bearing size is large, a considerable amount of force is required to install the bearing at room temperature. Installation can be facilitated by heating and expanding the inner ring beforehand. The required relative temperature difference between the inner ring and the shaft depends on the amount of interference and the shaft fitting surface diameter. **FIg. 15.5** shows the relation between the bearing inner bore diameter temperature differential and the amount of thermal expansion. **I a**



high pressure oil between the fitting surfaces.

F g. 15.9 a) shows one method of installation where a hydraulic nut is used to drive the bearing onto a tapered shaft.

F g. 15.9 b) and **c**) show installation using a hydraulic nut with adapter sleeves and withdrawal sleeves.

F g. 15.10 shows an installation method using a hydraulic withdrawal sleeve.

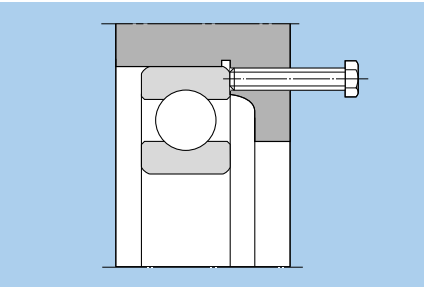
With tapered bore bearings, as the inner ring is driven axially onto the shaft or adapter or withdrawal sleeve, the interference will increase and the bearing internal radial clearance will decrease. Interference can be estimated by measuring decrease in internal radial clearance. As shown in **F g. 15.11**, the internal radial clearance between the rollers and outer ring of spherical roller bearings should be measured with a thickness gauge under no load while the rollers are held in the correct position. Instead of using the decrease in amount of internal radial clearance to estimate the interference, it is possible to estimate by measuring the distance the bearing has been driven onto the shaft.

For spherical roller bearings, **Tab e 15.1** indicates the appropriate interference which will be achieved as a result of the internal radial clearance decrease, or the distance the bearing has been driven onto the shaft.

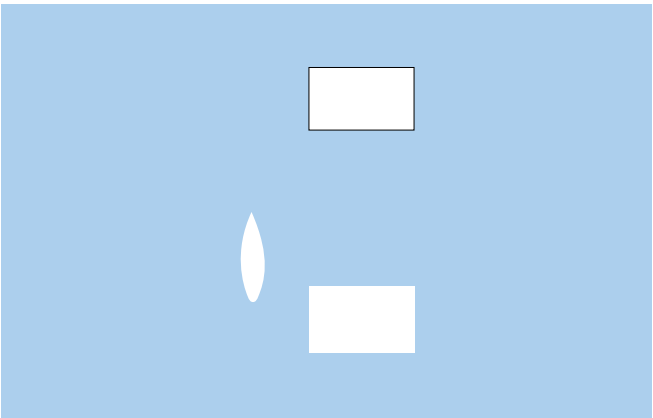
For conditions such as heavy loads, high speeds, or when there is a large temperature differential between the inner and outer rings, etc. which require large interference fits, bearings which have a minimum internal radial clearance of C3 or greater should be used. **Tab e 15.1** lists the maximum values for internal radial clearance

Units mm

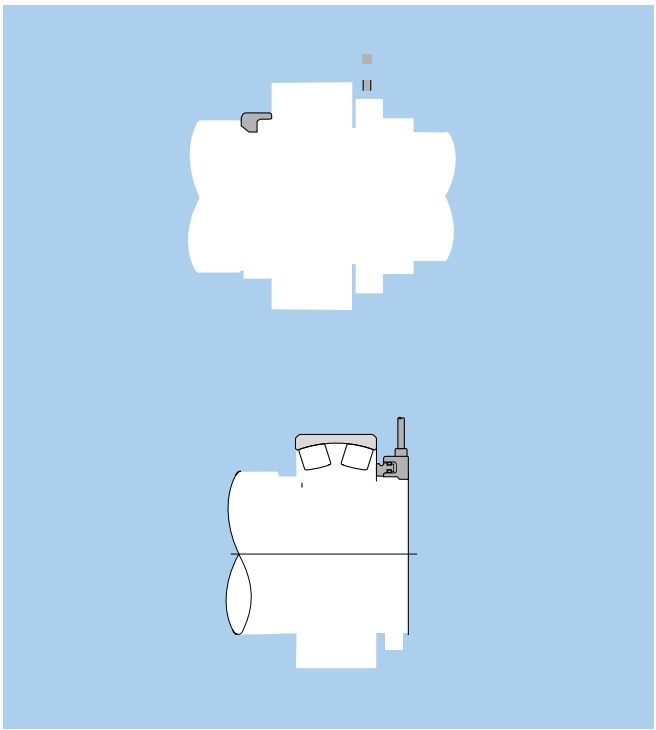
Nominal bearing bore diameter d		Reduction of radial internal clearance		Axial displacement drive up				Minimum allowable residual clearance		
				Taper, 1:12		Taper, 1:30				
		Min	Max	Min	Max	Min	Max	CN	C3	C4
30	40	0.02	0.025	0.35	0.4	—	—	0.015	0.025	0.04
40	50	0.025	0.03	0.4	0.45	—	—	0.02	0.03	0.05
50	65	0.03	0.035	0.45	0.6	—	—	0.025	0.035	0.055
65	80	0.04	0.045	0.6	0.7	—	—	0.025	0.04	0.07
80	100	0.045	0.055	0.7	0.8	1.75	2.25	0.035	0.05	0.08
100	120	0.05	0.06	0.75	0.9	1.9	2.25	0.05	0.065	0.1
120	140	0.065	0.075	1.1	1.2	2.75	3	0.055	0.08	0.11
140	160	0.075	0.09	1.2	1.4	3	3.75	0.055	0.09	0.13
160	180	0.08	0.1	1.3	1.6	3.25	4	0.06	0.1	0.15
180	200	0.09	0.11	1.4	1.7	3.5	4.25	0.07	0.1	0.16
200	225	0.1	0.12	1.6	1.9	4	4.75	0.08	0.12	0.18
225	250	0.11	0.13	1.7	2	4.25	5	0.09	0.13	0.2
250	280	0.12	0.15	1.9	2.4	4.75	6	0.1	0.14	0.22
280	315	0.13	0.16	2	2.5	5	6.25	0.11	0.15	0.24
315	355	0.15	0.18	2.4	2.8	6	7	0.12	0.17	0.26
355	400	0.17	0.21	2.6	3.3	6.5	8.25	0.13	0.19	0.29
400	450	0.2	0.24	3.1	3.7	7.75	9.25	0.13	0.2	0.31
450	500	0.21	0.26	3.3	4	8.25	10	0.16	0.23	0.35
500	560	0.24	0.3	3.7	4.6	9.25	11.5	0.17	0.25	0.36
560	630	0.26	0.33	4	5.1	10	12.5	0.2	0.29	0.41
630	710	0.3	0.37	4.6	5.7	11.5	14.5	0.21	0.31	
710	800	0.34	0.43	5.3	6.7	13.3	16.5	0.23	0.35	
800	900	0.37	0.47	5.7	7.3	14.3	18.5	0.27	0.39	
900	1,000	0.41	0.53	6.3	8.2	15.8	20.5	0.3	0.43	
1,000	1,120	0.45	0.58	6.8	8.7	17	22.5	0.32	0.48	
1,120	1,250	0.49	0.63	7.4	9.4	18.5	24.5	0.34	0.54	



F g. 15.19 O e g d a e b b



F g. 15.23 Re a f bea g b h d a c e e

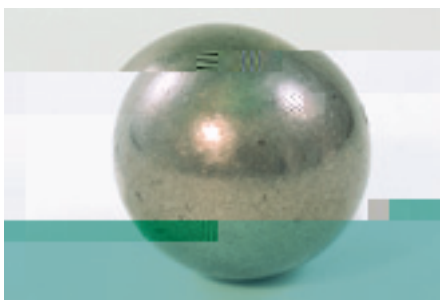


16. Bearing Damage and Corrective Measures

If handled correctly, bearings can generally be used for a long time before reaching their fatigue life. If damage occurs prematurely, the problem could stem from improper bearing selection, handling or lubrication. In this occurs, take note of the type of machine on which the bearings is used, the place where it is mounted, service conditions and surrounding structure. By investigating several possible causes surmised from the type of damage and condition at the time the damage occurred, it is possible to prevent the same kind of damage from reoccurring. **Table 16.1** gives the main causes of bearing damage and remedies for correcting the problem.

	Description		
Flaking	Surface of the raceway and rolling elements peels away in flakes Conspicuous hills and valleys form soon afterward. 	Causes	● Excessive load, fatigue life, improper handling ● Improper mounting. ● Improper precision in the shaft or housing. ● Insufficient clearance. ● Contamination. ● Rust. ● Improper lubrication ● Drop in hardness due to abnormally high temperatures.
		Correction	● Select a different type of bearing. ● Reevaluate the clearance. ● Improve the precision of the shaft and housing. ● Review application conditions. ● Improve assembly method and handling. ● Reevaluate the layout (design) of the area around the bearing. ● Review lubricant type and lubrication methods.
Seizure	The bearing heats up and becomes discolored. Eventually the bearing will seize up. 	Causes	● Insufficient clearance (including clearances made smaller by local deformation). ● Insufficient lubrication or improper lubricant. ● Excessive loads (excessive preload). ● Skewed rollers. ● Reduction in hardness due to abnormal temperature rise
		Correction	● Riview lubricant type and quantity. ● Check for proper clearance. (Increase clearances.) ● Take steps to prevent misalignment. ●
Cracking and notching	Localized flaking occurs. Little cracks or notches appear.  	Causes	
		Correction	

Table 16.1 Bearing damage, main causes of bearing damage and remedies for correcting the problem

Description		
Creeping	Surface becomes mirrored by sliding of inside and outside diameter surfaces. May by accompanied by discoloration or score.  	**Causes** ● Insufficient interference in the mating section. ● Sleeve not fastened down properly. ● Abnormal temperature rise. ● Excessive loads. **Correction** ● Reevaluate the interference. ● Reevaluate usage conditions. ● Review the precision of the shaft and housing. ● Raceway end panel scuffing
Speckles and discoloration	Luster of raceway surfaces is gone; surface is matted, rough, and / or evenly dimpled. Surface covered with minute dents.  	**Causes** ● Infiltration of bearing by foreign matter. ● Insufficient lubrication. **Correction** ● Reevaluation of lubricant type and lubrication method. ● Review sealing mechanisms. ● Examine lubrication oil purity. (filter may be excessively dirty, etc.)
Peeling	Patches of minute flaking or peeling (size, approx. 10 μm). Innumerable hair-line cracks visible though not yet peeling. (This type of damage frequently seen on roller bearings.) 	**Causes** ● Infiltration of bearing by foreign matter. ● Insufficient lubrication. **Correction** ● Reevaluation of lubricant type and lubrication method. ● Improve sealing performance. (to prevent infiltration of foreign matter) ● Take care to operate smoothly.

17. Technical data

17.1 Deep groove ball bearing radial internal clearances and axial internal clearances

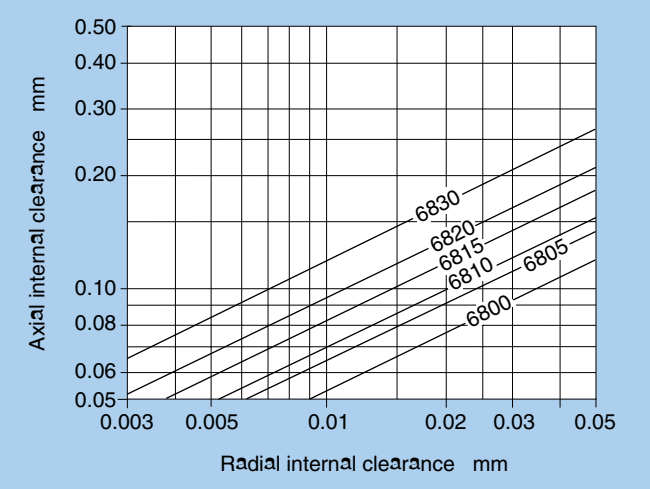


Fig. 17.1.1 Series 68 radial internal/axial internal clearances

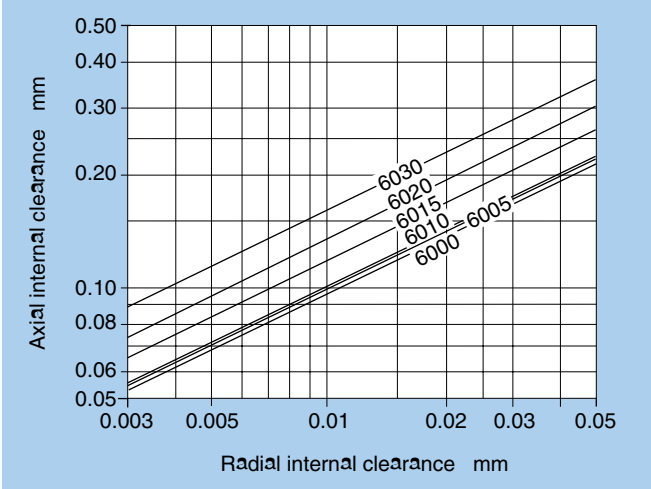


Fig. 17.1.3 Series 60 radial internal/axial internal clearances

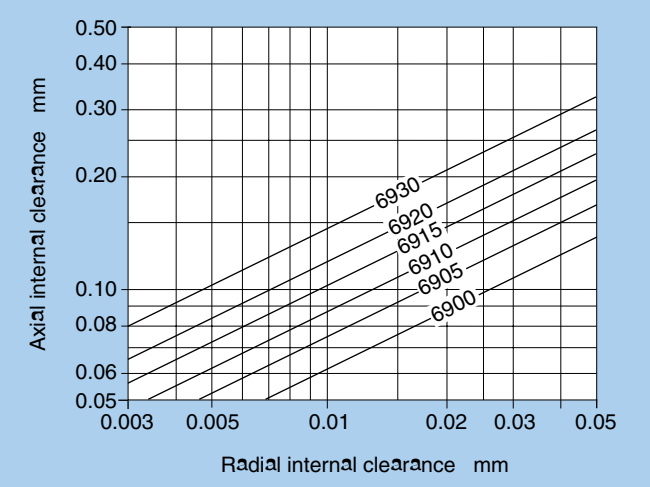


Fig. 17.1.2 Series 69 radial internal/axial internal clearances

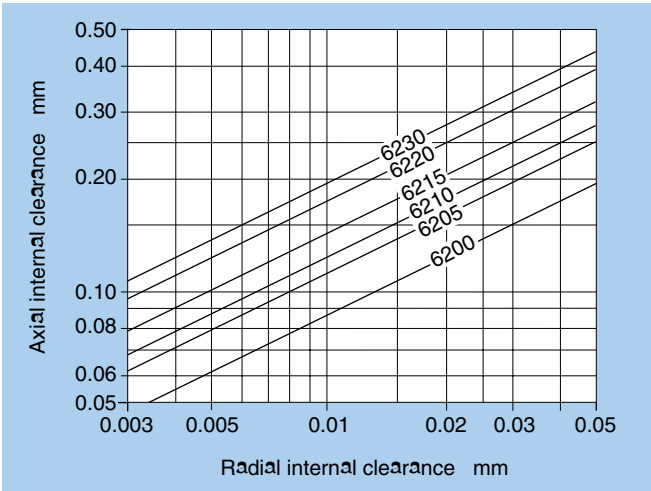


Fig. 17.1.4 Series 62 radial internal/axial internal clearances

17.2 Angular contact ball bearing axial load and axial displacement

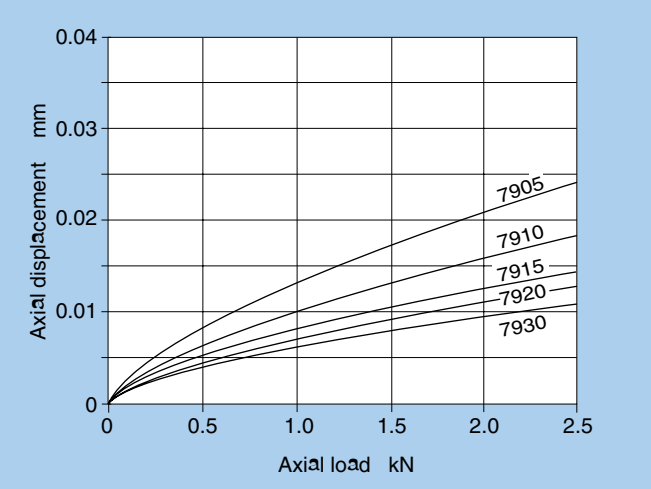


Fig. 17.2.1 Series 79 axial load and axial displacement

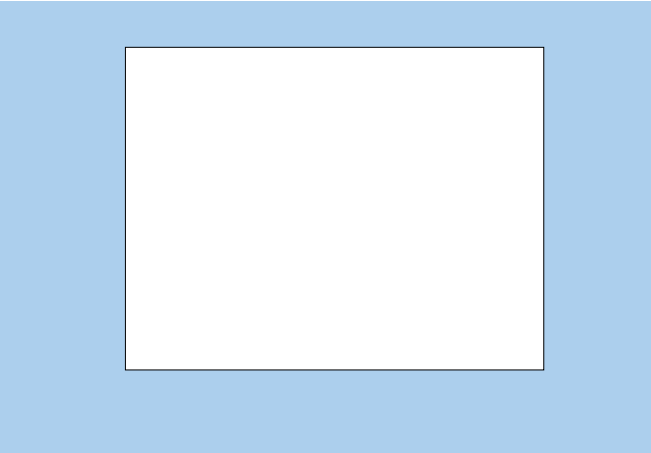


Fig. 17.2.2 Series 70 axial load and axial displacement

17.3 Tapered roller bearing axial load and axial displacement

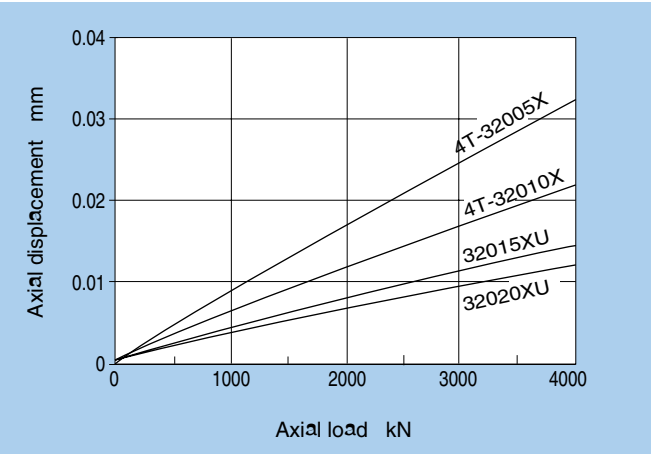


FIg. 17.3.1 Series 320 axial load and axial displacement

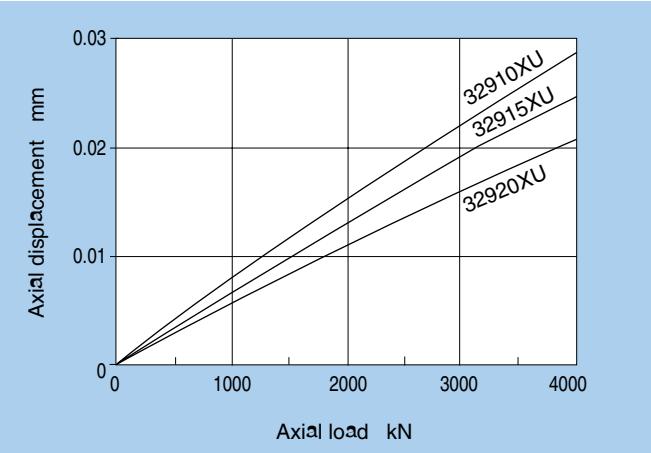


Fig. 17.3.2 Series 329 axial load and axial displacement

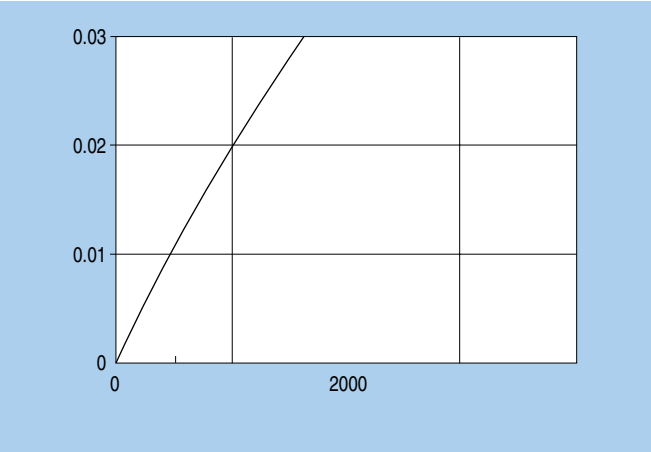


FIg. 17.3.3 Series 303/303 D axial load and axial displacement

Table 17.5.1 Fitting surface pressure and maximum stress

Fit conditions		Equation	
MPa {kgf / mm²}	Solid steel shaft/ inner ring fit	$P = \frac{E}{2} \frac{d_{eff}}{d} \left\{ 1 - \left(\frac{d}{D_i} \right)^2 \right\}$	
	Hollow steel shaft/ inner ring fit	$P = \frac{E}{2} \frac{d_{eff}}{d} \frac{[1 - (d / D_i)^2] [1 - (d_o / d)^2]}{[1 - (d_o / D_i)^2]}$	
	Steel housing/ outer ring fit		
Maximum stress MPa {kgf / mm²}	Shaft / inner ring fit		
	Housing/ outer ring fit		

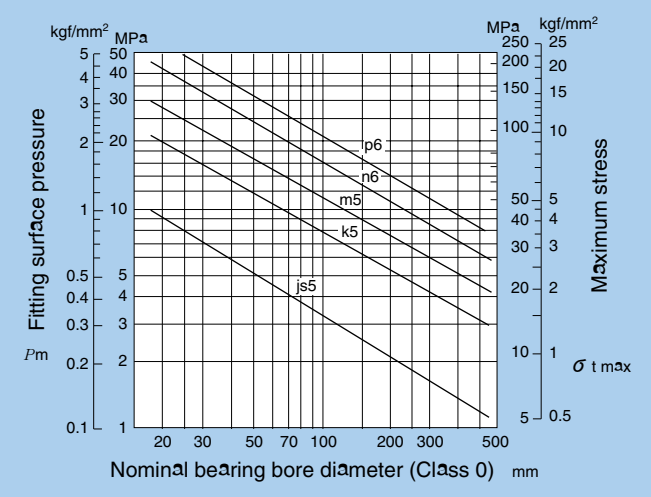


Fig. 17.5.1 Average fit interference as it relates to surface pressure P_m and max. stress $\sigma_{t\,max}$

17.6 Necessary press fit and pullout force

Equations (17.1) and (17.2) below can be used to calculate the necessary pullout force for press fit for inner rings and shafts or outer rings and housings.

For shaft and inner rings:

$$K_d = \mu \cdot P \cdot \pi \cdot d \cdot B \quad \cdots\cdots(17.1)$$

For housing and outer rings:

$$K_D = \mu \cdot P \cdot \pi \cdot D \cdot B \quad \cdots\cdots(17.2)$$

Where,

K_d : Inner ring press fit or pullout force N {kgf}
K_D : Outer ring press fit or pullout force N {kgf}
P : Fitting surface pressure MPa {kgf/mm²}
(Refer to **Table 17.5.1**)
d : Shaft diameter, inner ring bore diameter mm
D : Housing inner diameter, outer ring outer diameter mm
B : Inner or outer ring width
μ : Sliding friction coefficient (Refer to **Table 17.6.1**)

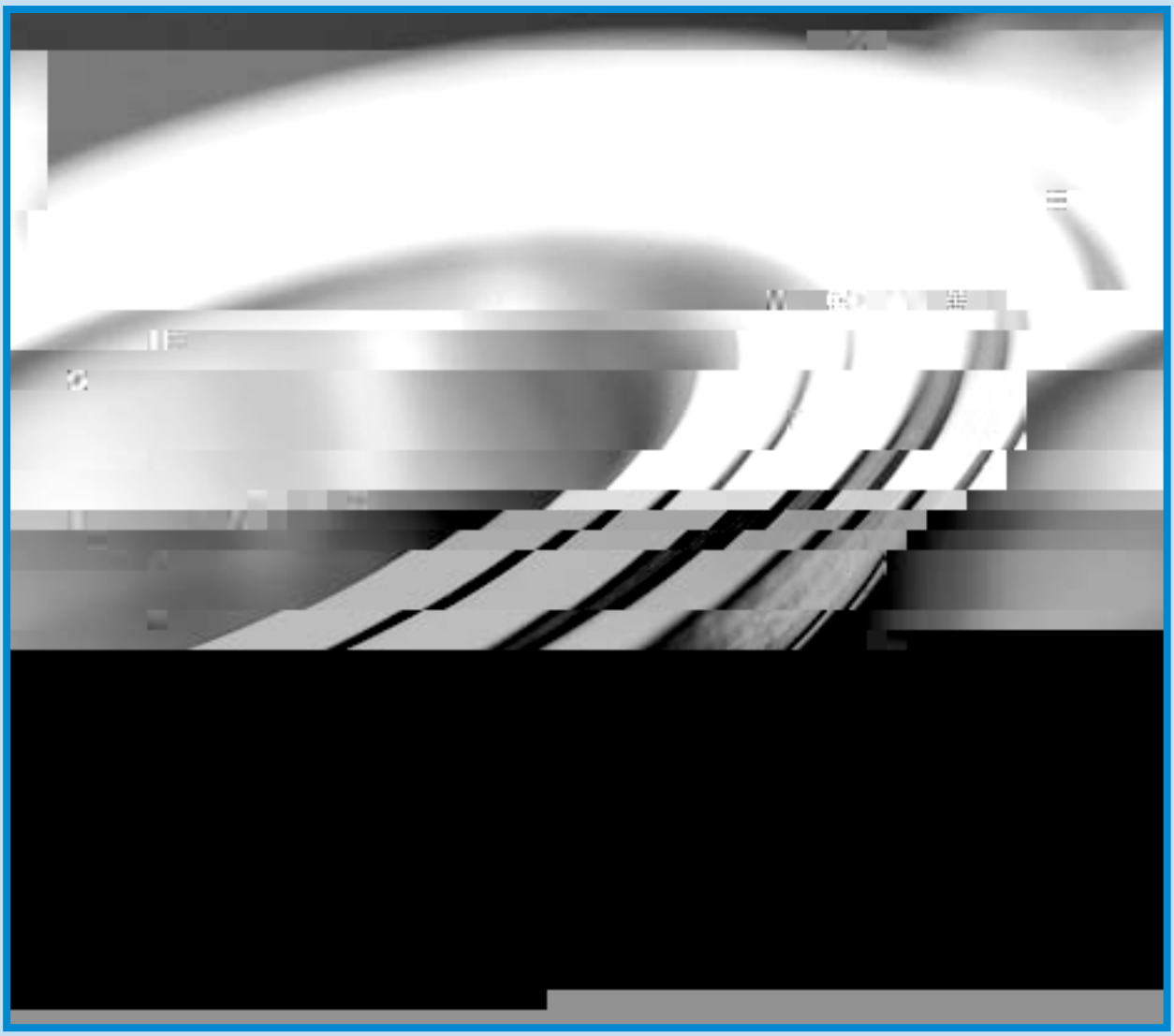
Table 17.6.1 Press fit and pullout sliding friction coefficient

Type	μ
Inner (outer) ring press fit onto cylindrical shaft (bore)	0.12
Inner (outer) ring pullout from cylindrical shaft (bore)	0.18
Inner ring press fit onto tapered shaft or sleeve	0.17
Inner ring pullout from tapered shaft	0.14
Sleeve press fit onto shaft/bearing	0.30
Sleeve pullout from shaft/bearing	0.33

Fig. 17.5.2 Maximum fit interference as it relates to surface pressure P_m and max. stress $\sigma_{t\,max}$

❶ ¤ÞÞ®¾Î¥ ËvDb& Cx ï A!Á TGbbh‡YU9™u•Y™H‡ rh‡H‡ rW² ñc•0bC‡Ÿ ƒ • ‡ ? ƒ•Ac t 6ñ80d 6 u…ñ88XP ‡…ñ80hP ‡)_ ƒ, • r(b_ ƒ "†% vˆta ™—

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NTN

1. Design features and special characteristics

Deep groove ball bearings are very widely used. A deep groove is formed on each inner and outer ring of the bearing enabling them to sustain radial and axial loads in either

2. Standard cage types

As shown in **Table 2**, pressed cages are generally used in deep groove ball bearings. Machined cages are however used for large bearings and high-speed bearings.

Table 2 Standard cage for deep groove ball bearings

Bearing series	Pressed cages	Machined cages
67	6700～ 6706	—
68	6800～ 6834	6836～ 68／600
69	6900～ 6934	6936～ 69／500
160	16001～16052	16056～ 16072
60	6000～ 6052	6056～ 6084
62	6200～ 6244	—
63	6300～ 6344	—
64	6403～ 6416	—

3. Other bearing types

3. 1 Bearings with snap rings

Some bearings accommodate a snap ring which is attached along the outer diameter of the outer ring. By using snap rings, positioning in the axial direction is possible and housing installation is simplified. In addition to open type, shielded and sealed types are also manufactured. Consult **NTN** Engineering.

3. 2 Expansion compensating bearings (creep prevention bearings)

The boundary dimensions of expansion compensating deep groove ball bearings are the same as for standard bearings, but formed high polymer material with a high expansion rate is provided in the grooves on the outer circumference of the outer ring (see **Diagram 1**) .

Due to the extremely small difference of thermal expansion attained between the fitted surfaces of the high polymer equipped outer ring and the light alloy bearing housing, a good interference fit can be achieved with stable performance across a wide temperature range. Another advantage is a large reduction in the occurrence of outer ring creeping.

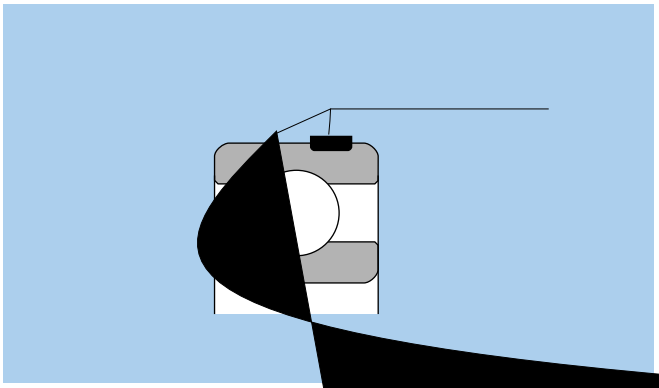


Diagram 1. Expansion **housing inner diameter chamfer**

(1) Allowable load

Maximum allowable load C_p (refer to the table of boundary dimensions) has been determined in accordance with outer ring strength; therefore, **it is necessary to select a bearing with a maximum allowable load greater than the largest anticipated bearing load.**

(2) Housing and bearing fit

Table 3 shows the recommended fits for bearings with light metal alloy housings.

In cases where the bearing is going to be interference fit with the housing, it is very important not to damage the high polymer material. Therefore it is essential that the lip of the housing diameter be given a 10˚–15˚ chamfer as shown in **Diagram 2**.

Furthermore, as shown in **Diagram 2**, it is also advisable to apply the interference fit using a press in order not force the bearing into the housing in a misaligned position. (**Diagram 2**)

(3) Radial internal clearance

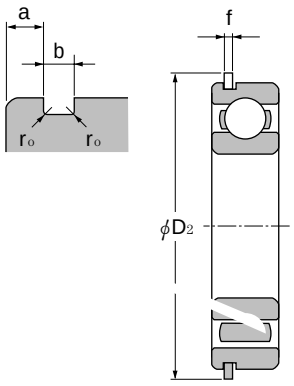
Regulations for radial internal clearance are the same as those for standard deep groove ball bearings. For standard fit and application conditions, a C3 clearance is used with

Table 3 Recommended fits for outer ring and housing bore



d 10～20mm

d	Dimensions						Basic load ratings		Limiting speeds		Open type	Shielded type (ZZ)	Non-contact sealed type (LLB, LLF)	Low torque sealed type (LLH)	Contact sealed type (LLU)
10	15	3	0.1	—	0.855	0.435	87	44	15.7	10 000	12 000	—	—	6700	—	—	—	—
	19	5	0.3	—	1.83	0.925	187	94	14.8	32 000	38 000	—	24 000	6800	ZZ	LLB	—	LLU
	22	6	0.3	0.3	2.7	1.27	275	129	14.0	30 000	36 000	—	21 000	6900	ZZ	LLB	—	LLU
	26	8	0.3	—	4.55	1.96	465	200	12.4	29 000	34 000	25 000	21 000	6000	ZZ	LLB	LLH	LLU
	30	9	0.6	0.5	5.10	2.39	520	244	13.2	25 000	30 000	21 000	18 000	6200	ZZ	LLB	LLH	LLU
	35	11	0.6	0.5	8.20	3.50	835	355	11.4	23 000	27 000	20 000	16 000	6300	ZZ	LLB	LLH	LLU
12	18	4	0.2	—	0.930	0.530	95	54	16.2	8 300	9 500	—	—	6701	—	LLF	—	—
	21	5	0.3	—	1.92	1.04	195	106	15.3	29 000	35 000	—	20 000	6801	ZZ	LLB	—	LLU
	24	6	0.3	0.3	2.89	1.46	295	149	14.5	27 000	32 000	—	19 000	6901	ZZ	LLB	—	LLU
	28	7	0.3	—	5.10	2.39	520	244	13.2	26 000	30 000	—	—	16001	—	—	—	—
	28	8	0.3	—	5.10	2.39	520	244	13.2	26 000	30 000	21 000	18 000	6001	ZZ	LLB	LLH	LLU
	32	10	0.6	0.5	6.10	2.75	620	280	12.7	22 000	26 000	20 000	16 000	6201	ZZ	LLB	LLH	LLU
	37	12	1	0.5	9.70	4.20	990	425	11.1	20 000	24 000	19 000	15 000	6301	ZZ	LLB	LLH	LLU
15	21	4	0.2	—	0.940	0.585	96	59	16.5	6 600	7 600	—	—	6702	—	LLF	—	—
	24	5	0.3	—	2.08	1.26	212	128	15.8	26 000	31 000	—	17 000	6802	ZZ	LLB	—	LLU
	28	7	0.3	0.3	3.65	2.00	375	204	14.8	24 000	28 000	—	16 000	6902	ZZ	LLB	—	LLU
	32	8	0.3	—	5.60	2.83	570	289	13.9	22 000	26 000	—	—	16002	—	—	—	—
	32	9	0.3	0.3	5.60	2.83	570	289	13.9	22 000	26 000	18 000	15 000	6002	ZZ	LLB	LLH	LLU
	35	11	0.6	0.5	7.75	3.60	790	365	12.7	19 000	23 000	18 000	15 000	6202	ZZ	LLB	LLH	LLU
	42	13	1	0.5	11.4	5.45	1 170	555	12.3	17 000	21 000	15 000	12 000	6302	ZZ	LLB	LLH	LLU
17	23	4	0.2	—	1.00	0.660	102	67	16.3	5 000	6 700	—	—	6703	—	LLF	—	—
	26	5	0.3	—	2.23	1.46	227	149	16.1	24 000	28 000	—	15 000	6803	ZZ	LLB	—	LLU
	30	7	0.3	0.3	4.65	2.58	475	263	14.7	22 000	26 000	—	14 000	6903	ZZ	LLB	—	LLU
	35	8	0.3	—	6.80	3.35	695	345	13.6	20 000	24 000	—	—	16003	—	—	—	—
	35	10	0.3	0.3	6.80	3.35	695	345	13.6	20 000	24 000	16 000	14 000	6003	ZZ	LLB	LLH	LLU
	40	12	0.6	0.5	9.60	4.60	980	465	12.8	18 000	21 000	15 000	12 000	6203	ZZ	LLB	LLH	LLU
	47	14	1	0.5	13.5	6.55	1 380	665	12.2	16 000	19 000	14 000	11 000	6303	ZZ	LLB	LLH	LLU
	62	17	1.1	—	22.7	10.8	2 320	1 100	11.1	14 000	16 000	—	—	6403	—	—	—	—
20	27	4	0.2	—	1.04	0.730	106	74	16.1	5 000	5 700	—	—	6704	—	LLF	—	—
	32	7	0.3	0.3	4.00	2.47	410	252	15.5	21 000	25 000	—	13 000	6804	ZZ	LLB	—	LLU
	37	9	0.3	0.3	6.40	3.70	650	375	14.7	19 000	23 000	—	12 000	6904	ZZ	LLB	—	LLU
	42	8	0.3	—	7.90	4.50	810	455	14.5	18 000	21 000	—	—	16004	—	—	—	—
	42	12	0.6	0.5	9.40	5.05	955	515	13.9	18 000	21 000	13 000	11 000	6004	ZZ	LLB	LLH	LLU
	47	14	1	0.5	12.8	6.65	1 310	680	13.2	16 000	18 000	12 000	10 000	6204	ZZ	LLB	LLH	LLU
	52	15	1.1	0.5	15.9	7.90	1 620	805	12.4	14 000	17 000	12 000	10 000	6304	ZZ	LLB	LLH	LLU



Bearing numbers		Snap ring groove dimensions mm				Snap ring dimensions mm		Abutment and fillet dimensions mm								Mass[4] kg
Snap ring groove	Snap ring	D_1 max.	a max.	b min.	r_o max.	D_2 max.	f max.	d_a min.	d_a max.[3]	D_a max.	D_X (appr.)	C_Y max.	C_Z min.	r_{as} max.	r_{Nas} max.	(appr.)
—	—	—	—	—	—	—	—	10.8	—	14.2	—	—	—	0.1	—	0.0015
—	—	—	—	—	—	—	—	12	12.5	17	—	—	—	0.3	—	0.005
N	**NR**	20.8	1.05	0.8	0.2	24.8	0.7	12	13	20	25.5	1.5	0.7	0.3	0.3	0.009
—[5]	—[5]	—	—	—	—	—	—	12	13.5	24	—	—	—	0.3	—	0.019
N	**NR**	28.17	2.06	1.35	0.4	34.7	1.12	14	16	26	35.5	2.9	1.2	0.6	0.5	0.032
N	**NR**	33.17	2.06	1.35	0.4	39.7	1.12	14	17	31	40.5	2.9	1.2	0.6	0.5	0.053
—	—	—	—	—	—	—	—	13.6	13.8	16.4	—	—	—	0.2	—	0.002
—	—	—	—	—	—	—	—	14	14.5	19	—	—	—	0.3	—	0.006
N	**NR**	22.8	1.05	0.8	0.2	26.8	0.7	14	15	22	27.5	1.5	0.7	0.3	0.3	0.011
—	—	—	—	—	—	—	—	14	—	26	—	—	—	0.3	—	0.019
—[5]	—[5]	—	—	—	—	—	—	14	16	26	—	—	—	0.3	—	0.021
N	**NR**	30.15	2.06	1.35	0.4	36.7	1.12	16	17	28	37.5	2.9	1.2	0.6	0.5	0.037
N	**NR**	34.77	2.06	1.35	0.4	41.3	1.12	17	18.5	32	42	2.9	1.2	1	0.5	0.06
—	—	—	—	—	—	—	—	16.6	16.8	19.4	—	—	—	0.2	—	0.0025
—	—	—	—	—	—	—	—	17	17.5	22	—	—	—	0.3	—	0.007
N	**NR**	26.7	1.3	0.95	0.25	30.8	0.85	17	17.5	26	31.5	1.9	0.9	0.3	0.3	0.016
—	—	—	—	—	—	—	—	17	—	30	—	—	—	0.3	—	0.025
N	**NR**	30.15	2.06	1.35	0.4	36.7	1.12	17	19	30	37.5	2.9	1.2	0.3	0.3	0.03
N	**NR**	33.17	2.06	1.35	0.4	39.7	1.12	19	20	31	40.5	2.9	1.2	0.6	0.5	0.045
N	**NR**	39.75	2.06	1.35	0.4	46.3	1.12	20	23	37	47	2.9	1.2	1	0.5	0.082
—	—	—	—	—	—	—	—	18.6	18.8	21.4	—	—	—	0.2	—	0.0025
—	—	—	—	—	—	—	—	19	19.5	24	—	—	—	0.3	—	0.008
N	**NR**	28.7	1.3	0.95	0.25	32.8	0.85	19	20	28	33.5	1.9	0.9	0.3	0.3	0.018
—	—	—	—	—	—	—	—	19	—	33	—	—	—	0.3	—	0.032
N	**NR**	33.17	2.06	1.35	0.4	39.7	1.12	19	21	33	40.5	2.9	1.2	0.3	0.3	0.039
N	**NR**	38.1	2.06	1.35	0.4	44.6	1.12	21	23	36	45.5	2.9	1.2	0.6	0.5	0.066
N	**NR**	44.6	2.46	1.35	0.4	52.7	1.12	22	25	42	53.5	3.3	1.2	1	0.5	0.115
—	—	—	—	—	—	—	—	23.5	—	55.5	—	—	—	1	—	0.27
—	—	—	—	—	—	—	—	21.6	22.3	25.4	—	—	—	0.2	—	0.0045
N	**NR**	30.7	1.3	0.95	0.25	34.8	0.85	22	22.5	30	35.5	1.9	0.9	0.3	0.3	0.019
N	**NR**	35.7	1.7	0.95	0.25	39.8	0.85	22	24	35	40.5	2.3	0.9	0.3	0.3	0.036
—	—	—	—	—	—	—	—	22	—	40	—	—	—	0.3	—	0.051
N	**NR**	39.75	2.06	1.35	0.4	46.3	1.12	24	26	38	47	2.9	1.2	0.6	0.5	0.069
N	**NR**	44.6	2.46	1.35	0.4	52.7	1.12	25	28	42	53.5	3.3	1.2	1	0.5	0.106
N	**NR**	49.73	2.46	1.35	0.4	57.9	1.12	26.5	28.5	45.5	58.5	3.3	1.2	1	0.5	0.144

d 20～35mm

20	72	19	1.1	—	28.5	13.9	2 900	1 420	11.4	12 000	14 000	—	—	**6404**	—	—	—	—
22	44	12	0.6	0.5	9.40	5.05	955	515	13.9	17								
25																		
28																		
30																		
32																		
35																		

d 40～60mm

40

45

50

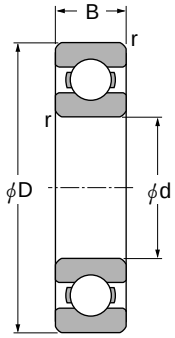
55

60

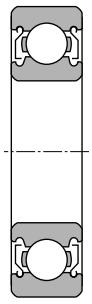
N	**NR**	50.7	1.3	0.95	0.25	54.8	0.85	42	43	50	5
N	**NR**	60.7	1.7	0.95	0.25	64.8	0.85	44	45	58	6
—	—	—	—	—	—	—	—	42	—	66	–
N	**NR**	64.82	2.49	1.9	0.6	74.6	1.7	45	47	63	7
N	**NR**	76.81	3.28	1.9	0.6	86.6	1.7	46.5	51	73.5	8
N	**NR**	86.79	3.28	2.7	0.6	96.5	2.46	48	54	82	9
—	—	—	—	—	—	—	—	49	—	101	–
N	**NR**	56.7	1.3	0.95	0.25	60.8	0.85	47	48	56	6
N	**NR**	66.7	1.7	0.95	0.25	70.8	0.85	49	51	64	7
—	—	—	—	—	—	—	—	49	—	71	–
N	**NR**	71.83	2.49	1.9	0.6	81.6	1.7	50	52.5	70	

d 65～85mm

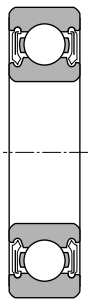
65	85	10	0.6	0.5	11.6	11.0	1 180	1 120	16.2	7 400	8 700	4 100	**6813**	**ZZ**	**LLB**	**LLU**
	90	13	1	0.5	17.4	16.1	1 770	1 640	16.6	7 000	8 200	4 000	**6913**	**ZZ**	**LLB**	**LLU**
	100	11	0.6	—	20.5	18.7	2 090	1 910	16.5	6 500	7 700	—	**16013**	—	—	—
	100	18	1.1	0.5	30.5	25.2	3 100	2 570	15.8	6 500	7 700	3 900	**6013**	**ZZ**	**LLB**	**LLU**
	120	23	1.5	0.5	57.5	40.0	5 850	4 100	14.4	5 500	6 500	3 600	**6213**	**ZZ**	**LLB**	**LLU**
	140	33	2.1	0.5	92.5	60.0	9 450	6 100	13.2	4 900	5 800	3 300	**6313**	**ZZ**	**LLB**	**LLU**
	160	37	2.1	—	111	72.5	11 300	7 400	12.7	4 400	5 200	—	**6413**	—	—	—
70	90	10	0.6	0.5	12.1	11.9	1 230	1 220	16.1	6 900	8 100	3 800	**6814**	**ZZ**	**LLB**	**LLU**
	100	16	1	0.5	23.7	21.2	2 420	2 160	16.3	6 500	7 700	3 700	**6914**	**ZZ**	**LLB**	**LLU**
	110	13	0.6	—	24.4	22.6	2 480	2 300	16.5	6 100	7 100	—	**16014**	—	—	—
	110	20	1.1	0.5	38.0	31.0	3 900	3 150	15.6	6 100	7 100	3 600	**6014**	**ZZ**	**LLB**	**LLU**
	125	24	1.5	0.5	62.0	44.0	6 350	4 500	14.5	5 100	6 000	3 400	**6214**	**ZZ**	**LLB**	**LLU**
	150	35	2.1	0.5	104	68.0	10 600	6 950	13.2	4 600	5 400	3 100	**6314**	**ZZ**	**LLB**	**LLU**
	180	42	3	—	128	89.5	13 100	9 100	12.7	4 100	4 800	—	**6414**	—	—	—
75	95	10	0.6	0.5	12.5	12.9	1 280	1 310	16.0	6 400	7 600	3 600	**6815**	**ZZ**	**LLB**	**LLU**
	105	16	1	0.5	24.4	22.6	2 480	2 300	16.5	6 100	7 200	3 500	**6915**	**ZZ**	**LLB**	**LLU**
	115	13	0.6	—	25.0	24.0	2 540	2 450	16.6	5 700	6 700	—	**16015**	—	—	—
	115	20	1.1	0.5	39.5	33.5	4 050	3 400	15.8	5 700	6 700	3 300	**6015**	**ZZ**	**LLB**	**LLU**
	130	25	1.5	0.5	66.0	49.5	6 750	5 050	14.7	4 800	5 600	3 200	**6215**	**ZZ**	**LLB**	**LLU**
	160	37	2.1	0.5	113	77.0	11 600	7 850	13.2	4 300	5 000	2 900	**6315**	**ZZ**	**LLB**	**LLU**
	190	45	3	—	138	99.0	14 000	10 100	12.7	3 800	4 500	—	**6415**	—	—	—
80	100	10	0.6	0.5	12.7	13.3	1 290	1 360	16.0	6 000	7 100	3 400	**6816**	**ZZ**	**LLB**	**LLU**
	110	16	1	0.5	24.9	24.0	2 540	2 450	16.6	5 700	6 700	3 200	**6916**	**ZZ**	**LLB**	**LLU**
	125	14	0.6	—	25.4	25.1	2 590	2 560	16.4	5 300	6 200	—	**16016**	—	—	—
	125	22	1.1	0.5	47.5	40.0	4 850	4 050	15.6	5 300	6 200	3 100	**6016**	**ZZ**	**LLB**	**LLU**
	140	26	2	0.5	72.5	53.0	7 400	5 400	14.6	4 500	5 300	3 0.5				
85																



Open type



Shielded type (ZZ)



Non-contact sealed type (LLB)



Contact sealed type (LLU)

d 90～120mm

Boundary dimensions					Basic load ratings				Factor	Limiting speeds			Bearing numbers			
					d namic	a ic	d namic	a ic				min^{-1}				
	mm				kN		kgf			g ea e	il		n n-	l -		
d	D	B	$r_{s\,min}$[1]	r_{NS} min	C_r	C_{or}	C_r	C_{or}	f_o	en e ZZ	en e LB	LLU	en e	c n ac hielded e	c n ac ealed e	c n ac ealed e
90	115	13	1	0.5	19.0	19.7	1 940	2 010	16.1	5 400	6 300	3 000	6818	ZZ	LLB	LLU
	125	18	1.1	0.5	33.0	31.5	3 350	3 200	16.5	5 100	6 000	2 900	6918	ZZ	LLB	LLU
	140	16	1	—	33.5	33.5	3 400	3 400	16.5	4 700	5 600	—	16018	—	—	—
	140	24	1.5	0.5	58.0	49.5	5 950	5 050	15.6	4 700	5 600	2 800	6018	ZZ	LLB	LLU
	160	30	2	0.5	96.0	71.5	9 800	7 300	14.5	4 000	4 700	2 600	6218	ZZ	LLB	LLU
	190	43	3	0.5	143	107	14 500	10 900	13.3	3 600	4 200	2 400	6318	ZZ	LLB	LLU
95	120	13	1	0.5	19.3	20.5	1 970	2 090	16.1	5 000	5 900	2 800	6819	ZZ	LLB	LLU
	130	18	1.1	0.5	33.5	33.5	3 450	3 400	16.6	4 800	5 700	2 800	6919	ZZ	LLB	LLU
	145	16	1	—	34.5	35.0	3 500	3 550	16.5	4 500	5 300	—	16019	—	—	—
	145	24	1.5	0.5	60.5	54.0	6 150	5 500	15.8	4 500	5 300	2 600	6019	ZZ	LLB	LLU
	170	32	2.1	0.5	109	82.0	11 100	8 350	14.4	3 700	4 400	2 500	6219	ZZ	LLB	LLU
	200	45	3	0.5	153	119	15 600	12 100	13.3	3 300	3 900	2 300	6319	ZZ	—	LLU
100	125	13	1	0.5	19.6	21.2	2 000	2 160	16.0	4 800	5 600	2 700	6820	ZZ	LLB	LLU
	140	20	1.1	0.5	41.0	39.5	4 200	4 050	16.4	4 500	5 300	2 600	6920	ZZ	LLB	LLU
	150	16	1	—	35.0	36.5	3 600	3 750	16.4	4 200	5 000	—	16020	—	—	—
	150	24	1.5	0.5	60.0	54.0	6 150	5 500	15.9	4 200	5 000	2 600	6020	ZZ	LLB	LLU
	180	34	2.1	0.5	122	93.0	12 500	9 450	14.4	3 500	4 200	2 300	6220	ZZ	LLB	LLU
	215	47	3	—	173	141	17 600	14 400	13.2	3 200	3 700	2 200	6320	ZZ	—	LLU
105	130	13	1	0.5	19.8	22.0	2 020	2 240	15.9	4 600	5 400	—	6821	—	—	—
	145	20	1.1	0.5	42.5	42.0	4 300	4 300	16.5	4 300	5 100	2 500	6921	ZZ	LLB	LLU
	160	18	1	—	52.0	50.5	5 300	5 150	16.3	4 000	4 700	—	16021	—	—	—
	160	26	2	0.5	72.5	65.5	7 400	6 700	15.8	4 000	4 700	2 400	6021	ZZ	LLB	LLU
	190	36	2.1	0.5	133	105	13 600	10 700	14.4	3 400	4 000	2 300	6221	ZZ	—	LLU
	225	49	3	—	184	153	18 700	15 700	13.2	3 000	3 600	2 100	6321	ZZ	—	LLU
110	140	16	1	0.5	24.9	28.2	2 540	2 880	16.0	4 300	5 100	—	6822	—	—	—
	150	20	1.1	0.5	43.5	44.5	4 450	4 550	16.6	4 100	4 800	2 400	6922	ZZ	LLB	LLU
	170	19	1	—	57.5	56.5	5 850	5 800	16.3	3 800	4 500	—	16022	—	—	—
	170	28	2	0.5	82.0	73.0	8 350	7 450	15.6	3 800	4 500	2 300	6022	ZZ	LLB	LLU
	200	38	2.1	0.5	144	117	14 700	11 900	14.3	3 200	3 800	2 200	6222	ZZ	—	LLU
	240	50	3	—	205	179	20 900	18 300	13.1	2 900	3 400	1 900	6322	ZZ	—	LLU
120	150	16	1	0.5	28.9	33.0	2 950	3 350	16.0	4 000	4 700	—	6824	—	—	—
	165	22	1.1	0.5	53.0	54.0	5 400	5 500	16.5	3 800	4 400	—	6924	—	—	—
	180	19	1	—	63.0	63.5	6 450	6 450	16.4	3 500	4 100	—	16024	—	—	—
	180	28	2	0.5	85.0	79.5	8 650	8 100	15.9	3 500	4 100	2 100	6024	ZZ	LLB	LLU

1) Smalle all able dimen i n f chamfe dimen i n r.

d 120～170mm

120	215	40	2.1	—	
130					
140					
150					
160					
170					

N	**NR**	217.0	6.5	4.5	1	227.8	3.1	131	143	204	230	9.2	3.1	2	0.5	5.15
—	—	—	—	—	—	—	—	133	—							

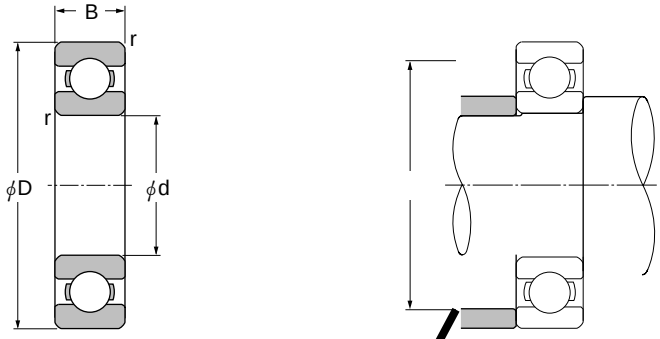
d 180～260mm

180	225	22	1.1	60.5	73.0	6 200	7 450	16.1	2 600	3 000	**6836**
	250	33	2	110	119	11 200	12 200	16.5	2 400	2 900	**6936**
	280	31	2	117	134	11 900	13 600	16.5	2 300	2 700	**16036**
	280	46	2.1	189	199	19 300	20 300	15.6	2 300	2 700	**6036**
	320	52	4	227	241	23 200	24 600	15.1	1 900	2 200	**6236**
	380	75	4	355	405	36 000	41 500	13.9	1 700	2 000	**6336**
190	240	24	1.5	73.0	88.0	7 450	9 000	16.1	2 400	2 900	**6838**
	260	33	2	113	127	11 500	13 000	16.6	2 300	2 700	**6938**
	290	31	2	134	156	13 700	15 900	16.6	2 100	2 500	**16038**
	290	46	2.1	197	215	20 100	21 900	15.8	2 100	2 500	**6038**
	340	55	4	255	281	26 000	28 700	15.0	1 800	2 100	**6238**
	400	78	5	355	415	36 000	42 500	14.1	1 600	1 900	**6338**
200	250	24	1.5	74.0	91.5	7 550	9 300	16.1	2 300	2 700	**6840**
	280	38	2.1	157	168	16 000	17 100	16.2	2 200	2 600	**6940**
	310	34	2	142	160	14 400	16 300	16.6	2 000	2 400	**16040**
	310	51	2.1	218	243	22 200	24 800	15.6	2 000	2 400	**6040**
	360	58	4	269	310	27 400	31 500	15.2	1 700	2 000	**6240**
	420	80	5	410	500	42 000	51 000	13.8	1 500	1 800	**6340**
220	270	24	1.5	76.5	98.0	7 800	10 000	16.0	2 100	2 400	**6844**
	300	38	2.1	160	180	16 400	18 400	16.4	2 000	2 300	**6944**
	340	37	2.1	181	216	18 500	22 000	16.5	1 800	2 200	**16044**
	340	56	3	241	289	24 600	29 400	15.8	1 800	2 200	**6044**
	400	65	4	297	365	30 500	37 000	15.3	1 500	1 800	**6244**
	460	88	5	410	520	42 000	53 000	14.3	1 400	1 600	**6344**
240	300	28	2	85.0	112	8 650	11 400	15.9	1 900	2 200	**6848**
	320	38	2.1	170	203	17 300	20 700	16.5	1 800	2 100	**6948**
	360	37	2.1	178	217	18 200	22 100	16.5	1 700	2 000	**16048**
	360	56	3	249	310	25 400	32 000	16.0	1 700	2 000	**6048**
260	320	28	2	87.0	120	8 900	12 200	15.8	1 700	2 000	**6852**
	360	46	2.1	222	280	22 600	28 500	16.3	1 600	1 900	**6952**
	400	44	3	227	299	23 200	30 500	16.5	1 500	1 800	**16052**
	400	65	4	291	375	29 700	38 500	15.8	1 500	1 800	**6052**

1)

	e	$\frac{F_a}{F_r}$			
0.172	0.19				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	0	0.56	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

Abutment and fillet dimensions mm			Mass kg
d_a min	D_a max	r_{as} max	(approx.)
186.5	218.5	1	2.03
189	241	2	4.76
189	271	2	6.49
191	269	2	8.8
196	304	3	15.1
196	364	3	35.6
198	232	1.5	2.62
199	251	2	4.98
199	281	2	6.77
201	279	2	9.18
206	324	3	18.2
210	380	4	41
208	242	1.5	2.73
211	269	2	7.1
209	301	2	8.68
211	299	2	11.9
216	344	3	21.6
220	400	4	46.3
228	262	1.5	3
231	289	2	7.69
231	329	2	11.3
233	327	2.5	15.7
236	384	3	30.2
240	440	4	60.8
249	291	2	4.6
251	309	2	8.28
251	349	2	12.1
253	347	2.5	16.8
269	311	2	5
271	349	2	13.9
273	387	2.5	18.5
276	384	3	25



d 280～440mm

Boundary dimensions mm				Basic load ratings (dynamic / static) kN		Basic load ratings (dynamic / static) kgf		Factor	Limiting speeds min^{-1} (grease / oil)		Bearing numbers
d	D	B	$r_{s\,min}$[1]	C_r	C_{or}	C_r	C_{or}	f_o	grease lubrication	oil lubrication	
280	350	33	2	137	177	13 900	18 100	16.1	1 600	1 900	6856
	380	46	2.1	227	299	23 200	30 500	16.5	1 500	1 800	6956
	420	44	3	232	315	23 700	32 500	16.5	1 400	1 600	16056
	420	65	4	325	420	33 000	43 000	15.5	1 400	1 600	6056
300	380	38	2.1	162	210	16 500	21 500	16.1	1 500	1 700	6860
	420	56	3	276	375	28 200	38 500	16.2	1 400	1 600	6960
	460	50	4	292	410	29 800	42 000	16.3	1 300	1 500	16060
	460	74	4	355	480	36 000	49 000	15.6	1 300	1 500	6060
320	400	38	2.1	168	228	17 200	23 200	16.1	1 400	1 600	6864
	440	56	3	285	405	29 000	41 000	16.4	1 300	1 500	6964
	480	50	4	300	440	30 500	45 000	16.4	1 200	1 400	16064
	480	74	4	370	530	38 000	54 000	15.7	1 200	1 400	6064
340	420	38	2.1	170	236	17 400	24 000	16.0	1 300	1 500	6868
	460	56	3	293	430	29 800	44 000	16.5	1 200	1 400	6968
	520	57	4	340	515	35 000	52 500	16.3	1 100	1 300	16068
	520	82	5	420	610	42 500	62 500	15.6	1 100	1 300	6068
360	440	38	2.1	187	258	19 100	26 300	16.0	1 200	1 400	6872
	480	56	3	300	455	30 500	46 500	16.5	1 100	1 300	6972
	540	57	4	350	550	36 000	56 000	16.4	1 100	1 200	16072
	540	82	5	440	670	44 500	68 000	15.7	1 100	1 200	6072
380	480	46	2.1	231	340	23 600	34 500	16.1	1 100	1 300	6876
	520	65	4	325	510	33 000	52 000	16.6	1 100	1 200	6976
	560	82	5	455	725	46 500	74 000	15.9	990	1 200	6076
400	500	46	2.1	226	340	23 100	34 500	16.0	1 100	1 200	6880
	540	65	4	335	535	34 000	54 500	16.5	990	1 200	6980
	600	90	5	510	825	52 000	84 000	15.7	930	1 100	6080
420	520	46	2.1	260	405	26 500	41 500	16.1	1 000	1 200	6884
	560	65	4	340	560	35 000	57 000	16.4	940	1 100	6984
	620	90	5	530	895	54 000	91 000	15.8	880	1 000	6084
440	540	46	2.1	264	420	26 900	43 000	16.0	950	1 100	6888
	600	74	4	365	615	37 500	63 000	16.4	890	1 000	6988

1) Smallest allowable dimension for chamfer dimension r.

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

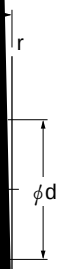
$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load

$P_{or} = 0.6F_r + 0.5F_a$

When $P_{or} < F_r$ use $P_{or} = F_r$

Abutment and fillet dimensions mm			Mass kg
d_a min	D_a max	r_{as} max	(approx.)
289	341	2	7.4
291	369	2	14.8
293	407	2.5	23
296	404	3	31
311	369	2	10.5
313	407	2.5	23.5
316	444	3	32.5
316	444	3	43.8
331	389	2	10.9
333	427	2.5	24.8
336	464	3	34.2
336	464	3	46.1
351	409	2	11.5
353	447	2.5	26.2
356	504	3	47.1
360	500	4	61.8
371	429	2	12.3
373	467	2.5	27.5
376	524	3	49.3
380	520	4	64.7
391	469	2	19.7
396	504	3	39.8
400	540	4	67.5
411	489	2	20.6
416	524	3	41.6
420	580	4	87.6
431	509	2	21.6
436	544	3	43.4
440	600	4	91.1
451	529	2	22.5
456	584	3	60



				Basic load ratings				Factor	Limiting speeds		Bearing numbers
				d namic	a ic	d namic	a ic		min^{-1}		
				kN		kgf			g ea e l b ica i n	il l b ica i n	en e
			1)	C_r	C_{or}	C_r	C_{or}	f_o			
4		3		315	515	32 000	52 500	16.2	900	1 100	**6892**
		4		375	645	38 500	66 000	16.4	850	1 000	**6992**
48		3		320	540	32 500	55 000	16.1	860	1 000	**6896**
		5		430	770	44 000	78 500	16.5	810	950	**6996**
50		3		325	560	33 500	57 000	16.1	820	970	**68/500**
	8	5		445	805	45 500	82 500	16.5	770	910	**69/500**
530		56	3	330	580	34 000	59 500	16.0	770	900	**68/530**
560	680	56	3	335	600	34 000	61 500	16.0	710	840	**68/560**
600	730	60	3	375	705	38 500	72 000	16.0	660	780	**68/600**

1) Smalle all able dimen i n f chamfe dimen i n r.

$\frac{f_0 \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r}$	
		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

Abutment and fillet dimensions mm			Mass kg
d_a min	D_a max	r_{as} max	(approx.)
473	567	2.5	34.8
476	604	3	62.2
493	587	2.5	36.2
500	630	4	73.0
513	607	2.5	37.5
520	650	4	75.5
543	637	2.5	39.5
573	667	2.5	41.5
613	717	2.5	51.7

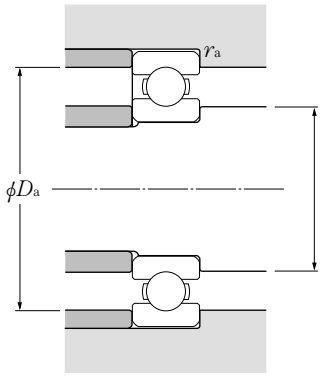
d 10～50mm

10	26	8	0.3	4.55	1.96	465	200	1.65	168	12.4	29 000	34 000	21 000	**EC-6000**	**ZZ**	**LLB**	**LLU**
	30	9	0.6	5.10	2.39	520	244	2.39	244	13.2	25 000	30 000	18 000	**EC-6200**	**ZZ**	**LLB**	**LLU**
	35	11	0.6	8.20	3.50	835	355	3.45	355	11.4	23 000	27 000	16 000	**EC-6300**	**ZZ**	**LLB**	**LLU**
12	28	8	0.3	5.10	2.39	520	244	1.78	181	13.2	26 000	30 000	18 000	**EC-6001**	**ZZ**	**LLB**	**LLU**
	32	10	0.6	6.10	2.75	620	280	2.29	233	12.7	22 000	26 000	16 000	**EC-6201**	**ZZ**	**LLB**	**LLU**
	37	12	1	9.70	4.20	990	425	3.65	375	11.1	20 000	24 000	15 000	**EC-6301**	**ZZ**	**LLB**	**LLU**
15	32	9	0.3	5.60	2.83	570	289	2.83	289	13.9	22 000	26 000	15 000	**EC-6002**	**ZZ**	**LLB**	**LLU**
	35	11	0.6	7.75	3.60	790	365	2.78	284	12.7	19 000	23 000	15 000	**EC-6202**	**ZZ**	**LLB**	**LLU**
	42	13	1	11.4	5.45	1 170	555	4.40	450	12.3	17 000	21 000	12 000	**EC-6302**	**ZZ**	**LLB**	**LLU**
17	35	10	0.3	6.80	3.35	695	345	2.88	294	13.6	20 000	24 000	14 000	**EC-6003**	**ZZ**	**LLB**	**LLU**
	40	12	0.6	9.60	4.60	980	465	3.45	350	12.8	18 000	21 000	12 000	**EC-6203**	**ZZ**	**LLB**	**LLU**
	47	14	1	13.5	6.55	1 380	665	6.55	665	12.2	16 000	19 000	11 000	**EC-6303**	**ZZ**	**LLB**	**LLU**
20	42	12	0.6	9.40	5.05	955	515	5.05	515	13.9	18 000	21 000	11 000	**EC-6004**	**ZZ**	**LLB**	**LLU**
	47	14	1	12.8	6.65	1 310	680	5.05	515	13.2	16 000	18 000	10 000	**EC-6204**	**ZZ**	**LLB**	**LLU**
	52	15	1.1	15.9	7.90	1 620	805	7.90	805	12.4	14 000	17 000	10 000	**EC-6304**	**ZZ**	**LLB**	**LLU**
25	47	12	0.6	10.1	5.85	1 030	595	5.85	595	14.5	15 000	18 000	9 400	**EC-6005**	**ZZ**	**LLB**	**LLU**
	52	15	1	14.0	7.85	1 430	800	6.55	665	13.9	13 000	15 000	8 900	**EC-6205**	**ZZ**	**LLB**	**LLU**
	62	17	1.1	21.2	10.9	2 160	1 110	10.9	1 110	12.6	12 000	14 000	8 100	**EC-6305**	**ZZ**	**LLB**	**LLU**
30	55	13	1	13.2	8.30	1 350	845	8.30	845	14.8	13 000	15 000	7 700	**EC-6006**	**ZZ**	**LLB**	**LLU**
	62	16	1	19.5	11.3	1 980	1 150	9.85	1 000	13.8	11 000	13 000	7 300	**EC-6206**	**ZZ**	**LLB**	**LLU**
	72	19	1.1	26.7	15.0	2 720	1 530	15.0	1 530	13.3	10 000	12 000	6 600	**EC-6306**	**ZZ**	**LLB**	**LLU**
35	62	14	1	16.0	10.3	1 630	1 050	10.3	1 050	14.8	12 000	14 000	6 800	**EC-6007**	**ZZ**	**LLB**	**LLU**
	72	17	1.1	25.7	15.3	2 620	1 560	14.5	1 480	13.8	9 800	11 000	6 300	**EC-6207**	**ZZ**	**LLB**	**LLU**
	80	21	1.5	33.5	19.1	3 400	1 950	18.5	1 890	13.1	8 800	10 000	6 000	**EC-6307**	**ZZ**	**LLB**	**LLU**
40	68	15	1	16.8	11.5	1 710	1 170	11.5	1 170	15.2	10 000	12 000	6 100	**EC-6008**	**ZZ**	**LLB**	**LLU**
	80	18	1.1	29.1	17.8	2 970	1 820	17.5	1 780	14.0	8 700	10 000	5 600	**EC-6208**	**ZZ**	**LLB**	**LLU**
	90	23	1.5	40.5	24.0	4 150	2 450	23.4	2 380	13.2	7 800	9 200	5 300	**EC-6308**	**ZZ**	**LLB**	**LLU**
45	75	16	1	21.0	15.1	2 140	1 540	15.1	1 540	15.3	9 200	11 000	5 400	**EC-6009**	**ZZ**	**LLB**	**LLU**
	85	19	1.1	32.5	20.4	3 350	2 080	20.3	2 070	14.1	7 800	9					
50																	

12	13.5	24	0.3	0.019
14	16	26	0.6	0.031
14	17	31	0.6	0.051
14	16	26	0.3	0.021
16	17.5	28	0.6	0.036
17	18.5	32	1	0.058
17	19	30	0.3	0.029
19	20.5	31	0.6	0.043
20	23	37	1	0.079
19	21	33	0.3	0.037
21	23	36	0.6	0.062
22	25	42	1	0.11
24	26	38	0.6	0.066
25	28	42	1	0.101
26.5	28.5	45.5	1	0.139

d 10～45mm

10	26	8	0.3	4.55	1. 6	465	200	1.53	156	12.4	2 000	34 000	21 000	**AC-6000**	**ZZ**	**LLB**	**LLU**
	30		0.6	5.10	2.3	520	244	2.3	244	13.2	25 000	30 000	18 000	**AC-6200**	**ZZ**	**LLB**	**LLU**
	35	11	0.6	8.20	3.50	835	355	2. 8	305	11.4	23 000	27 000	16 000	**AC-6300**	**ZZ**	**LLB**	**LLU**
12	28	8	0.3	5.10	2.3	520	244	1.73	177	13.2	26 000	30 000	18 000	**AC-6001**	**ZZ**	**LLB**	**LLU**
	32	10	0.6	6.10	2.75	620	280	2.75	280	12.7	22 000	26 000	16 000	**AC-6201**	**ZZ**	**LLB**	**LLU**
	37	12	1	.70	4.20	0	425	3.00	310	11.1	20 000	24 000	15 000	**AC-6301**	**ZZ**	**LLB**	**LLU**
15	32		0.3	5.60	2.83	570	28	2.43	247	13.	22 000	26 000	15 000	**AC-6002**	**ZZ**	**LLB**	**LLU**
	35	11	0.6	7.75	3.60	7 0	365	2.71	277	12.7	1 000	23 000	15 000	**AC-6202**	**ZZ**	**LLB**	**LLU**
	42	13	1	11.4	5.45	1 170	555	3. 0	400	12.3	17 000	21 000	12 000	**AC-6302**	**ZZ**	**LLB**	**LLU**
17	35	10	0.3	6.80	3.35	6 5	345	2.44	24	13.6	20 000	24 000	14 000	**AC-6003**	**ZZ**	**LLB**	**LLU**
	40	12	0.6	.60	4.60	80	465	3.50	355	12.8	18 000	21 000	12 000	**AC-6203**	**ZZ**	**LLB**	**LLU**
	47	14	1	13.5	6.55	1 380	665	5.10	520	12.2	16 000	1 000	11 000	**AC-6303**	**ZZ**	**LLB**	**LLU**
20	42	12	0.6	.40	5.05	55	515	3.80	385	13.	18 000	21 000	11 000	**AC-6004**	**ZZ**	**LLB**	**LLU**
	47	14	1	12.8	6.65	1 310	680	4.20	430	13.2	16 000	18 000	10 000	**AC-6204**	**ZZ**	**LLB**	**LLU**
	52	15	1.1	15.	7. 0	1 620	805	5.40	550	12.4	14 000	17 000	10 000	**AC-6304**	**ZZ**	**LLB**	**LLU**
25	47	12	0.6	10.1	5.85	1 030	5 5	4.50	460	14.5	15 000	18 000	400	**AC-6005**	**ZZ**	**LLB**	**LLU**
	52	15	1	14.0	7.85	1 430	800	5.80	5 0	13.	13 000	15 000	8 00	**AC-6205**	**ZZ**	**LLB**	**LLU**
	62	17	1.1	21.2	10.	2 160	1 110	7.30	745	12.6	12 000	14 000	8 100	**AC-6305**	**ZZ**	**LLB**	**LLU**
30	55	13	1	13.2	8.30	1 350	845	6.85	6 5	14.8	13 000	15 000	7 700	**AC-6006**	**ZZ**	**LLB**	**LLU**
	62	16	1	1 .5	11.3	1 80	1 150	7.55	770	13.8	11 000	13 000	7 300	**AC-6206**			
35																	
40																	
45																	



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.1				2.30
0.345	0.22				1.
0.68	0.26				1.71
1.03	0.28				1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.8	0.44				1.00

Static equivalent radial load

$P_{or} = 0.6F_r + 0.5F_a$

[illegible] $P_{or} < F_r$ [illegible] $P_{or} = F_r$

Abutment and fillet dimensions				Mass
d_a	3)	D_a	r_{as}	[illegible] (, , .)
12	13.5	24	0.3	0.01
14	16	26	0.6	0.031
14	17	31	0.6	0.051
14	16	26	0.3	0.021
16	17.5	28	0.6	0.036
17	18.5	32	1	0.058
17	1	30	0.3	0.02
1	20.5	31	0.6	0.043
20	23	37	1	0.07
1	21	33	0.3	0.037
21	23	36	0.6	0.062
22	25	42	1	0.11
24	26	38	0.6	0.066
25	28	42	1	0.101
26.5	28.5	45.5	1	0.13
2	30.5	43	0.6	0.075
30	32	47	1	0.122
31.5	35	55.5	1	0.223
35	37	50	1	0.11
35	3	57	1	0.1 1
36.5	43	65.5	1	0.334
40	42	57	1	0.148
41.5	45	65.5	1	0.277
43	47	72	1.5	0.44
46.5	51	73.5	1	0.352
48	54	82	1.5	0.60
51.5	55.5	78.5	1	0.3 1
53	61.5	2	1.5	0.80

3) [illegible]

1. Design features and special characteristics

The dimensional range of miniature and extra small ball bearings is given in **Table 1**. Boundary dimensions for both metric and inch systems are in accordance with the internationally specified ISO and ANSI/ABMA standards. The most widely used sealed and shielded type ball bearings

d 1.5～5mm

1.5	4	1.2	2	5	5	0.4	0.6	0.15	102	29.0	10.0	3.00	13.6	88 000	100 000
	5	2	2.6	6.5	6.5	0.6	0.8	0.15	171	51.0	17.0	5.00	13.3	79 000	93 000
	6	2.5	3	7.5	7.5	0.6	0.8	0.15	274	86.0	28.0	9.00	12.3	71 000	84 000
2	4	1.2	—	—	—	—	—	0.05	104	37.0	11.0	4.00	14.8	83 000	98 000
	5	1.5	2.3	6.1	6.1	0.5	0.6	0.08	171	51.0	17.0	5.00	13.3	74 000	87 000
	5	2	2.5	—	—	—	—	0.1	171	51.0	17.0	5.00	13.3	74 000	87 000
	6	2.3	3	7.5	7.5	0.6	0.8	0.15	279	89.0	28.0	9.00	12.8	67 000	79 000
	6	2.5	—	7.2	—	0.6	—	0.15	279	89.0	28.0	9.00	12.8	67 000	79 000
	7	2.5	—	—	—	—	—	0.15	390	120	40.0	12.0	11.9	59 000	70 000
	7	2.8	3.5	8.5	8.5	0.7	0.9	0.15	380	125	39.0	13.0	12.4	62 000	73 000
2.5	5	1.5	2.3	—	—	—	—	0.08	153	59.0	16.0	6.00	15.0	70 000	82 000
	6	1.8	2.6	7.1	7.1	0.5	0.8	0.08	209	73.0	21.0	7.50	14.2	65 000	76 000
	7	—	3	—	8.2	—	0.6	0.15	284	96.0	29.0	10.0	13.8	59 000	70 000
	7	2.5	3.5	8.5	8.5	0.7	0.9	0.15	284	96.0	29.0	10.0	13.8	59 000	70 000
	8	2.5	2.8	9.2	—	0.6	—	0.15	430	152	44.0	16.0	13.2	56 000	66 000
	8	2.8	4	9.5	9.5	0.7	0.9								
3															
4															
5															

Bearing numbers											
68/1.5	W68/1.5SA	SSA	FL68/1.5	FLW68/1.5SA	SSA	2.3	2.4	3.2	0.05	0.07	0.09
69/1.5A	W69/1.5ASA	SSA	FL69/1.5A	FLW69/1.5ASA	SSA	2.7	2.9	3.8	0.15	0.18	0.24
60/1.5	W60/1.5ZA	ZZA	FL60/1.5	FLW60/1.5ZA	ZZA	2.7	3.0	4.8	0.15	0.35	0.42
672	—	—	—	—	—	2.5	2.6	3.5	0.05	0.06	—
682	W682SA	SSA	FL682	FLW682SA	SSA	2.8	2.9	4.2	0.08	0.13	0.17
BC2-5	WBC2-5SA	SSA	—	—	—	2.8	2.9	4.2	0.10	0.16	—
692	W692SA	SSA	FL692	FLW692SA	SSA	3.2	3.3	4.8	0.15	0.31	0.38
BC2-6	—	—	FLBC2-6	—	—	3.2	3.3	4.8	0.15	0.32	0.38
BC2-7A	—	—	—	—	—	3.2	3.6	5.8	0.15	0.44	—
602	W602ZA	ZZA	FL602	FLW602ZA	ZZA	3.2	3.7	5.8	0.15	0.54	0.64
67/2.5	W67/2.5ZA	ZZA	—	—	—	3.1	3.3	4.4	0.08	0.11	—
68/2.5	W68/2.5ZA	ZZA	FL68/2.5	FLW68/2.5ZA	ZZA	3.1	3.6	4.8	0.08	0.22	0.26
—	WBC2.5-7ZA	ZZA	—	FLWBC2.5-7ZA	ZZA	3.7	4.0	5.8	0.15	0.6[3)]	0.67[3)]
69/2.5	W69/2.5SA	SSA	FL69/2.5	FLW69/2.5SA	SSA	3.7	4.0	5.8	0.15	0.43	0.53
BC2.5-8	WBC2.5-8ZA	ZZA	FLBC2.5-8	—	—	3.7	4.3	6.8	0.15	0.57	0.65
60/2.5	W60/2.5ZA	ZZA	FL60/2.5	FLW60/2.5ZA	ZZA	3.7	4.1	6.8	0.15	0.72	0.83
673	WA673SA	SSA	FL673	FLWA673SA	SSA	3.6	4.1	5.4	0.08	0.2	0.26
683	W683ZA	ZZA	FL683	FLW683ZA	ZZA	3.9	4.1	5.8	0.1	0.33	0.38
BC3-8	—	—	FLBC3-8	—	—	4.2	4.4	6.8	0.15	0.52	0.6
693	W693Z	ZZ	FL693	FLW693Z	ZZ	4.2	4.4	6.8	0.15	0.61	0.72
BC3-9	WBC3-9ZA	ZZA	FLBC3-9	FLAWBC3-9ZA	ZZA	4.2	5.0	7.8	0.15	0.71	0.79
603	W603Z	ZZ	FL603	FLW603Z	ZZ	4.2	5.0	7.8	0.15	0.92	1
623	623Z	ZZ	FL623	FL623Z	ZZ	4.2	5.2	8.8	0.15	1.6	1.8
674A	WA674ASA	SSA	FL674A	FLWA674ASA	SSA	4.6	5.0	6.4	0.08	0.28	0.35
BC4-8	WBC4-8Z	ZZ	FLBC4-8	FLWBC4-8Z	ZZ	4.8	5.0	6.8	0.08	0.38	0.46
684AX50	W684AX50Z	ZZ	FL684AX50	FLW684AX50Z	ZZ	5.0	5.2	7.8	0.1	0.67	0.76
BC4-10	WBC4-10Z	ZZ	FLBC4-10	FLAWBC4-10Z	ZZ	5.2	6.0	8.8	0.15	1	1.1
694	694Z	ZZ	FL694	FL694Z	ZZ	5.2	6.4	9.8	0.15	1.8	2
604	604Z	ZZ	FL604	FL604Z	ZZ	5.6	6.6	10.4	0.2	2.1	2.3
624	624Z	ZZ	FL624	FL624Z	ZZ	5.6	6.2	11.4	0.2	3.2	3.5
634	634Z	ZZ	—	—	—	6	7.6	14	0.3	5.1	—
675	WA675Z	ZZ	FL675	FLWA675Z	ZZ	5.6	6.0	7.4	0.08	0.32	0.4
BC5-9	WBC5-9Z	ZZ	FLBC5-9	FLWBC5-9Z	ZZ	5.2	6.1	7.8	0.15	0.55	0.63
BC5-10	WBC5-10Z	ZZ	FLBC5-10	FLAWBC5-10Z	ZZ	6.2	6.4	8.8	0.15	0.88	0.97

2) This dimension applies to sealed and shielded bearings. 3) Values for double shielded bearings shown.

5

6

7

8

9

—	WBC5-11Z	ZZ	—	FLWBC5-11Z	ZZ	6.2	6.8	9.8	0.2	1.8[3]	2[2]
685	W685Z	ZZ	FL685	FLW685Z	ZZ	6.2	6.8	9.8	0.15	1.1	1.3
695	695Z	ZZ	FL695	FL695Z	ZZ	6.6	6.9	11.4	0.2	2.4	2.7
—	WBC5-13Z	ZZ	—	FLWBC5-13Z	ZZ	6.6	6.9	11.4	0.2	3.4[3]	3.7[3]
605	605Z	ZZ	FL605	FL605Z	ZZ	6.6	7.4	12.4	0.2	3.5	3.9
625	625Z	ZZ	FL625	FL625Z	ZZ	7	7.6	14	0.3	4.8	5.2
635	635Z	ZZ	—	sCèp Ë• Q)%l 7sƒCèp Ë• “ 7A ò% Cèp É 17 Qst8‡$w8 ° k8‡/"P >‡‰ Wi8‡$w8Cèp N							
676A	WA676AZ	ZZ	FL676A	FLWA676AZ	ZZ	6.6	6.7	9.2	0.1	0.65	0.74
BC6-12	WBC6-12Z	ZZ	FLBC6-12	FLAWBC6-12Z	ZZ	7.2	7.9	10.8			

1.984

2.380

3.175

Dynamic equivalent radial load

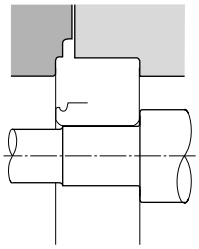
$P_r = XF_r + YF_a$

$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19				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	0	0.56	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

1-4	**A1-4ZA**	**ZZA**	**FL**	**1-4**	**FL**	**A1-4ZA**	**ZZA**	2.8	3.3	5.5	0.08	0.35	0.41
133	**A133ZA**	**ZZA**	**FL**	**133**	**FL**	**A133ZA**	**ZZA**	2.9	3.1	4	0.08	0.12	0.16
1-5	**A1-5ZA**	**ZZA**	**FL**	**1-5**	**FL**	**A1-5ZA**	**ZZA**	3.2	4.3	7.1	0.1	0.69	0.76
144	**A144ZA**	**ZZA**	**FL**	**144**	**FL**	**A144ZA**	**ZZA**	3.9	4.0	5.5	0.08	0.27	0.33
2-5	**A2-5Z**	**ZZ**	**FL**	**2-5**	**FL**	**A2-5Z**	**ZZ**	4	4.4	7	0.08	0.61	0.68
2-6	**A2-6ZA**	**ZZA**	**FL**	**2-6**	**FL**	**A2-6ZA**	**ZZA**	4	5.2	8.7	0.1	0.88	0.96
2	**A2ZA**	**ZZA**	**FL**	**2**	**FL**	**A2ZA**	**ZZA**	4.8	5.2	7.8	0.3	1.3	1.5
A2	**A2Z**	**ZZ**		—		—	—	4.8	5.4	11	0.3	2.5	—
155	**A155ZA**	**ZZA**	**FL**	**155**	**FL**	**A155ZA**	**ZZA**	4.8	5.3	7	0.08	0.54	0.61
156	**A156Z**	**ZZ**	**FL**	**156**	**FL**	**A156Z**	**ZZ**	5.5	5.6	7	0.08	0.44	0.51
166	**166Z**	**ZZ**	**FL**	**166**	**FL**	**A166Z**	**ZZ**	5.6	5.9	8.7	0.08	0.8	0.89
3	—	—		—		—	—	6.4	7.2	11	0.3	2.2	—
A3	**A3Z**	**ZZ**	**FL**	**A3**	**FL**	**A3Z**	**ZZ**	6.0	6.4	11	0.3	2.4	2.7
168A	**168AZ**	**AZZ**		—	**FL**	**A168AZ**	**ZZ**	7.1	7.3	8.7	0.08	0.6	0.69
188	**A188ZA**	**ZZA**	**FL**	**188**	**FL**	**A188ZA**	**ZZA**	7.2	8.2	11.8	0.1	1.6	1.7
4	**4Z**	**ZZ**	**FL**	**4**	**FL**	**4Z**	**ZZ**	8	8.6	14.2	0.3	4.4	4.8
—	**A4Z**	**ZZ**		—		—	—	8.4	9.5	17	0.4	11[2)]	—
—	**6Z**	**ZZ**		—	**FL**	**6Z**	**ZZ**	11.5	11.9	20.2	0.4	14[3)]	15[3)]

d 5～12mm

d
5
6
8
10
12



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

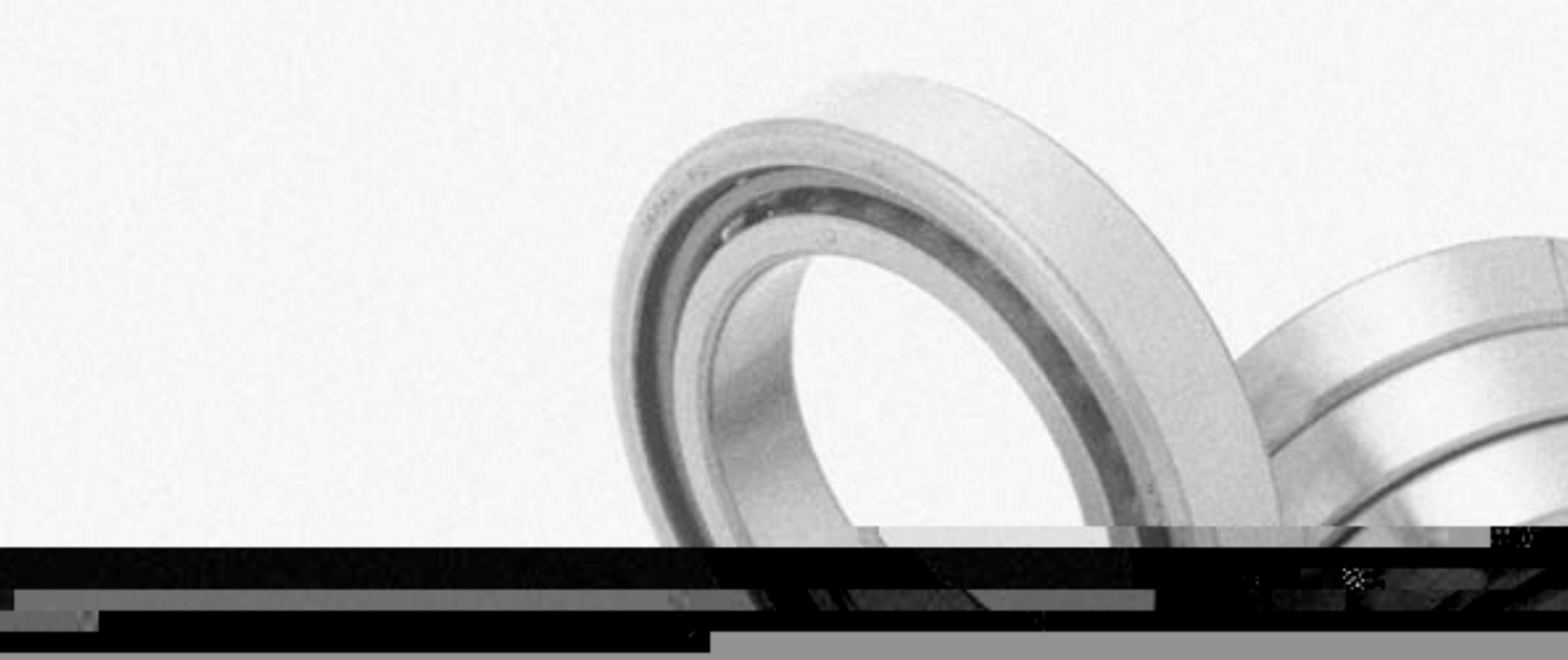
$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19				2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load

$P_{or} = 0.6F_r + 0.5F_a$

When $P_{or} < F_r$ use $P_{or} = F_r$

Snap ring groove dimensions mm				Snap ring dimensions mm				Abutment and fillet dimensions mm						Mass kg
D_1 max	a max	b min	r_o max	D_2 max	f max	d_a min	d_a max	D_a max	D_X (approx.)	C_Y max	C_Z min	r_{as} max	r_{Nas} max	with snap ring (approx.)
12.15	0.88	0.55	0.2	15.2	0.55	6.6	6.9	11.4	15.9	1.2	0.6	0.2	0.1	0.002
13.03	1.28	0.65	0.06	16.13	0.54	6.6	7.4	12.4	16.9	1.6	0.6	0.2	0.2	0.004
11.15	0.78	0.60	0.02	14.2	0.55	7.2	7.9	10.8	14.9	1.1	0.6	0.15	0.1	0.001
12.15	1.08	0.55	0.2	15.2	0.55	7.0	7.2	11.8	15.9	1.4	0.6	0.15	0.1	0.002
14.03	1.03	0.65	0.06	17.2	0.60	7.6	7.8	13.4	17.9	1.4	0.7	0.2	0.2	0.004
17.9	0.93	0.80	0.2	22.0	0.70	8.0	9.5	17.0	22.8	1.4	0.7	0.3	0.3	0.008
14.95	0.53	0.65	0.05	18.2	0.54	9.6	10.0	14.4	18.9	0.9	0.6	0.2	0.1	0.003
20.8	2.35	0.80	0.2	24.8	0.70	10.0	12.7	20	25.5	2.8	0.7	0.3	0.4	0.013
24.5	2.20	0.90	0.3	28.8	0.85	12	13.5	24	29.5	2.8	0.9	0.3	0.3	0.02
26.44	2.20	0.90	0.3	32.7	0.85	14	16	26	33.4	2.8	0.9	0.3	0.3	0.022




A
C
B
B

1.2 F -

0 A
D 2,

■F
" "
D 4
A

d 10～30mm

d														
10	26	8	16	0.3	0.15	4.65	2.07	470	212	29 000	39 000	**7000**	9	0.023
	30	9	18	0.6	0.3	5.45	2.74	555	279	28 000	37 000	**7200**	10.5	0.029
	30	9	18	0.6	0.3	5.00	2.52	510	257	24 000	32 000	**7200B**	13	0.029
	35	11	22	0.6	0.3	10.1	4.95	1 030	500	26 000	34 000	**7300**	12	0.04
	35	11	22	0.6	0.3	9.50	4.60	970	470	22 000	29 000	**7300B**	15	0.041
12	28	8	16	0.3	0.15	5.05	2.46	515	251	26 000	35 000	**7001**	10	0.025
	32	10	20	0.6	0.3	7.60	3.95	775	405	25 000	33 000	**7201**	11.5	0.035
	32	10	20	0.6	0.3	7.00	3.65	775	405	21 000	28 000	**7201B**	14	0.036
	37	12	24	1	0.6	11.2	5.25	1 140	535	23 000	30 000	**7301**	13	0.044
	37	12	24	1	0.6	10.5	4.95	1 080	505	19 000	26 000	**7301B**	16.5	0.045
15	32	9	18	0.3	0.15	5.80	3.15	590	320	23 000	31 000	**7002**	11.5	0.035
	35	11	22	0.6	0.3	9.05	4.70	925	480	22 000	29 000	**7202**	12.5	0.046
	35	11	22	0.6	0.3	8.35	4.35	855	445	18 000	25 000	**7202B**	16	0.046
	42	13	26	1	0.6	13.5	7.20	1 370	735	19 000	26 000	**7302**	15	0.055
	42	13	26	1	0.6	12.5	6.65	1 270	680	17 000	22 000	**7302B**	19	0.057
17	35	10	20	0.3	0.15	7.15	3.85							
20														
25														
30														

d 30～55mm

30
35
40
45
50
55

36.5	29.6	3 750	3 000	9 800	13 000	DB	DF	D	35.5	34.5	56.5	57.5	1	0.6
33.5	27.1	3 400	2 760	8 600	11 000	DB	DF	D	35.5	34.5	56.5	57.5	1	0.6
54.5	44.5	5 550	4 550	8 900	12 000	DB	DF	D	37	34.5	65	67.5	1	0.6
50.0	41.0	5 100	4 200	7 700	10 000	DB	DF	D	37	34.5	65	67.5	1	0.6
19.5	17.7	1 990	1 810	10 000	13 000	DB	DF	D	39.5	39.5	50.5	52.5	0.6	0.3
28.5	25.1	2 900	2 560	9 400	13 000	DB	DF	D	40.5	40.5	56.5	57.5	1	0.6
48.5	40.0	4 900	4 100	8 600	11 000	DB	DF	D	42	39.5	65	67.5	1	0.6
44.0	36.5	4 500	3 750	7 500	10 000	DB	DF	D	42	39.5	65	67.5	1	0.6
65.0	52.5	6 600	5 350	7 800	10 000	DB	DF	D	43.5	40.5	71.5	74.5	1.5	1
59.5	48.5	6 100	4 950	6 800	9 000	DB	DF	D	43.5	40.5	71.5	74.5	1.5	1
20.6	20.4	2 100	2 080	9 000	12 000	DB	DF	D	44.5	44.5	57.5	59.5	0.6	0.3
30.5	29.2	3 100	2 970	8 300	11 000	DB	DF	D	45.5	45.5	62.5	63.5	1	0.6
57.5	50.5	5 850	5 150	7 700	10 000	DB	DF	D	47	44.5	73.0	75.5	1	0.6
52.0	46.0	5 300	4 700	6 700	8 900	DB	DF	D	47	44.5	73	75.5	1	0.6
79.5	66.0	8 100	6 700	6 900	9 200	DB	DF	D	48.5	45.5	81.5	84.5	1.5	1
73.0	60.5	7 400	6 200	6 000	8 000	DB	DF	D	48.5	45.5	81.5	84.5	1.5	1
25.5	25.7	2 600	2 620	8 100	11 000	DB	DF	D	49.5	49.5	63.5	65.5	0.6	0.3
36.0	35.5	3 700	3 600	7 500	10 000	DB	DF	D	50.5	50.5	69.5	70.5	1	0.6
64.5	57.5	6 550	5 850	6 900	9 200	DB	DF	D	52	49.5	78	80.5	1	0.6
58.5	52.5	5 950	5 350	6 000	8 000	DB	DF	D	52	49.5	78	80.5	1	0.6
103	88.0	10 500	8 950	6 200	8 200	DB	DF	D	53.5	50.5	91.5	94.5	1.5	1
95.0	80.5	9 650	8 250	5 400	7 200	DB	DF	D	53.5	50.5	91.5	94.5	1.5	1
27.0	28.9	2 750	2 950	7 300	9 800	DB	DF	D	54.5	54.5	67.5	69.5	0.6	0.3
38.5	40.0	3 900	4 100	6 800	9 100	DB	DF	D	55.5	55.5	74.5	75.5	1	0.6
67.0	63.0	6 850	6 400	6 300	8 300	DB	DF	D	57	54.5	83	85.5	1	0.6
60.5	57.0	6 200	5 850	5 500	7 300	DB	DF	D	57	54.5	83	85.5	1	0.6
121	105	12 300	10 700	5 600	7 500	DB	DF	D	60	55.5	100	104.5	2	1
111	96.0	11 300	9 850	4 900	6 500	DB	DF	D	60	55.5	100	104.5	2	1
28.1	32.0	2 870	3 300	6 700	8 900	DB	DF	D	60.5	60.5	74.5	75.5	1	0.6
50.5	52.5	5 150	5 350	6 300	8 400	DB	DF	D	62	62	83	85.5	1	0.6
83.0	79.0	8 450	8 050	5 700	7 600	DB	DF	D	63.5	60.5	91.5			

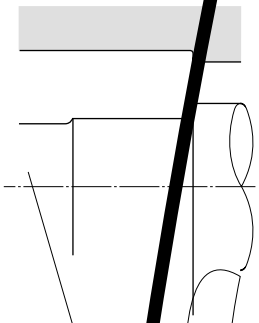
d 60～85mm

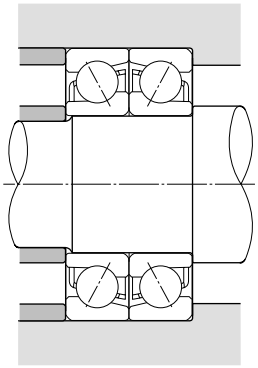
d														
60	85	13	26	1	0.6	18.1	17.4	1 840	1 780	7 800	10 000	**7912**	27.5	0.23
	95	18	36	1.1	0.6	32.0	28.1	3 250	2 860	7 200	9 600	**7012**	31.5	0.478
	110	22	44	1.5	1	61.5	49.0	6 300	5 000	6 600	8 800	**7212**	36	0.765
	110	22	44	1.5	1	56.0	44.5	5 700	4 550	5 700	7 600	**7212B**	47.5	0.78
	130	31	62	2.1	1.1	98.0	71.5	10 000	7 300	5 900	7 900	**7312**	43	1.74
	130	31	62	2.1	1.1	90.0	66.0	9 200	6 700	5 100	6 800	**7312B**	56	1.77
65	90	13	26	1	0.6	18.3	18.0	1 860	1 840	7 200	9 600	**7913**	29	0.245
	100	18	36	1.1	0.6	33.5	31.5	3 450	3 200	6 700	9 000	**7013**	33	0.509
	120	23	46	1.5	1	70.5	58.0	7 150	5 900	6 100	8 100	**7213**	38	0.962
	120	23	46	1.5	1	63.5	52.5	6 500	5 350	5 200	7 000	**7213B**	50.5	0.981
	140	33	66	2.1	1.1	111	82.0	11 300	8 350	5 500	7 300	**7313**	46	2.11
	140	33	66	2.1	1.1	102	75.0	10 400	7 700	4 700	6 300	**7313B**	59.5	2.15
70	100	16	32	1	0.6	26.2	26.2	2 670	2 670	6 700	9 000	**7914**	32.5	0.397
	110	20	40	1.1	0.6	42.5	39.5	4 350	4 000	6 200	8 300	**7014**	36	0.705
	125	24	48	1.5	1	76.5	63.5	7 800	6 500	5 700	7 600	**7214**	40	1.09
	125	24	48	1.5	1	69.0	58.0	7 050	5 900	4 900	6 500	**7214B**	53	1.11
	150	35	70	2.1	1.1	125	93.5	12 700	9 550	5 100	6 800	**7314**	49.5	2.56
	150	35	70	2.1	1.1	114	86	11 700	8 800	4 400	5 800	**7314B**	63.5	2.61
75	105	16	32	1	0.6	26.50	27.1	2 710	2 760	6 300	8 400	**7915**	34	0.42
	115	20	40	1.1	0.6	43.50	41.5	4 450	4 250	5 800	7 800	**7015**	37.5	0.745
	130	25	50	1.5	1	79.0	68.5	8 050	7 000	5 300	7 100	**7215**	42.5	1.17
	130	25	50	1.5	1	71.5	62.0	7 300	6 350	4 500	6 000	**7215B**	56	1.19
	160	37	74	2.1	1.1	136	106	13 800	10 800	4 800	6 300	**7315**	52.5	3.07
	160	37	74	2.1	1.1	125	97.5	12 700	9 900	4 100	5 400	**7315B**	68	3.13
80	110	16	32	1	0.6	26.9	28.0	2 740	2 860	5 900	7 800	**7916**	35.5	0.444
	125	22	44	1.1	0.6	53.5	50.5	5 450	5 150	5 500	7 300	**7016**	40.5	0.994
	140	26	52	2	1	89.0	76.0	9 100	7 750	5 000	6 600	**7216**	45	1.39
	140	26	52	2	1	80.5	69.5	8 200	7 050	4 300	5 700	**7216B**	59	1.42
	170	39	78	2.1	1.1	147	119	15 000	12 100	4 500	5 900	**7316**	55.5	3.65
	170	39	78	2.1	1.1	135	109	13 800	11 100	3 800	5 100	**7316B**	72	3.72
85	120	18	36	1.1	0.6	36.0	38.0	3 700	3 850	5 500	7 400	**7917**	38.5	0.628
	130	22	44	1.1	0.6	54.5	53.5	5 600	5 450	5 100	6 900	**7017**	42	1.04
	150	28	56	2	1	99.5	88.5	10 100	9 050	4 700	6 200	**7217**	48	1.78
	150	28	56	2	1	90.0	80.5	9 150	8 200	4 000	5 300	**7217B**	63.5	1.82

29.3	35.0	2 990	3 550	6 200	8 300	**DB**	**DF**	**D**	65.5	65.5	79.5	80.5	1	0.6
52.0	56.0	5 300	5 700	5 800	7 700	**DB**	**DF**	**D**	67	67	88	90.5	1	0.6
100	98.0	10 200	10 000	5 300	7 000	**DB**	**DF**	**D**	68.5	65.5	101.5	104.5	1.5	1
91.0	89.0	9 250	9 100	4 600	6 100	**DB**	**DF**	**D**	68.5	65.5	101.5	104.5	1.5	1
159	143	16 200												

d 85～120mm

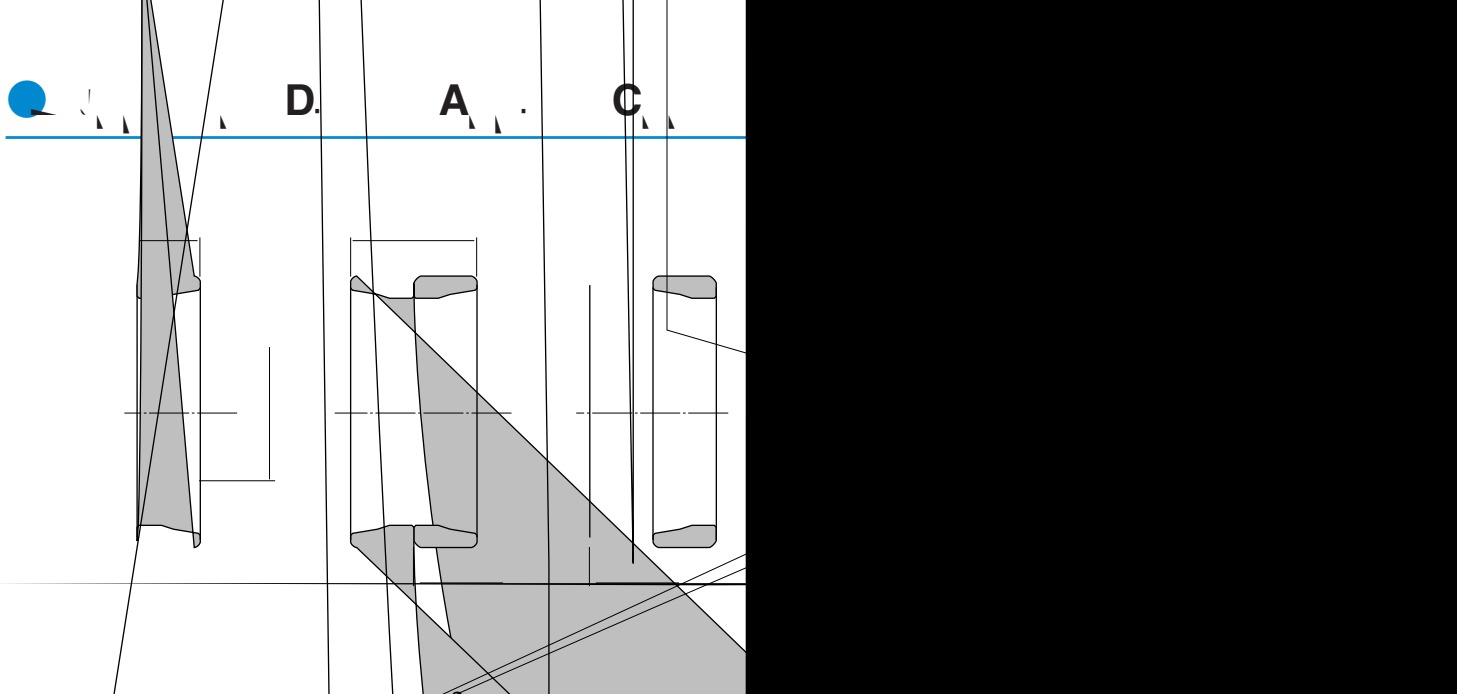
85
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95
100
105
110
120





258	285	26 300	27 000	3 300	4 500	**DB**	**DF**	**D**	99	92	166	173	2.5	1
236	244	24 100	24 900	2 900	3 900	**DB**	**DF**	**D**	99	92	166	173	2.5	1
58.0	75.5	5 900	7 700	4 200	5 500	**DB**	**DF**	**D**	97	97	118	120.5	1	0.6
106	127	10 800	12 900	3 900	5 200	**DB**	**DF**	**D**	98.5	98.5	131.5	134.5	1.5	1
191	206	19 500	21 000	3 500	4 700	**DB**	**DF**	**D**	100	95.5	150	154.5	2	1
173	188	17 700	19 100	3 100	4 100	**DB**	**DF**	**D**	100	95.5	150	154.5	2	1
277	294	28 300	30 000	3 200	4 200	**DB**	**DF**	**D**	104	97	176	183	2.5	1
254	270	25 900	27 600	2 700	3 700	**DB**	**DF**	**D**	104	97	176	183	2.5	1
60.5	81.5	6 150	8 300	3 900	5 300	**DB**	**DF**	**D**	102	102	123	125.5	1	0.6
109	134	11 100	13 600	3 700	4 900	**DB**	**DF**	**D**	103.5	103.5	136.5	139.5	1.5	1
217	236	22 100	24 100	3 300	4 400	**DB**	**DF**	**D**	107	102	158	163	2	1
196	215	20 000	21 900	2 900	3 800	**DB**	**DF**	**D**	107	102	158	163	2	1
297	325	30 500	33 000	3 000	3 900	**DB**	**DF**	**D**	109	102	186	193	2.5	1
272	298	27 700	30 500	2 600	3 400	**DB**	**DF**	**D**	109	102	186	193	2.5	1
78.0	105	7 950	10 700	3 700	5 000	**DB**	**DF**	**D**	107	107	133	135.5	1	0.6
111	141	11 300	14 400	3 500	4 600	**DB**	**DF**	**D**	108.5	108.5	141.5	144.5	1.5	1
233	251	23 800	25 600	3 100	4 200	**DB**	**DF**	**D**	112	107	168	173	2	1
212	229	21 600	23 300	2 700	3 600	**DB**	**DF**	**D**	112	107	168	173	2	1
335	385	34 500	39 500	2 800	3 700	**DB**	**DF**	**D**	114	107	201	208	2.5	1
310	355	31 500	36 000	2 400	3 300	**DB**	**DF**	**D**	114	107	201	208	2.5	1
79.0	109	8 050	11 100	3 500	4 700	**DB**	**DF**	**D**	112	112	138	140.5	1	0.6
130	163	13 300	16 700	3 300	4 400	**DB**	**DF**	**D**	115	115	150	154.5	2	1
254	283	25 900	28 900	3 000	4 000	**DB**	**DF**	**D**	117	112	178	183	2	1
231	258	23 500	26 300	2 600	3 500	**DB**	**DF**	**D**	117	112	178	183	2	1
355	420	36 500	43 000	2 700	3 600	**DB**	**DF**	**D**	119	112	211	218	2.5	1
330	385	33 500	39 500	2 300	3 100	**DB**	**DF**	**D**	119	112	211	218	2.5	1
80.0	112	8 150	11 400	3 400	4 500	**DB**	**DF**	**D**	117	117	143	145.5	1	0.6
149	186	15 200	18 900	3 100	4 200	**DB**	**DF**	**D**	120	120	160	164.5	2	1
276	315	28 100	32 500	2 800	3 800	**DB**	**DF**	**D**	122	117	188	193	2	1
250	289	25 500	29 400	2 500	3 300	**DB**	**DF**	**D**	122	117	188	193	2	1
400	490	41 000	50 000	2 600	3 400	**DB**	**DF**	**D**	124	117	226	233	2.5	1
365	455	37 500	46 000	2 200	3 000	**DB**	**DF**	**D**	124	117	226	233	2.5	1
99.0	139	10 100	14 200	3 100	4 100	**DB**	**DF**	**D**	127	127	158	160.5	1	0.6

Note: For bearing series **79** and **70**, inner rings are constructed with groove abutments on both sides. Therefore, the inner ring chamfer dimension r_1 is identical to dimension r. Furthermore, the radius r_{1a} of the shaft corner roundness is likewise identical to r_a.



d 120～170mm

B

d	D	B	$2B$	$r_{s\,min}$ 2)	$r_{1s\,min}$ 2)								
120	180	28	56	2	1	93							
	215	40	80	2.1	1.1	183							
	215	40	80	2.1	1.1	165							
	260	55	110	3	1.1	246							
	260	55	110	3	1.1	225							
130	180	24	48	1.5	1	75.0							
	200	33	66	2	1	117	1						
	230	40	80	3	1.1	196	19						
	230	40	80	3	1.1	177	180						
	280	58	116	4	1.5	273	293						
	280	58	116	4	1.5	250	268						
140	190	24	48	1.5	1	75.5	90.0						
	210	33	66	2	1	120	133	1					
	250	42	84	3	1.1	203	215	20					
	250	42	84	3	1.1	183	195	18 70					
	300	62	124	4	1.5	300	335	30 500					
	300	62	124	4	1.5	275	310	28 100	3				
150	210	28	56	2	1	97.5	117	9 900	11 900				
	225	35	70	2.1	1.1	137	154	14 000	15 700				
	270	45	90	3	1.1	232	259	23 700	26 400	2			
	270	45	90	3	1.1	210	235	21 400	24 000	2 20			
	320	65	130	4	1.5	330	380	33 500	39 000	2 30	3		
	320	65	130	4	1.5	300	350	30 500	36 000	2 00	2 600		
160	220	28	56	2	1	98.5	121	10 000	12 300	2 80	3 800	**7932**	69	3.13
	240	38	76	2.1	1.1	155	176	15 800	18 000	2 70	3 600	**7032**	77	5.96
	290	48	96	3	1.1	263	305							
	290	48	96	3	1.1	238	279	24 200	28 400	2 000	2 700	**7232B**	118	13.7
	340	68	136	4	1.5	345	420	35 500	43 000	2 100	2 800	**7332**	106	29.8
	340	68	136	4	1.5	315	385	32 000	39 500	1 800	2 400	**7332B**	139	29.8
170	230	28	56	2	1	102	129	10 400	13 100	2 700	3 600	**7934**	71.5	3.29
	260	42	84	2.1	1.1	186	214	18 900	21 900	2 500	3 300	**7034**	83	7.96
	310	52	104	4	1.5	295	360	30 000	36 500	2 200	3 000	**7234**	95.5	17
	310	52	104	4	1.5	266	325	27 200	33 000	1 900	2 500	**7234B**	127	17
	360	72	144	4	1.5	390	485	39 500	49 500	2 000	2 700	**7334**	113	35.3

1) Bearing numbers appended with the code "**B**" have a contact angle of 40˚; bearings with this code have a contact angle of 30˚.
2) Smallest allowable dimension for chamfer dimension r or r_1.

d 170～300mm

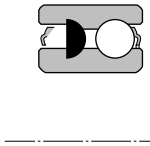
170
180
190
200
220
240
260
280
300

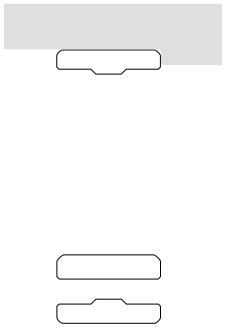
B . dynamic (duplex) kN C_r	static (duplex) kN C_{or}	dynamic (duplex) kgf C_r	static (duplex) kgf C_{or}	(duplex) min^{-1} grease	oil	B . 1) DB	DF	D	A . mm d_a min	D_a max	D_b max	r_{as} max	r_{1as} max
575	890	59 000	90 500	1 400	1 800	DB	DF	D	188	342	351.5	3	1.5
213	325	21 700	33 500	2 000	2 700	DB	DF	D	190	240	244.5	2	1
355	530	36 500	54 000	1 900	2 500	DB	DF	D	192	268	273	2	1
495	770	50 500	78 500	1 700	2 200	DB	DF	D	198	302	311.5	3	1.5
450	700	45 500	71 000	1 400	1 900	DB	DF	D	198	302	311.5	3	1.5
665	1 070	68 000	109 000	1 500	2 000	DB	DF	D	198	362	371.5	3	1.5
605	975	62 000	99 500	1 300	1 700	DB	DF	D	198	362	371.5	3	1.5
216	335	22 000	34 500	1 900	2 500	DB	DF	D	200	250	254.5	2	1
365	560	37 000	57 000	1 800	2 300	DB	DF	D	202	278	283	2	1
495	780	50 000	79 500	1 600	2 100	DB	DF	D	208	322	331.5	3	1.5
445	705	45 000	72 000	1 400	1 800	DB	DF	D	208	322	331.5	3	1.5
695	1 170	71 000	119 000	1 400	1 900	DB	DF	D	212	378	390	4	2
635	1 070	64 500	109 000	1 200	1 600	DB	DF	D	212	378	390	4	2
300	465	30 500	47 000	1 800	2 400	DB	DF	D	212	268	273	2	1
410	650	41 500	66 000	1 700	2 200	DB	DF	D	212	298	303	2	1
550	900	56 000	92 000	1 500	2 000	DB	DF	D	218	342	351.5	3	1.5
495	815	50 500	83 000	1 300	1 700	DB	DF	D	218	342	351.5	3	1.5
730	1 210	74 500	124 000	1 300	1 800	DB	DF	D	222	398	410	4	2
665	1 110	68 000	113 000	1 200	1 500	DB	DF	D	222	398	410	4	2
305	475	31 000	48 500	1 600	2 100	DB	DF	D	232	288	293	2	1
315	510	32 000	52 000	1 500	1 900	DB	DF	D	252	308	313	2	1
420	750	42 500	76 500	1 300	1 800	DB	DF	D	272	348	353	2	1
425	775	43 000	79 000	1 200	1 600	DB	DF	D	292	368	373	2	1
530	1 040	54 000	106 000	1 100	1 500	DB	DF	D	314	406	413	2.5	1

d 30～90mm

95～120mm

	170	32	2.1	168	335	17 200	34 000	3 000	3 900		107	158	2	76.5	3.35
	200	45	3	227	450	23 100	46 000	2 700	3 500	**QJ319**	109	186	2.5	85	7.41
	180	34	2.1	181	355	18 400	36 000	2 800	3 700	**QJ220**	112	168	2	81	4.02
	215	47	3	273	585	27 800	59 500	2 500	3 400	**QJ320**	114	201	2.5	91	9.14
	190	36	2.1	197	400	20 100	41 000	2 700	3 600		117	178	2	85	4.75
	225	49	3	273	585	27 900	59 500	2 400	3 200	**QJ321**	119	211	2.5	95.5	10.4
	200	38	2.1	213	450	21 700	45 500	2 500	3 400		122	188	2	89.5	5.62
	240	50	3	305	680	31 000	69 500	2 300	3 100	**QJ322**	124	226	2.5	101	12
	215	40	2.1	240	540	24 500	55 000	2 300	3 100		132	203	2	96.5	6.75
	260	55	3	325	765	33 000	78 000	2 100	2 800	**QJ324**	134	246	2.5	110	15.9

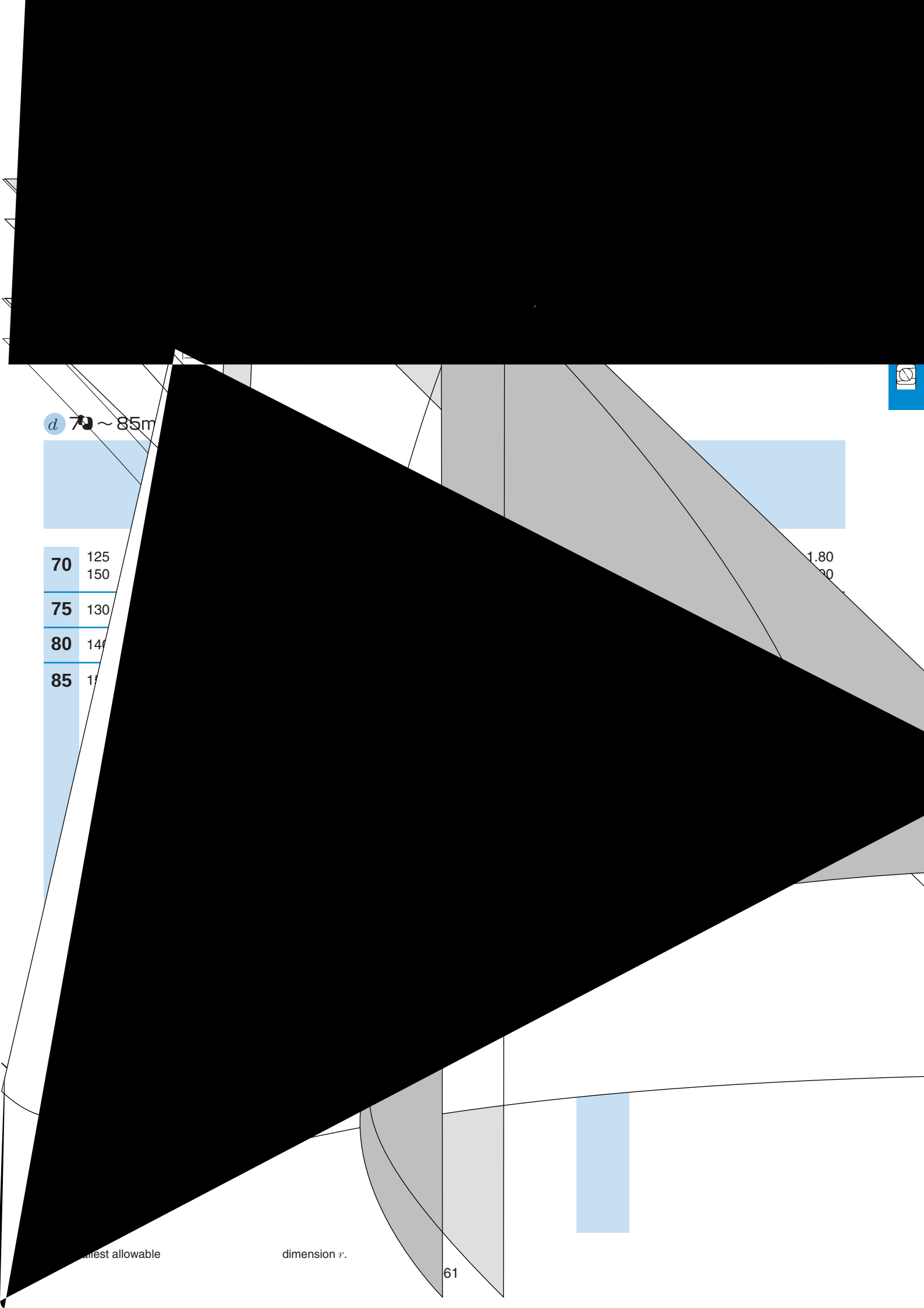




d 10 ～ 65mm

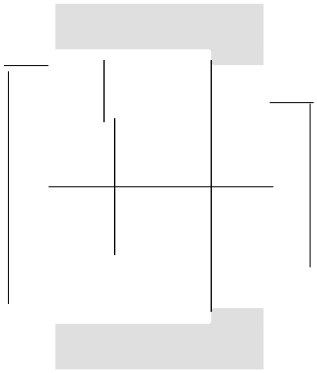
10	30	14.3	0.6	7.15	3.90	730	400	17 000	22 000	**5200S**	15	25	0.6	14.5	0.05
12	32	15.9	0.6	10.5	5.80	1 070	590	15 000	20 000	**5201S**	17	27	0.6	16.7	0.06
15	35	15.9	0.6	11.7	7.05	1 190	715	13 000	17 000	**5202S**	20	30	0.6	18.3	0.07
	42	19	1	17.6	10.2	1 800	1 040	11 000	15 000	**5302S**	21	36	1	22.0	0.11
17	40	17.5	0.6	14.6	9.05	1 490	920	11 000	15 000	**5203S**	22	35	0.6	20.8	0.09
	47	22.2	1	21.0	12.6	2 140	1 280	10 000	13 000	**5303S**	23	41	1	25.0	0.14
20	47	20.6	1	19.6	12.4	2 000	1 270	10 000	13 000	**5204S**	26	41	1	24.3	0.12
	52	22.2	1.1	24.6	15.0	2 510	1 530	9 000	12 000	**5304S**	27	45	1	26.7	0.23
25	52	20.6	1	21.3	14.7	2 170	1 500	8 500	11 000	**5205S**	31	46	1	26.8	0.19
	62	25.4	1.1	32.5	20.7	3 350	2 110	7 500	10 000	**5305S**	32	55	1	31.8	0.34
30	62	23.8	1	29.6	21.1	3 000	2 150	7 100	9 500	**5206S**	36	56	1	31.6	0.29
	72	30.2	1.1	40.5	28.1	4 150	2 870	6 300	8 500	**5306S**	37	65	1	36.5	0.51
35	72	27	1.1	39.0	28.7	4 000	2 920	6 300	8 000	**5207S**	42	65	1	36.6	0.43
	80	34.9	1.5	51.0	36.0	5 200	3 700	5 600	7 500	**5307S**	44	71	1.5	41.6	0.79
40	80	30.2	1.1	44.0	33.5	4 500	3 400	5 600	7 100	**5208S**	47	73	1	41.5	0.57
	90	36.5	1.5	56.5	41.0	5 800	4 200	5 300	6 700	**5308S**	49	81	1.5	45.5	1.05
45	85	30.2	1.1	49.5	38.0	5 050	3 900	5 000	6 700	**5209S**	52	78	1	43.4	0.62
	100	39.7	1.5	68.5	51.0	7 000	5 200	4 500	6 000	**5309S**	54	91	1.5	50.6	1.40
50	90	30.2	1.1	53.0	43.5	5 400	4 400	4 800	6 000	**5210S**	57	83	1	45.9	0.67
	110	44.4	2	81.5	61.5	8 300	6 250	4 300	5 600	**5310S**	60	100	2	55.6	1.95
55	100	33.3	1.5	56.0	49.0	5 700	5 000	4 300	5 600	**5211S**	64	91	1.5	50.1	0.96
	120	49.2	2	95.0	73.0	9 700	7 450	3 800	5 000	**5311S**	65	110	2	60.6	2.30
60	110	36.5	1.5	69.0	62.0	7 150	6 300	3 800	5 000	**5212S**	69	101	1.5	56.5	1.35
	130	54	2.1	125	98.5	12 800	10 000	3 400	4 500	**5312S**	72	118	2	69.2	3.15
65	120	38.1	1.5	76.5	69.0	7 800	7 050	3 600	4 500	**5213S**	74	111	1.5	59.7	1.65
	140	58.7	2.1	142	113	14 500	11 500	3 200	4 300	**5313S**	77	128	2	72.8	3.85

1) Smallest allowable dimension for chamfer dimension r.


d 70 ～ 85m
70
125
150
75
130
80
85
1.80

d 10～40mm

10
12
15
17
20
25
30
35
40



Abutment and fillet dimensions mm				Load center mm
d_a min	d_a max	D_a max	r_{as} max	a
14	15.5	26	0.6	14.5
16	19.0	28	0.6	16.3
19	19.0	31	0.6	16.3
21	23.5	36	0.6	20.1
23	25.5	41	1	24.3
26	26.5	41	1	23.0
31	32.0	46	1	25.4
32	38.5	55	1	30.9
36	38.5	56	1	30.9
37	44.5	65	1	36.6
42	45.0	65	1	36.3
44	50.5	71	1.5	41.5
47	50.5	73	1	39.4
49	53.0	81	1.5	43.0


NTN

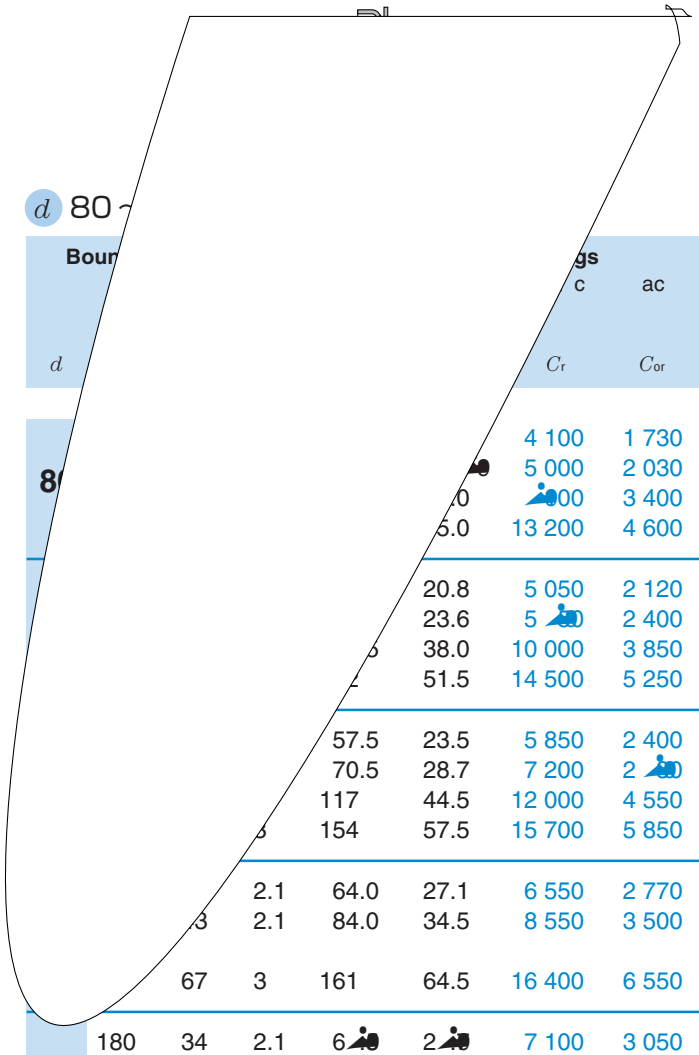
d 10～35mm

10
12
15
17
20
25
30
35

d 40～75mm

40	80	18	1.1	1	6.50	1	665	7 500		**1208S**	**1208SK**	46.5	73.5	1
	80	23	1.1	22.4	7.35	2 2	750	7 500		**2208S**	**2208SK**	46.5	73.5	1
		23	1.5	2		3 050		6 700	8 500	**1308S**	**1308SK**	48.0	82.0	1.5
		3		45.5	13.5	4 650		6 300	8 000		**2308SK**	48.0	82.0	1.5
45	85	1	1.1	22.0	7.35	2 240	750	7 100	8 500	**1209S**	**1209SK**	51.5	78.5	1
50														
55														
60														
65														
70														
75														

0.22	2.8	4.3	2.[illegible]	0.415
0.33	1.[illegible]	3.0	2.0	0.477
0.24	2.6	4.0	2.7	0.715
0.43	1.5	2.3	1.5	0.88[illegible]
0.21	3.0	4.7	3.1	0.465
0.30	2.1	3.2	2.2	0.522
0.25	2.6	4.0	2.7	0.[illegible]5
0.41	1.5	2.4	1.6	1.200
0.21	3.1	4.7	3.2	0.525
0.28	2.2	3.4	2.3	0.564
0.23	2.7	4.2	2.8	1.250
0.42	1.5	2.3	1.6	1.580
0.20	3.2	4.[illegible]	3.3	0.705
0.28	2.3	3.5	2.4	0.746
0.23	2.7	4.2	2.8	1.600
0.41	1.5	2.4	1.6	2.030
0.18	3.4	5.3	3.6	0.[illegible]0
0.28	2.3	3.5	2.4	1.030
0.23	2.8	4.3	2.[illegible]	2.030
0.40	1.6	2.4	1.6	2.570
0.17	3.7	5.7	3.8	1.150
0.28	2.3	3.5	2.4	1.400
0.23	2.7	4.2	2.[illegible]	2.540
0.3[illegible]	1.6	2.5	1.7	3.200
0.18	3.4	5.3	3.6	1.300
0.26	2.4	3.7	2.5	1.520
0.22	2.8	4.4	3.0	3.1[illegible]
0.38	1.7	2.6		



d 80 ~

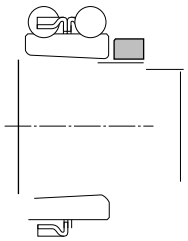
Boun				gs c	ac	Limiting speeds -1		Bearing numbers		Abutment and fillet dimensions		
d				C_r	C_{or}			c dc a b e	ae e d[2] b e	d_a	D_a a	r_{as} a
8				4 100	1 730	4 000	5 000	1216S	1216SK	8	131	2
				5 000	2 030	4 000	5 000	2216S	2216SK	8	131	2
				00	3 400	3 600	4 300	1316S	1316SK		15	2
				5.0	13 200	4 600	3 200	4 000	2316S	2316SK		15	2
				20.8	5 050	2 120	3 800	4 500	1217S	1217SK		141	2
				23.6	5	2 400	3 800	4 800	2217S	2217SK		141	2
				38.0	10 000	3 850	3 400	4 000	1317S	1317SK		167	2.5
				51.5	14 500	5 250	3 000	3 800	2317S	2317SK		167	2.5
			57.5	23.5	5 850	2 400	3 600	4 300	1218S	1218SK		151	2
			70.5	28.7	7 200	2	3 600	4 300	2218S	2218SK		151	2
			117	44.5	12 000	4 550	3 200	3 800	1318S	1318SK	103	177	2.5
			154	57.5	15 700	5 850	2 800	3 600	2318S	2318SK	103	177	2.5
		2.1	64.0	27.1	6 550	2 770	3 400	4 000	1219S	1219SK	106	15	2
	3	2.1	84.0	34.5	8 550	3 500	3 400	4 000	2219S	2219SK	106	15	2
	67	3	161	64.5	16 400	6 550	2 800	3 400	2319S	2319SK	108	187	2.5
100	180	34	2.1	6	2	7 100	3 050	3 200	3 800	1220S	1220SK	111	16	2
	180	46	2.1	5	38.5	50	3	3 200	3 800	2220S	2220SK	111	16	2
	215	47	3	140	57.5	14 300	5 850	2 800	3 400	1320S	1320SK	113	202	2.5
	215	73	3	187	7	1 00	8 050	2 400	3 200	2320S	2320SK	113	202	2.5
105	1	36	2.1	75.0	32.5	7 650	3 300	3 000	3 600	1221S	—	116	17	2
	1	50	2.1	10	45.0	11 100	4 550	3 000	3 600	2221S	—	116	17	2
	225	4	3	154	64.5	15 700	6 600	2 600	3 200	1321S	—	118	212	2.5
	225	77	3	200	87.0	20 400	8 850	2 400	3 000	2321S	—	118	212	2.5
110	200	38	2.1	87.0	38.5	8	3	2 800	3 400	1222S	1222SK	121	18	2
	200	53	2.1	122	51.5	12 500	5 250	2 800	3 400	2222S	2222SK	121	18	2
	240	50	3	161	72.5	16 400	7 300	2 400	3 000	1322S	1322SK	123	227	2.5
	240	80	3	211	5	21 600	50	2 200	2 800	2322S[3]	2322SK	123	227	2.5

1) ae a abe de e ch a e -de e r. 2) "K" dc æ be a- h ae ae e d b e h a ae - a 1 12.
3) Mah e dc ae a da d -2322 ( ).

Constant				
0.16	3.[illegible]	6.0	4.1	1.73
0.25	2.5	3.[illegible]	2.7	1.[illegible]
0.22	2.[illegible]	4.5	3.1	4.31
0.3[illegible]	1.6	2.5	1.7	5.54
0.17	3.7	5.7	3.8	2.0[illegible]
0.25	2.5	3.[illegible]	2.6	2.48
0.21	2.[illegible]	4.6	3.1	5.13
0.37	1.7	2.6	1.8	6.56
0.17	3.8	5.8	3.[illegible]	2.55
0.27	2.4	3.7	2.5	3.13
0.22	2.8	4.3	2.[illegible]	5.[illegible]
0.38	1.7	2.6	1.7	7.76
0.17	3.7	5.8	3.[illegible]	3.21
0.27	2.4	3.7	2.5	3.87
0.23	2.8	4.3	2.[illegible]	6.84
0.38	1.7	2.6	1.8	[illegible]1
0.17	3.6	5.6	3.8	3.82
0.27	2.4	3.7	2.5	4.53
0.24	2.7	4.1	2.8	8.46
0.38	1.7	2.6	1.8	11.6
0.18	3.6	5.5	3.7	4.52
0.28	2.3	3.5	2.4	5.64
0.23	2.7	4.2	2.[illegible]	10.0
0.38	1.7	2.6	1.7	14.4
0.18	3.7	5.7	3.[illegible]	5.33
0.28	2.2	3.5	2.3	6.64
0.22	2.8	4.4	3.0	12.0
0.37	1.7	2.6	1.8	17.4

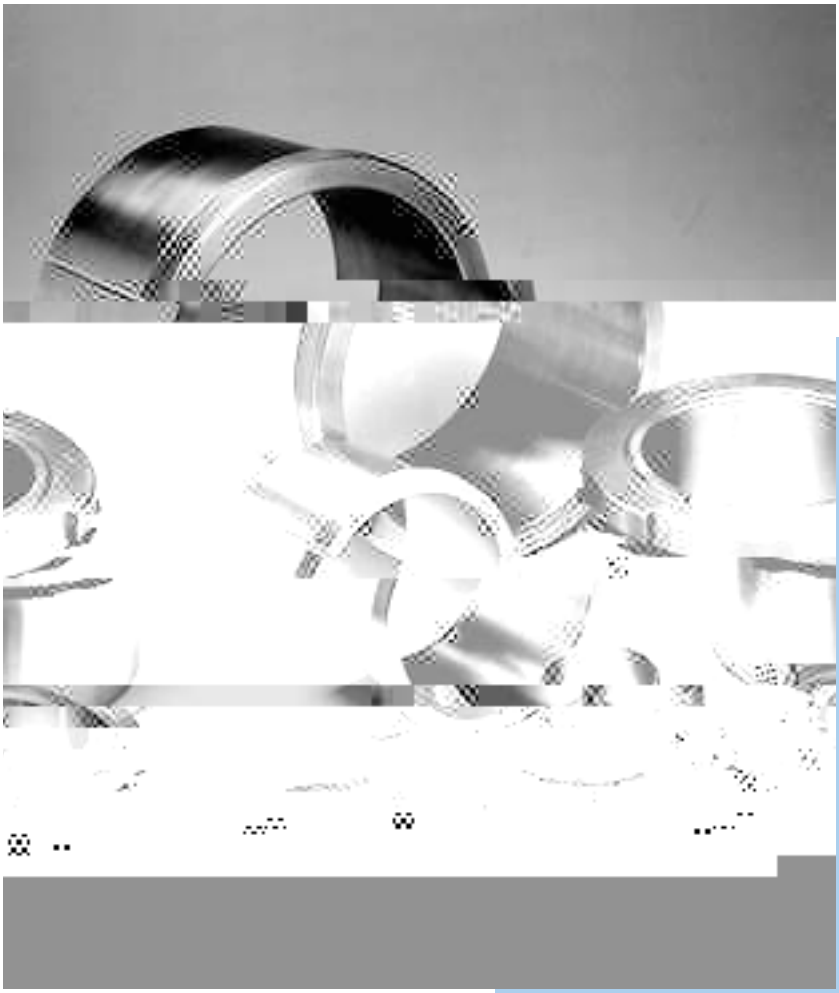
d 17～50mm

1	24	32	7	1204SK; **20**	23	27	5	41	1	0.041
	28	32	7	2204SK; **30**	24	28	5	41	1	0.045
	28	32	7	1304SK; **30**	24	31	8	45	1	0.045
	31	32	7	2304SK; **230**	24	28	5	45	1	0.049
20	26									
2										
30										
3										
0										
0										



d 50～85mm

0	45	75	12	2211SK; **311**	60	69	11	91.5	1.5	0.345
	45	75	12	1311SK; **311**	60	73	6	110	2	0.345
	59	75	12	2311SK; **2311**	61	71	6	110	2	0.42
	38	80	13	1212SK; **212**	64	76	5	101.5	1.5	0.346
	47	80	13	2212SK; **312**	65	75	9	101.5	1.5	0.394
	47	80	13	1312SK; **312**	65	79	5	118	2	0.394
	62	80	13	2312SK; **2312**	66	77	5	118	2	0.481
0	40	85	14	1213SK; **213**	70	83	5	111.5	1.5	0.401
	50	85	14	2213SK; **313**	70	81	8	111.5	1.5	0.458
	50	85	14	1313SK; **313**	70	85	5	128	2	0.458
	65	85	14	2313SK; **2313**	72	84	5	128	2	0.557
	43	98	15	1215SK; **21**	80	93	5	121.5	1.5	0.707
	55	98	15	2215SK; **31**	80	93	12	121.5	1.5	0.831
	55	98	15	1315SK; **31**	80	97	5	148	2	0.831
	73	98	15	2315SK; **231**	82	96	5	148	2	1.05
0	46	105	17	1216SK; **21**	85	100	5	130	2	0.882
	59	105	17	2216SK; **31**	86	98	12	130	2	1.03
	59	105	17	1316SK; **31**	86	103	5	158	2	1.03
	78	105	17	2316SK; **231**	87	103	5	158	2	1.28
	50	110	18	1217SK; **21**	90	106	6	140	2	1.02
	63	110	18	2217SK; **31**	91	104	12	140	2	1.18
	63	110	18	1317SK; **31**	91	110	6	166	2.5	1.18
	82	110	18	2317SK; **231**	94	110	6	166	2.5	1.45
0	52	120	18	1218SK; **21**	95	111	6	150	2	1.19
	65	120	18	2218SK; **31**	96	112	10	150	2	1.37
	65	120	18	1318SK; **31**	96	116	6	176	2.5	1.37
	86	120	18	2318SK; **231**	99	117	6	176	2.5	1.69
	55	125	19	1219SK; **21**	101	118	7	158	2	1.37
	68	125	19	2219SK; **31**	102	117	9	158	2	1.56





d 20～40mm

d														
20	47	14	1	0.6	25.7	22.6	2 620	2 310	15 000	18 000	**NU204E**	**NJ**	**NUP**	—
	47	18	1	0.6	30.5	28.3	3 100	2 890	14 000	16 000	**NU2204E**	**NJ**	**NUP**	—
	52	15	1.1	0.6	31.5	26.9	3 200	2 740	13 000	15 000	**NU304E**	**NJ**	**NUP**	—
	52	21	1.1	0.6	42.0	39.0	4 300	3 950	12 000	14 000	**NU2304E**	**NJ**	**NUP**	—
25	47	12	0.6	0.3	15.1	14.1	1 540	1 430	16 000	19 000	**NU1005**	**NJ**	**NUP**	**N**
	52	15	1	0.6	29.3	27.7	2 990	2 830	13 000	15 000	**NU205E**	**NJ**	**NUP**	—
	52	18	1	0.6	35.0	34.5	3 550	3 550	11 000	13 000	**NU2205E**	**NJ**	**NUP**	—
	62	17	1.1	1.1	41.5	37.5	4 250	3 800	11 000	13 000	**NU305E**	**NJ**	**NUP**	—
	62	24	1.1	1.1	57.0	56.0	5 800	5 700	9 700	11 000	**NU2305E**	**NJ**	**NUP**	—
	80	21	1.5	1.5	46.5	40.0	4 750	4 050	8 500	10 000	**NU405**	**NJ**	**NUP**	**N**
30	55	13	1	0.6	19.7	19.6	2 000	2 000	14 000	16 000	**NU1006**	**NJ**	**NUP**	**N**
	62	16	1	0.6	39.0	37.5	4 000	3 800	11 000	13 000	**NU206E**	**NJ**	**NUP**	—
35														
40														

—	26.5	—	29.5	24	—	26	29	32	42	—	—	1	0.6	0.122	—
—	26.5	—	29.5	24	—	26	29	32	42	—	—	1	0.6	0.158	—
—	27.5	—	31.1	24	—	27	30	33	45.5	—	—	1	0.6	0.176	—
—	27.5	—	31.1	24	—	27	30	33	45.5	—	—	1	0.6	0.242	—

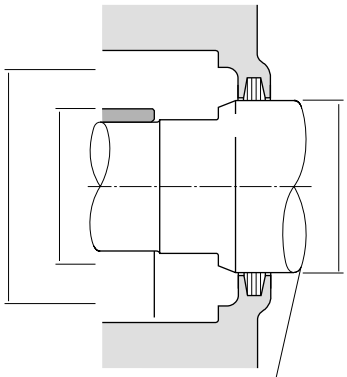
d 45～60mm

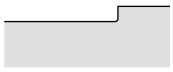
45

50

d 60～75mm

	110	28	1.5	1.5	131	157	13 400	16 486003 Tc BT 9 03504 42.213 486.225m (16) T 9 0 0318282.867 4
60								
65								
70								
75								





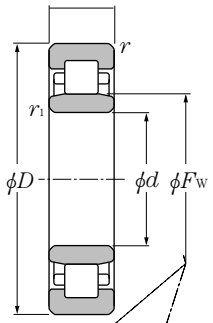
D				A									M	
mm				mm									kg	
NF	F_w	E_w	J	d_a min	d_b min	d_c max	d_d min	d_e min	D_a max	D_b max	D_b min[4]	r_{as} max	r_{1as} max	type NU (approx.)	type N (approx.)
—	72	—	77.6	68	—	71	75	80	102	—	—	1.5	1.5	1.21	—
NF	77	113	84.2	71	71	75	79	86	119	119	116	2	2	1.8	1.76
—	77	—	84.6	71	—	75	79	86	119	—	—	2	2	2.05	—
—	77	113	84.2	71	71	75	79	86	119	119	116	2	2	2.71	2.66
—	77	—	84.6	71	—	75	79	86	119	—	—	2	2	2.96	—
NF	83	127	91.8	71	71	82	85	94	139	139	128	2	2	3	2.93
—	74.5	90.5	77.7	70	71.5	73	76	78.5	93.5	95	91.5	1	1	0.485	0.477
NF	79.6	105.6	84.8	73	73	77	81	87	112	112	108	1.5	1.5	1.02	1
—	78.5	—	84.5	73	—	77	81	87	112	—	—	1.5	1.5	1.21	—
—	79.6	105.6	84.8	73	73	77	81	87	112	112	108	1.5	1.5	1.4	1.37
—	78.5	—	84.5	73	—	77	81	87	112	—	—	1.5	1.5	1.6	—
NF	83.5	121.5	91	76	76	81	85	93	129	129	125	2	2	2.23	2.18
—	82.5	—	91	76	—	81	85	93	129	—	—	2	2	2.54	—
—	83.5	121.5	91	76	76	81	85	93	129	129	125	2	2	3.27	3.2
—	82.5	—	91	76	—	81	85	93	129	—	—	2	2	3.48	—
NF	89.3	135.3	98.5	76	76	88	91	100	149	149	137	2	2	3.6	3.5
—	80	100	84	75	76.5	78	82	85	103.5	105	101	1	1	0.699	0.689
NF	84.5	110.5	89.6	78	78	82	86	92	117	117	114	1.5	1.5	1.12	1.1
—	83.5	—	89.5	78	—	82	86	92	117	—	—	1.5	1.5	1.3	—
—	84.5	110.5	89.6	78	78	82	86	92	117	117	114	1.5	1.5	1.47	1.44
—	83.5	—	89.5	78	—	82	86	92	117	—	—	1.5	1.5	1.7	—
NF	90	130	98	81	81	87	92	100	139	139	134	2	2	2.71	2.65
—	89	—	98	81	—	87	92	100	139	—	—	2	2	3.1	—
—	90	130	98	81	81	87	92	100	139	139	134	2	2	3.98	3.9
—	89	—	98	81	—	87	92	100	139	—	—	2	2	4.25	—
NF	100	152	110.5	83	83	99	102	112	167	167	153	2.5	2.5	5.24	5.1
—	85	105	89	80	81.5	83	87	90	108.5	110	106	1	1	0.738	0.727
NF	88.5	116.5	94	83	83	87	90	96	122	122	120	1.5	1.5	1.23	1.21
—	88.5	—	94.5	83	—	87	90	96	122	—	—	1.5	1.5	1.41	—
—	88.5	116.5	94	83	83	87	90	96	122	122	120	1.5	1.5	1.55	1.52
—	88.5	—	94.5	83	—	87	90	96	122	—	—	1.5	1.5	1.79	—
NF	95.5	139.5	104.2	86	86	93	97	106	149	149	143	2	2	3.28	3.21
—	95	—	104.6	86	—	93	97	106	149	—	—	2	2	3.74	—
—	95.5	139.5	104.2	86	86	93	97	106	149	149	143	2	2	4.87	4.77

4) Does not apply to side of the outer ring rib of type **NF** bearings.

d 75～95mm

75	160	55	2.1	2.1	330	395	33 500	40 000	3 500	4 100	**NU2315E**	**NJ**	**NUP**
80													
85													
90													
95													

	D					A								M	
	mm					mm								kg	
—	113.5	151.5	121	106	106	111	116	123	159	159	155	2	2	3.79	3.71
—	112.5	—	121	106	—	111	116	123	159	—	—	2	2	4.14	—
NF	121.5	173.5	132	108	108	119	124	134	187	187	178	2.5	2.5	6.13	5.99
—	121.5	—	132.7	108	—	119	124	134	187	—	—	2.5	2.5	6.62	—
—	121.5	173.5	132	108	108	119	124	134	187	187	178	2.5	2.5	9.2	9.02
—	121.5	—	132.7	108	—	119	124	134	187	—	—	2.5	2.5	9.8	—
—	113	137	117.8	106.5	108	111	116	119	142	143.5	139	1.5	1	1.45	1.43
NF	120	160	128	111	111	117	122	130	169	169	164	2	2	3.33	3.26
—	119	—	128	111	—	117	122	130	169	—	—	2	2	3.66	—
—	120	160	128	111	111	117	122	130	169	169	164	2	2	4.57	4.48
—	119	—	128	111	—	117	122	130	169	—	—	2	2	5.01	—
NF	129.5	185.5	140.5	113	113	125	132	143	202	202	190	2.5	2.5	7.49	7.32
—	127.5	—	140.3	113	—	125	132	143	202	—	—	2.5	2.5	8.57	—
—	129.5	185.5	140.5	113	113	125	132	143	202	202	190	2.5	2.5	11.7	11.5
—	127.5	—	140.3	113	—	125	132	143	202	—	—	2.5	2.5	12.8	—
—	119.5	145.5	124.7	111.5	114	118	122	126	151	153.5	147.5	2	1	1.84	1.81
NF	126.8	168.8	135	116	116	124	129	137	179	179	173	2	2	3.95	3.87
NF	135	195	147	118	118	132	137	149	212	212	199	2.5	2.5	8.53	8.33
—	125	155	131	116.5	119	124	128	132	161	163.5	157	2	1	2.33	2.3
NF	132.5	178.5	141.5	121	121	130	135	144	189	189	182	2	2	4.63	4.54
—	132.5	—	142.1	121	—	130	135	144	189	—	—	2	2	4.27	—
—	132.5	178.5	141.5	121	121	130	135	144	189	189	182	2	2	6.56	6.43
—	132.5	—	142.1	121	—	130	135	144	189	—	—	2	2	7.4	—
NF	143	207	155.5	123	123	140	145	158	227	227	211	2.5	2.5	10	9.77
—	143	—	156.6	123	—	140	145	158	227	—	—	2.5	2.5	11.1	—
—	143	207	155.5	123	123	140	145	158	227	227	211	2.5	2.5	17.1	16.8
—	143	—	156.6	123	—	140	145	158	227	—	—	2.5	2.5	19.4	—
—	135	165	141	126.5	129	134	138	142	171	173.5	167	2	1	2.44	2.4
NF	143.5	191.5	153	131	131	141	146	156	204	204	196	2	2	5.57	5.46
—	143.5	—	153.9	131	—	141	146	156	204	—	—	2	2	5.97	—
—	143.5	191.5	153	131	131	141	146	156	204	204	196	2	2	8.19	8.03
—	143.5	—	153.9	131	—	141	146	156	204	—	—	2	2	9.18	—
NF	154	226	168.5	133	133	151	156	171	247	247	230	2.5	2.5	12.8	12.5



d 160～200mm

160	290	80	3	3	630	940	64 500	96 000	2 100	2 400	NU2232	NJ	NUP	N
	290	80	3	3	810	1 190	82 500	121 000	1 900	2 200	NU2232E	NJ	NUP	—
	340	68	4	4	700	875	71 000	89 500	2 000	2 300	NU332	NJ	NUP	N
	340	68	4	4	860	1 050	87 500	107 000	1 800	2 100	NU332E	NJ	NUP	—
	340	114	4	4	1 070	1 520	109 000	155 000	1 700	2 000	NU2332	NJ	NUP	N
	340	114	4	4	1 310	1 820	134 000	186 000	1 600	1 900	NU2332E	NJ	NUP	—
170	260	42	2.1	2.1	278	400	28 300	41 000	2 600	3 000	NU1034	NJ	NUP	N
	310	52	4	4	475	635	48 500	65 000	2 200	2 500	NU234	NJ	NUP	N
	310	52	4	4	605	800	61 500	81 500	2 000	2 300	NU234E	NJ	NUP	—
	310	86	4	4	715	1 080	73 000	110 000	2 000	2 300	NU2234	NJ	NUP	N
	310	86	4	4	965	1 410	98 500	144 000	1 800	2 100	NU2234E	NJ	NUP	—
	360	72	4	4	795	1 010	81 500	103 000	1 800	2 200	NU334	NJ	NUP	N
	360	120	4	4	1 220	1 750	125 000	179 000	1 600	1 900	NU2334	NJ	NUP	N
180	280	46	2.1	2.1	340	485	35 000	49 500	2 400	2 900	NU1036	NJ	NUP	N
	320	52	4	4	495	675	50 500	69 000	2 000	2 400	NU236	NJ	NUP	N
	320	52	4	4	625	850	64 000	87 000	1 800	2 200	NU236E	NJ	NUP	—
	320	86	4	4	745	1 140	76 000	117 000	1 800	2 200	NU2236	NJ	NUP	N
	320	86	4	4	1 010	1 510	103 000	154 000	1 600	1 900	NU2236E	NJ	NUP	—
	380	75	4	4	905	1 150	92 000	118 000	1 700	2 000	NU336	NJ	NUP	N
	380	126	4	4	1 380	1 990	141 000	203 000	1 500	1 800	NU2336	NJ	NUP	N
190	290	46	2.1	2.1	350	510	36 000	52 000	2 300	2 700	NU1038	NJ	NUP	N
	340	55	4	4	555	770	56 500	78 500	1 900	2 200	NU238	NJ	NUP	N
	340	55	4	4	695	955	71 000	97 500	1 700	2 000	NU238E	NJ	NUP	—
	340	92	4	4	830	1 290	84 500	131 000	1 700	2 000	NU2238	NJ	NUP	N
	340	92	4	4	1 100	1 670	113 000	170 000	1 500	1 800	NU2238E	NJ	NUP	—
	400	78	5	5	975	1 260	99 500	129 000	1 600	1 900	NU338	NJ	NUP	N
	400	132	5	5	1 520	2 220	155 000	226 000	1 400	1 700	NU2338	NJ	NUP	N
200	310	51	2.1	2.1	390	580	40 000	59 500	2 200	2 600	NU1040	NJ	NUP	N
	360	58	4	4	620	865	63 500	88 500	1 800	2 100	NU240	NJ	NUP	N
	360	58	4	4	765	1 060	78 000	108 000	1 600	1 900	NU240E	NJ	NUP	—
	360	98	4	4	925	1 440	94 000	147 000	1 600	1 900	NU2240	NJ	NUP	N
	360	98	4	4	1 220	1 870	125 000	191 000	1 500	1 700	NU2240E	NJ	NUP	—
	420	80	5	5	975	1 270	99 500	130 000	1 500	1 800	NU340	NJ	NUP	N

1) This value achieved with machined cages; when pressed cages are used, 80% of this value is acceptable.
2) Production switched to E type only for bearing number for which there is no standard form.
3) Minimal allowable dimension for chamfer dimension r or r_1.

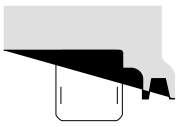
—	195	255	207	173	173	192

d 200～360mm

200	420	138	5	5	1 510	2 240	154 000	229 000	1 400	1 600	**NU2340**	**NJ**	**NUP**	**N**
220	340	56	3	3	500	750	51 000	76 500	2 000	2 300	**NU1044**	**NJ**	**NUP**	**N**
	400	65	4	4	760	1 080	77 500	110 000	1 600	1 900	**NU244**	**NJ**	**NUP**	**N**
	400	108	4	4	1 140	1 810	116 000	184 000	1 500	1 700	**NU2244**	**NJ**	**NUP**	**N**
	460	88	5	5	1 190	1 570	122 000	161 000	1 400	1 600	**NU344**	**NJ**	**NUP**	**N**
	460	145	5	5	1 780	2 620	181 000	268 000	1 200	1 400	**NU2344**	**NJ**	**NUP**	**N**
240	360	56	3	3	530	820	54 000	83 500	1 800	2 100	**NU1048**	**NJ**	**NUP**	**N**
	440	72	4	4	935	1 340	95 500	136 000	1 500	1 700	**NU248**	**NJ**	**NUP**	**N**
	440	120	4	4	1 440	2 320	146 000	236 000	1 300	1 600	**NU2248**	**NJ**	**NUP**	**N**
	500	95	5	5	1 430	1 950	146 000	198 000	1 300	1 500	**NU348**	**NJ**	**NUP**	**N**
	500	155	5	5	2 100	3 200	214 000	325 000	1 100	1 300	**NU2348**	**NJ**	**NUP**	**N**
260	400	65	4	4	645	1 000	65 500	102 000	1 600	1 900	**NU1052**	**NJ**	**NUP**	**N**
	480	80	5	5	1 150	1 660	117 000	170 000	1 300	1 600	**NU252**	**NJ**	**NUP**	**N**
	480	130	5	5	1 780	2 930	182 000	299 000	1 200	1 400	**NU2252**	**NJ**	**NUP**	**N**
	540	102	6	6	1 620	2 230	165 000	228 000	1 200	1 400	**NU352**	**NJ**	**NUP**	**N**
	540	165	6	6	2 340	3 600	239 000	365 000	1 000	1 200	**NU2352**	**NJ**	**NUP**	**N**
280	420	65	4	4	660	1 050	67 000	107 000	1 500	1 800	**NU1056**	**NJ**	**NUP**	**N**
	500	80	5	5	1 190	1 760	121							
300														
320														
340														
360														

d 380～500mm

380	560	82	5	5	1 100	1 840	112 000	187 000	1 100	1 200	**NU1076**	**NJ**	**NUP**	**N**
400	600	90	5	5	1 320	2 190	134 000	223 000	990	1 200	**NU1080**	**NJ**	**NUP**	**N**
420	620	90	5	5	1 350	2 290	138 000	233 000	950	1 100	**NU1084**	**NJ**	**NUP**	**N**
440	650	94	6	6	1 430	2 430	146 000	248 000	900	1 100	**NU1088**	**NJ**	**NUP**	**N**
460	680	100	6	6	1 540	2 630	157 000	269 000	850	1 000	**NU1092**	**NJ**	**NUP**	**N**
480	700	100	6	6	1 580	2 750	161 000	280						
500														





—	425	515	443	400	400	421	430	445	540	540	519	4	4	67.5	66.5
—	450	550	470	420	420	446	455	473	580	580	554	4	4	87.6	86.3
—	470	570	490	440	440	466	475	493	600	600	574	4	4	91	89.6
—	493	597	513.8	464	464	488	499	517	626	626	602	5	5	105	103
—	516	624	537.6	484	484	511	522	541	656	656	629	5	5	122	120
—	536	644	557.6	504	504	531	542	561	676	676	649	5	5	126	124
—	556	664	577.6	524	524	551	562	581	696	696	669	5	5	130	128

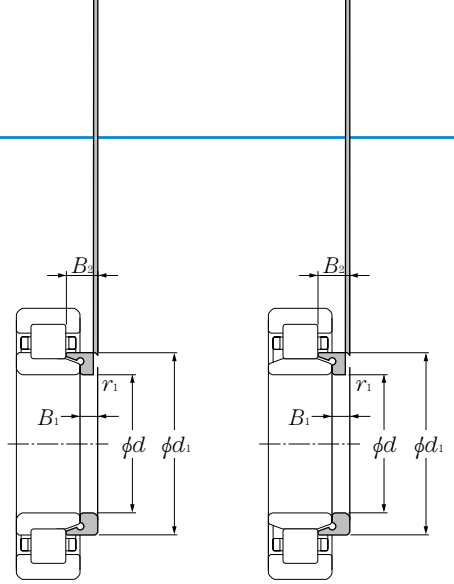
4) Does not apply to side of the outer ring rib of type **NF** bearings.

d 20～60mm

20	29.9	3	6.75	0.6	**HJ204**	0.012
	29.5	3	5.5	0.6	**HJ204E**	0.009
	29.9	3	7.5	0.6	**HJ2204**	0.013
	29.5	3	6.5	0.6	**HJ2204E**	0.01
	31.8	4	7.5	0.6	**HJ304**	0.017
	31.1	4	6.5	0.6	**HJ304E**	0.014
	31.8	4	8.5	0.6	**HJ2304**	0.018
	31.1	4	7.5	0.6	**HJ2304E**	0.015
25	34.8	3	7.25	0.6	**HJ205**	0.015
	34.5	3	6.	0.6	**HJ205E**	0.012
	34.8	3	7.5	0.6	**HJ2205**	0.015
	34.5	3	6.5	0.6	**HJ2205E**	0.013
	39	4	8	1.1	**HJ305**	0.025
	38	4	7	1.1	**HJ305E**	0.021
	39	4	9	1.1	**HJ2305**	0.027
	38	4	8	1.1	**HJ2305E**	0.024
	43.6	6	10.5	1.5	**HJ405**	0.057
30	41.7	4	8.25	0.6	**HJ206**	0.025
	41.1	4	7	0.6	**HJ206E**	0.017
	41.7	4	8.5	0.6	**HJ2206**	0.025
	41.1	4	7.5	0.6	**HJ2206E**	0.02
	45.9	5	9.5	1.1	**HJ306**	0.039
	44.9	5	8.5	1.1	**HJ306E**	0.035
	45.9	5	11.5	1.1	**HJ2306**	0.043
	44.9	5	9.5	1.1	**HJ2306E**	0.035
	50.5	7	11.5	1.5	**HJ406**	0.08
35	47.6	4	8	0.6	**HJ207**	0.03
	48	4	7	0.6	**HJ207E**	0.027
	47.6	4	8.5	0.6	**HJ2207**	0.031
	48	4	8.5	0.6	**HJ2207E**	0.031
	50.8	6	11	1.1	**HJ307**	0.056
	51	6	9.5	1.1	**HJ307E**	0.048
	50.8	6	14	1.1	**HJ2307**	0.064
	51	6	11	1.1	**HJ2307E**	0.055
	59	8	13	1.5	**HJ407**	0.12

40	54.2	5	9	1.1	**HJ208**	0.046
	53.9	5	8.5	1.1	**HJ208E**	0.042
	54.2	5	9.5	1.1	**HJ2208**	0.047
	53.9	5	9	1.1	**HJ2208E**	0.045
	58.4	7	12.5	1.5	**HJ308**	0.083
	57.6	7	11	1.5	**HJ308E**	0.07
	58.4	7	14.5	1.5	**HJ2308**	0.09
	57.6	7	12.5	1.5	**HJ2308E**	0.08
	64.8	8	13	2	**HJ40 BT T ET BT 9 BT 9 5**	
45						0.083
	5 59) T T BT 9 0 0 9 384.0229 36				**H 8 E**	5) T 0.147 T 9 0 0 9
	5 54)T T BT 9 0 0 9 384.887 353.381 Tm					5) T T BT 9 0 0 9
		7	12.5	5.1	**HJ 9 T ET BT 9 00 9 537 7**	
		7	**1**	**5 1**	**HJ2 9 T ET BT 9 00 9 537**	
			1			10083
		8			**HJ98E**	16.75
50						0.055
			9.5	1.1	**HH108E**	061.1
			14		**H108E**	08.12
			1			
			1		**2H108E**	15709
						.015
					4108	2375
55						07609
			1		**H118**	.8012
			1			
					23118E	20083
					2311E8E	18583
					41112	2975
60						

L Type Loose Rib



NH＝NJ＋HJ **NUJ＝NU＋HJ**

d 60～105mm

Dimensions mm					Bearing numbers	Mass kg
d	d_1	B_1	B_2	$r_{1s\,min}$ 1)		approx.)
60	84.2	9	15.5	2.1	**HJ312**	0.22
	84.6	9	14.5	2.1	**HJ312E**	0.205
	84.2	9	19	2.1	**HJ2312**	0.245
	84.6	9	16	2.1	**HJ2312E**	0.23
	91.8	10	16.5	2.1	**HJ412**	0.34
65	84.8	6	11	1.5	**HJ213**	0.123
	84.5	6	10	1.5	**HJ213E**	0.111
	84.8	6	11.5	1.5	**HJ2213**	0.126
	84.5	6	10.5	1.5	**HJ2213E**	0.118
	91	10	17	2.1	**HJ313**	0.28
	91	10	15.5	2.1	**HJ313E**	0.25
	91	10	20	2.1	**HJ2313**	0.304
	91	10	18	2.1	**HJ2313E**	0.29
	98.5	11	18	2.1	**HJ413**	0.42
70	89.6	7	12.5	1.5	＊ **HJ214**	0.15
	89.5	7	11	1.5	**HJ214E**	0.13
	89.5	7	11.5	1.5	**HJ2214E**	0.138
	98	10	17.5	2.1	**HJ314**	0.33
	98	10	15.5	2.1	**HJ314E**	0.293
	98	10	20.5	2.1	**HJ2314**	0.358
	98	10	18.5	2.1	**HJ2314E**	0.35
	110.5	12	20	3	**HJ414**	0.605
75	94	7	12.5	1.5	＊ **HJ215**	0.156
	94.5	7	11	1.5	**HJ215E**	0.141
	94.5	7	11.5	1.5	**HJ2215E**	0.164
	104.2	11	18.5	2.1	**HJ315**	0.4
	104.6	11	16.5	2.1	**HJ315E**	0.35
	104.2	11	21.5	2.1	**HJ2315**	0.432
	104.6	11	19.5	2.1	**HJ2315E**	0.41
	116.0	13	21.5	3	**HJ415**	0.71
80	101.2	8	13.5	2	＊ **HJ216**	0.207
	101.7	8	12.5	2	＊ **HJ216E**	0.193
	111.8	11	19.5	2.1	**HJ316**	0.47
	111	11	17	2.1	**HJ316E**	0.405
	111.8	11	23	2.1	**HJ2316**	0.511
80	111	11	20	2.1	**HJ2316E**	0.45
	122	13	22	3	**HJ416**	0.78
85	108.2	8	14	2	＊ **HJ217**	0.25
	107.7	8	12.5	2	**HJ217E**	0.21
	107.7	8	13	2	**HJ2217E**	0.216
	117.5	12	20.5	3	**HJ317**	0.56
	118.4	12	18.5	3	**HJ317E**	0.505
	117.5	12	24	3	**HJ2317**	0.606
	118.4	12	22	3	**HJ2317E**	0.55
90	114.2	9	15	2	**HJ218**	0.305
	114.6	9	14	2	**HJ218E**	0.272
	114.2	9	16	2	**HJ2218**	0.315
	114.6	9	15	2	**HJ2218E**	0.308
	125	12	21	3	**HJ318**	0.63
	124.7	12	18.5	3	**HJ318E**	0.548
	125	12	26	3	**HJ2318**	0.704
	124.7	12	22	3	**HJ2318E**	0.69
95	121	9	15.5	2.1	**HJ219**	0.352
	121	9	14.0	2.1	**HJ219E**	0.304
	121	9	16.5	2.1	**HJ2219**	0.363
	121	9	15.5	2.1	**HJ2219E**	0.335
	132	13	22.5	3	**HJ319**	0.76
	132.7	13	20.5	3	**HJ319E**	0.7
	132	13	26.5	3	**HJ2319**	0.826
	132.7	13	24.5	3	**HJ2319E**	0.8
100	128	10	17	2.1	**HJ220**	0.444
	128	10	15	2.1	**HJ220E**	0.38
	128	10	18	2.1	**HJ2220**	0.456
	128	10	16	2.1	**HJ2220E**	0.385
	140.5	13	22.5	3	**HJ320**	0.895
	140.3	13	20.5	3	**HJ320E**	0.8
	140.5	13	27.5	3	**HJ2320**	0.986
	140.3	13	23.5	3	**HJ2320E**	0.92
105	135.0	10	17.5	2.1	**HJ221**	0.505

1) Minimal allowable dimension for chamfer dimension r. Note: 1. This L type collar ring is used with **NU** type cylindrical roller bearings; in duplex arrangements with **NJ** or **NU** type bearing numbers, they become **NH** type and **NUJ** type respectively. For bearing dimensions, allowable rotations, and mass, please refer to pages **B-84** to **B-88**. 2. " ＊ " indicates L type collar rings that can also be used with dimension series **22** bearings.

d 105～200mm

105	147.0	13	22.5	3	**HJ321**	0.97
110	141.5	11	18.5	2.1	**HJ222**	0.615
	142.1	11	17	2.1	**HJ222E**	0.553
	141.5	11	20.5	2.1	**HJ2222**	0.645
	142.1	11	19.5	2.1	**HJ2222E**	0.605
	155.5	14	23	3	**HJ322**	1.17
	156.6	14	22	3	**HJ322E**	1.09
	155.5	14	28	3	**HJ2322**	1.28
	156.6	14	26.5	3	**HJ2322E**	1.25
120	153	11	19	2.1	**HJ224**	0.715
	153.9	11	17	2.1	**HJ224E**	0.634
	153	11	22	2.1	**HJ2224**	0.767
	153.9	11	20	2.1	**HJ2224E**	0.705
	168.5	14	23.5	3	**HJ324**	1.4
	169.2	14	22.5	3	**HJ324E**	1.28
	168.5	14	28	3	**HJ2324**	1.53
	169.2	14	26	3	**HJ2324E**	1.42
130	165.5	11	19	3	**HJ226**	0.84
	164.7	11	17	3	**HJ226E**	0.684
	165.5	11	25	3	**HJ2226**	0.953
	164.7	11	21	3	**HJ2226E**	0.831
	182	14	24	4	**HJ326**	1.62
	183	14	23	4	**HJ326E**	1.53
	182	14	29.5	4	**HJ2326**	1.8
	183	14	28	4	**HJ2326E**	1.75
140	179.5	11	19	3	**HJ228**	1
150	194	12	19.5	3	**HJ230E**	1.18
	193	12	26.5	3	**HJ2230**	1.39
	194	12	24.5	3	**HJ2230E**	1.42
	210	15	26.5	4	**HJ330**	2.37
	211	15	25	4	**HJ330E**	2.25
	210	15	34	4	**HJ2330**	2.69
	211	15	31.5	4	**HJ2330E**	2.6
160	207	12	21	3	**HJ232**	1.48
	207.8	12	20	3	**HJ232E**	1.34
	207	12	28	3	**HJ2232**	1.69
	206.6	12	24.5	3	**HJ2232E**	1.61
	225	15	28	4	**HJ332**	2.75
	223.2	15	25	4	**HJ332E**	2.4
	225	15	37	4	**HJ2332**	3.16
	223.2	15	32	4	**HJ2332E**	2.85
170	220.5	12	22	4	**HJ234**	1.7
	221.4	12	20	4	**HJ234E**	1.51
	220.5	12	29	4	**HJ2234**	1.93
	220.2	12	24	4	**HJ2234E**	1.82
	238	16	29.5	4	**HJ334**	3.25
	238	16	38.5	4	**HJ2334**	3.71
180	230.5	12	22	4	**HJ236**	1.8
	231.4	12	20	4	**HJ236E**	1.7
	230.5	12	29	4	**HJ2236**	2.04
	230.2	12	24	4	**HJ2236E**	1.91
	252	17	30.5	4	**HJ336**	3.85
	252	17	40	4	**HJ2336**	4.42
190	244.5	13	23.5	4	**HJ238**	2.2
	245.2	13	21.5	4	**HJ238E**	1.94
	244.5	13	31.5	4	**HJ2238**	2.52
	244	13	26.5	4	**HJ2238E**	2.38
	265	18	32	5	**HJ338**	4.45
	265	18	41.5	5	**HJ2338**	5.05
200	258	14	25	4	**HJ240**	2.6

HJ234E

d 200～320mm

200	259 258	14 14	23	4	**HJ240E**	2.35
220						
240						
260						
280						
300						
320						

d 25～110mm

25	47	16	0.6	25.8	30.0	2 630	3 050	14 000	17 000	—	—
30	55	19	1	31.0	37.0	3 150	3 800	12 000	15 000	—	—
35	62	20	1	38.0	47.5	3 850	4 850	11 000	13 000	—	—
40	68	21	1	43.5	55.5	4 400	5 650	9 700	11 000	—	—
45	75	23	1	52.0	68.5	5 300	7 000	8 800	10 000	—	—
50	80	23	1	53.0	72.5	5 400	7 400	8 000	9 400	—	—
55	90	26	1.1	69.5	96.5	7 050	9 850	7 300	8 600	—	—
60	95	26	1.1	71.0	102	7 250	10 400	6 700	7 900	—	—
65	100	26	1.1	75.0	111	7 650	11 400	6 200	7 300	—	—
70	110	30	1.1	94.5	143	9 650	14 600	5 800	6 800	—	—
75	115	30	1.1	96.5	149	9 850	15 200	5 400	6 300	—	—
80	125	34	1.1	116	179	11 800	18 200	5 100	5 900	—	—
85	130	34	1.1	122	194	12 400	19 800	4 800	5 600	—	—
90	140	37	1.5	143	228	14 600	23 200	4 500	5 300	—	—
95											
100											
105											
110											

NN3005	**NN3005K**	—	41.3	29	30	—	—	—	43	42	0.6	—	—	0.124	0.121
NN3006	**NN3006K**	—	48.5	35	36.5	—	—	—	50	49	1	—	—	0.199	0.193
NN3007	**NN3007K**	—	55	40	41.5	—	—	—	57	56	1	—	—	0.242	0.235
NN3008	**NN3008K**	—	61	45	47	—	—	—	63	62	1	—	—	0.312	0.303
NN3009	**NN3009K**	—	67.5	50	52	—	—	—	70	69	1	—	—	0.405	0.393
NN3010	**NN3010K**	—	72.5	55	57	—	—	—	75	74	1	—	—	0.433	0.419
NN3011	**NN3011K**	—	81	61.5	63.5	—	—	—	83.5	82	1	—	—	0.651	0.631
NN3012	**NN3012K**	—	86.1	66.5	68.5	—	—	—	88.5	87	1	—	—	0.704	0.683
NN3013	**NN3013K**	—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.758	0.735
NN3014	**NN3014K**	—	100	76.5	79	—	—	—	103.5	101	1	—	—	1.04	1.01
NN3015	**NN3015K**	—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.14	1.11
NN3016	**NN3016K**	—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.52	1.47
NN3017	**NN3017K**	—	118	91.5	94.5	—	—	—	123.5	119	1	—	—	1.61	1.56
NN3018	**NN3018K**	—	127	98	101	—	—	—	132	129	1.5	—	—	2.07	2.01

d 120～280mm

120	165	45	1.1	183	360	18 700	37 000	3 600	4 200	**NNU4924**	**NNU4924K**
	180	46	2	233	390	23 700	40 000	3 300	3 900	—	—
130	180	50	1.5	220	440	22 400	45 000	3 300	3 900	**NNU4926**	**NNU4926K**
	200	52	2	284	475	29 000	48 500	3 100	3 600	—	—
140	190	50	1.5	227	470	23 100	48 000	3 000	3 600	**NNU4928**	**NNU4928K**
	210	53	2	298	515	30 500	52 500	2 800	3 300	—	—
150	210	60	2	345	690	35 000	70 500	2 800	3 300	**NNU4930**	**NNU4930K**
	225	56	2.1	335	585	34 000	60 000	2 600	3 100	—	—
160	220	60	2	355	740	36 500	75 500	2 600	3 100	**NNU4932**	**NNU4932K**
	240	60	2.1	375	660	38 000	67 500	2 500	2 900	—	—
170	230	60	2	360	765	37 000	78 000	2 500	2 900	**NNU4934**	**NNU4934K**
	260	67	2.1	440	775	45 000	79 000	2 300	2 700	—	—
180	250	69	2	460	965	46 500	98 500	2 300	2 700	**NNU4936**	**NNU4936K**
	280	74	2.1	565	995	57 500	102 000	2 200	2 600	—	—
190	260	69	2	475	1 030	48 500	105 000	2 200	2 600	**NNU4938**	**NNU4938K**
	290	75	2.1	580	1 040	59 000	106 000	2 000	2 400	—	—
200	280	80	2.1	555	1 180	56 500	120 000	2 100	2 400	**NNU4940**	**NNU4940K**
	310	82	2.1	655	1 170	66 500	119 000	1 900	2 300	—	—
220	300	80	2.1	585	1						
240											
260											
280											

NN4924	**NN4924K**	134.5	154.5	126.5	130	133	137	158.5	158.5	156.5	1	2.75	2.63	2.63	2.51
NN3024	**NN3024K**	—	165	129	133	—	—	—	171	167	2	—	—	3.98	3.83
NN4926	**NN4926K**	146	168	138	142	144	148	172	172	170	1.5	3.69	3.52	3.52	3.35
NN3026	**NN3026K**	—	182	139	143	—	—	—	191	183	2	—	—	5.92	5.71
NN4928	**NN4928K**	156	178	148	152	154	158	182	182	180	1.5	3.94	3.76	3.76	3.58
NN3028	**NN3028K**	—	192	149	153	—	—	—	201	194	2	—	—	6.44	6.21
NN4930	**NN4930K**	168.5	196.5	159	164	166	171	201	201	198.5	2	6.18	5.9	5.9	5.62
NN3030	**NN3030K**	—	206	161	166	—	—	—	214	208	2	—	—	7.81	7.53
NN4932	**NN4932K**	178.5	206.5	169	174	176	182	211	211	208.5	2	6.53	6.23	6.24	5.94
NN3032	**NN3032K**	—	219	171	176	—	—	—	229	221	2	—	—	8.92	8.59
NN4934	**NN4934K**	188.5	216.5	179	184	186	192	221	221	218.5	2	6.87	6.55	6.56	6.24
NN3034	**NN3034K**	—	236	181	187	—	—	—	249	2					

d 300～500mm

d											
300	420	118	3	1 200	2 800	122 000	285 000	1 300	1 500	**NNU4960**	**NNU4960K**
	460	118	4	1 330	2 560	135 000	261 000	1 200	1 500	—	—
320	440	118	3	1 240	2 970	126 000	305 000	1 200	1 400	**NNU4964**	**NNU4964K**
	480	121	4M /Cs81 CS 1 SC 50.83 460.84m (0.00 460.84m 77 SC 50.83SC 50.84m 77 74-0.0004 T(359 0 0 9 200.233469.24								
340											
360											
380											
400											
420											
440											
460											
480											
500											

d 120～200mm

120	180 180	92 105	92 105	2.5 2.5	2.5 2.5	400 445	785 855	40 500 45 500	80 000 87 000
130	200	104	104	2.5	2.5	490	955	49 500	97 000
140	210	116	116	2.5	2.5	510	1 030	52 000	105 000
145									
150									
160									
170									
180									
190									
200									

B	D	D	M
	F_w		kg (approx.)
4R2437	137	1	8.2
4R2438	135	1	9.3
4R2628	150	1	12.1
4R2823	160	1	13.9
4R2906	166	1	18
4R2908	169	1	23.4
4R3031	168	1	19.4
4R3029	174	1	20
4R3040	174	1	24.5
4R3039	177	1	29.6
4R3224	177	1	20.2
4R3226	180	1	16.6
4R3232	179	1	23.4
4R3225	183	1	27.8
4R3426	187	1	14.2
4R3429	189	1	22.2
4R3423	190	1	22.8
4R3432	193	1	28.2
4R3425	193	1	19.3
4R3433	192	1	29.5
4R3431	196	1	44
4R3625	200	1	23.2
4R3628	202	1	29.4
4R3618	204	1	34.2
4R3820	212	1	26.9
4R3818	213	1	31.7
4R3821	212	1	37.5
4R3823	214	1[2)]	41.5
4R4039	222	1	28.5
4R4026	223	1	36.7
4R4037	222	1	40.5

Note: **D** **1** represents a bearing with solid rollers and machined cage.

B	D	D	M
	F_w		kg (approx.)
4R4041	226	1	42.5
4R4028	231	1	67
4R4206	236	1	39.5
4R4413	239	1	33.8
4R4419	245	1	32.8
4R4426	246	1	46.9
4R4425	247	1	49.8
4R4420	242	1	51.5
4R4416	245	1	54.9
4R4430	245	1	63.5
4R4428	245	1	46.5
4R4429	248	1	60.5
4R4614	258	1	58.6
4R4611	261	1	82.6
4R4811	270	1[2)]	56.8
4R4806	268	1	63.6
4R4807	274	1	79.6
4R5008	278	1	66
4R5217	292	1	76.5
4R5213	294	1	109
4R5405	299.7	2[3)]	105
4R5611	312	1	81.3
4R5612	312	1	105
4R5605	323	1	139
4R5806	320	1	103
4R5805	327	1	141
E-4R6014	328	1	104
E-4R6017	334	1	106
E-4R6015	334	1	125
E-4R6020	332	2	130

Note: D **1** represents a bearing with solid rollers and machined cage; D **2** represents a bearing with hollow rollers and pin type cage.

d 300～460mm

d	D	B_1	C_1	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	dynamic C_r	static C_{or}	dynamic C_r	static C_{or}
		mm				kN		kgf	
300	420	320	300	3	3	2 900	7 850	295 000	800 000
	460	270	270	3	3	2 510	5 350	256 000	545 000
310	430	240	240	3	3	2 240	5 950	228 000	605 000
320	440	240	230	3	3	2 290	6 050	234 000	615 000
	450	240	240	3	3	2 370	6 150	242 000	630 000
	460	340	340	3	3	3 400	9 450	345 000	960 000
	470	350	350	3	3	4 150	10 900	425 000	1 110 000
330	440	200	200	3	3	1 820	4 850	186 000	495 000
	460	340	340	4	4	3 250	8 850	330 000	905 000
340	480	370	350	5	5	3 450	9 650	350 000	985 000
	490	300	300	4	4	3 350	8 300	340 000	845 000
360	510	400	400	5	5	4 250	11 500	435 000	1 170 000
370	480	230	230	5	5	2 100	6 250	214 000	635 000
	520	400	400	5	5	4 650	13 500	475 000	1 370 000
380	520	280	280	4	4	3 400	9 150	350 000	935 000
	520	300	300	4	4	3 550	9 600	360 000	980 000
	540	400	400	4	4	5 200	15 200	530 000	1 550 000
400	560	400	400	5	5	4 250	11 800	430 000	1 210 000
	560	410	410	4	4	5 750	17 000	585 000	1 730 000
410	546	400	400	5	5	4 200	12 700	430 000	1 290 000
420	560	280	280	4	4	3 150	8 750	320 000	895 000
	580	230	230	4	4	2 430	6 250	248 000	635 000
	620	400	400	5	5	5 000	13 400	510 000	1 360 000
440	620	450	450	5	5	6 450	18 700	660 000	1 910 000
460	620	400	400	4	4	5 350	16 700	545 000	1 700 000
	620	400	400	4	4	4 950	15 000	505 000	1 530 000
	650	470	470	5	5	7 150	20 600	730 000	2 100 000

1) Minimal allowable dimension for chamfer dimension r or r_1. 2) Oil inlet and oil groove are in center of the outer ring; no oil groove on the side.
3) Oil inlet in space of outer ring; no oil groove. 4) One-piece inner ring.

B	D	D	M
	F_w		kg (approx.)
E-4R6018	332	2	136
E-4R6019	344	1	162
E-4R6202	344.5	1	108
E-4R6414	351	1	106
E-4R6411	358	1	125
E-4R6412	360	1	178
E-4R6406	361.7	2	212
E-4R6603	360	1[2)]	83.6
E-4R6605	365	1	181
E-4R6811	378	1	198
E-4R6804	377	1	187
E-4R7203	397	1[2)]	262
E-4R7405	400	1	106
E-4R7404	409	1	273
E-4R7605	417	1	174
E-4R7607	416	2[3)]	210
E-4R7604	422	2[3)]	325
E-4R8007	446	1	303
E-4R8010	445	2	349
E-4R8201	444	1[2)]	256
E-4R8403	457	1	189
E-4R8404	466	1	181
E-4R8401	478	1	410
E-4R8801	487	2	437
E-4R9211	502	2[3)4)]	383
E-4R9209	502	1	341
E-4R9216	509	2	540

Note: D **1** represents a bearing with solid rollers and machined cage; D **2** represents a bearing with hollow rollers and pin type cage.

d 480～690mm

480	650	420	420	5	5	5 950	18 100	605 000	1 840 000
	650	450	450	9.5X20°	5	7 100	21 600	720 000	2 200 000
	680	500	500	6	6	7 950	24 000	810 000	2 450 000
500	680	420	405	5	5	7 100	22 900	725 000	2 340 000
	690	470	470	5	5	7 650	22 500	780 000	2 290 000
	690	510	510	5	5	7 750	24 600	790 000	2 500 000
	700	515	515	5	5	7 900	24 100	805 000	2 450 000
	710	480	480	6	6	8 650	24 700	880 000	2 520 000
	720	530	530	5	5	8520			
510									
520									
530									
550									
560									
570									
600									
610									
650									
660									
690									

B	D	D	M
	F_w		kg (approx.)
E-4R9607	523	2[4]	369
E-4R9609	525	2[4]	395
E-4R9604	532	2	640
E-4R10010	550	2[3]	495
E-4R10016	547	2	590
E-4R10006	552	2	640
E-4R10011	554	2	680
E-4R10008	556	2	675
E-4R10015	568	2	780
E-4R10201	554	2[4]	335
E-4R10202	558	2	689
E-4R10403	564	2	658
E-4R10402	574.5	2	740
E-4R10603	574	2	626
E-4R10601	590	2	800
E-4R10602	601	2	1 010
E-4R11001	622	2	965
E-4R11202	590	1	265
E-4R11402	628	2	1 040
E-4R12003	655	2	980
E-4R12002	672	2	1 150
E-4R12001	672	2	1 330
E-4R12202	680	2[2]	1 400
E-4R13005	723	2	1 500
E-4R13003	723	2	1 550
E-4R13201	702	2	580
E-4R13802	767.5	2	1 850

4) One-piece inner ring. Note:

d 700～1 200mm

700	930	620	620	15X20°	6	12 900	43 000	1 320 000	4 400 000	
710	1 000	715	715	9.5	6	16 800	54 500	1 710 000	5 550 000	
725	1 000	700	700	6	6	15 900	53 500	1 620 000	5 450 000	
750	1 050	745	720	7.5	7.5	17 600	58 000	1 790 000	5 900 000	
	1 090	745	720	7.5	7.5	19 100	60 500	1 950 000	6 150 000	
760	1 030	750	750	7.5	7.5	17 300	59 500	1 760 000	6 050 000	
	1 080	805	790	6	6	18 700	61 000	1 900 000	6 250 000	
	1 100	745	720	7.5	7.5	19 100	60 500	1 950 000	6 150 000	
800	1 080	700	700	7.5	7.5	16 500	55 000	1 680 000	5 600 000	
	1 080	750	750	6	6	17 300	59 000	1 760 000	6 000 000	
820	1 130	800	800	7.5	7.5	19 600	66 500	2 000 000	6 800 000	
	1 130	825								
840										
850										
860										
900										
920										
1000										
1030										
1200										

E-4R14003	763	2	1 200
E-4R14205	787.5	2[2)]	1 900
E-4R14501	796	2	1 730
E-4R15001	830	2[3)]	2 180
E-4R15002	845	2[3)]	2 530
E-4R15204			





1. Types, design features, and characteristics

T
D
T
A

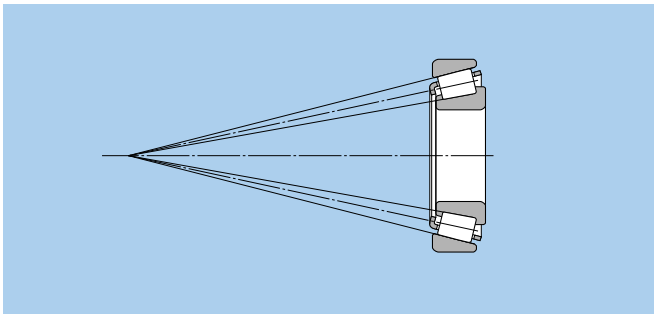
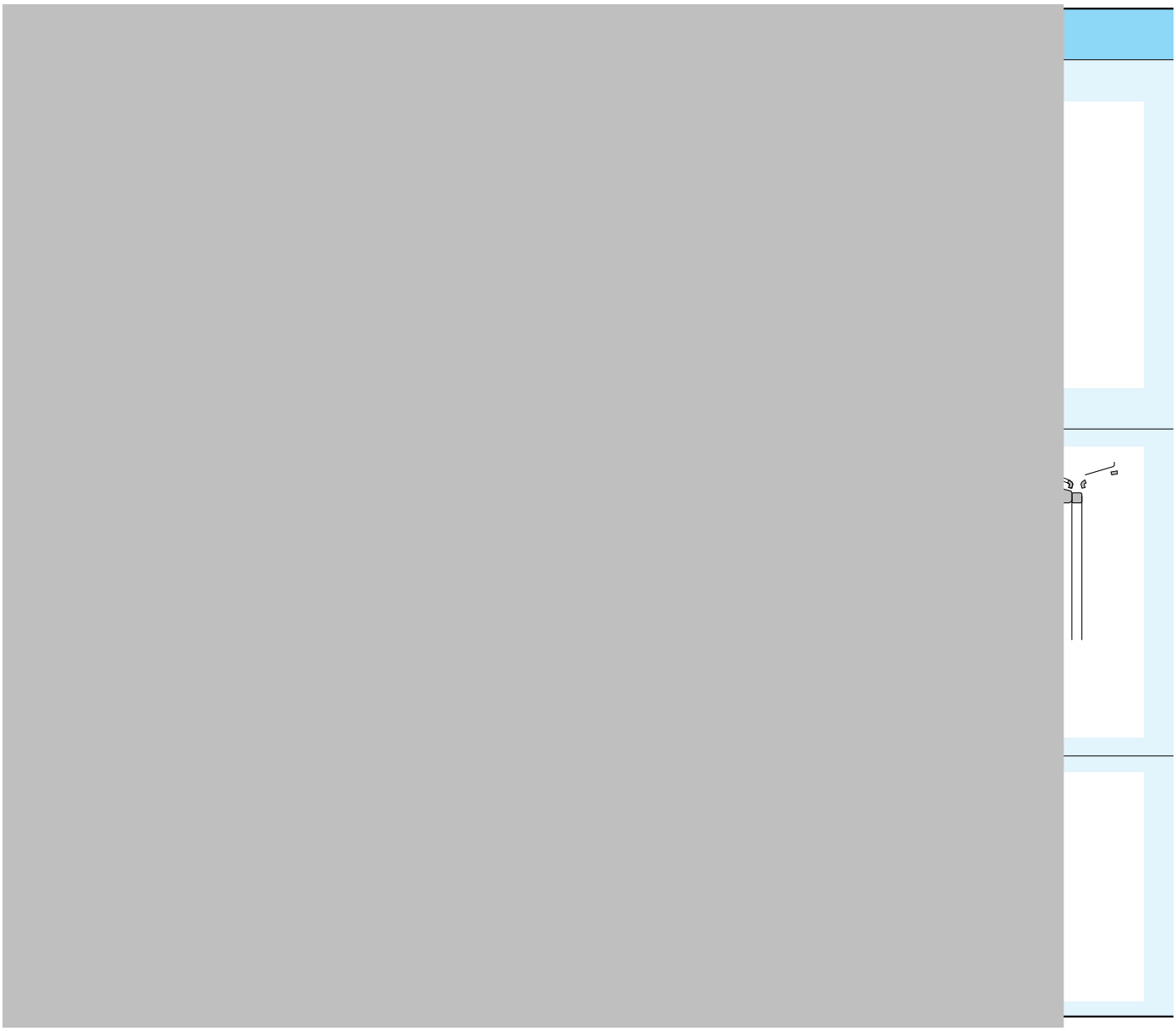


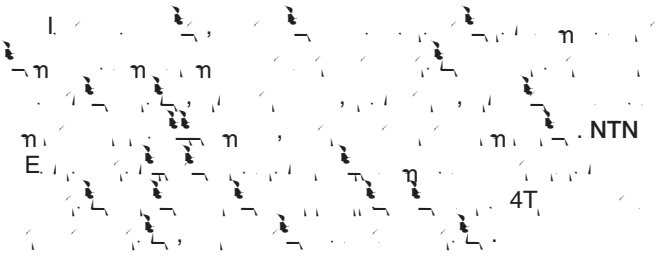
Diagram 1.

Table 1 Tapered roller bearing types and characteristics

Type	Characteristics
Single row tapered roller bearings	(1) T Dimension series M: ● JIS B 1512 ● ISO 355 / I: ● ABMA (J-) B: E , 30210 ∗T2EE040 / I ("J" J-) ∗D 3XX JIS B 1512; 3XX (2) I. C D, (3) S T ISO ABMA H A (J). (R Diagram 2) S 2α E E : O ( ) α : N Diagram 2. C



5. ECO-Top tapered roller bearings



NTN

NTN

ECO-Top tapered roller bearing

T

NTN):

(1) T

(2) T

Inch series Tapered Roller Bearings (single row) index

335	336／332	B-159
335	339／332	B-155
335	344／332	B-157
355	350A／354A	B-157
355	355／354A	B-159
355	358／354A	B-161
355	359A／354A	B-161
355	359S／352	

Inch series Tapered Roller Bearings (single row) index

3100	3188／3120	B-153
3100	3193／3120	B-153
3100	3196／3120	B-153
3300	3379／3320	B-159
3300	3382／3339	B-157
3300	3386／3320	B-157
3400	3476／3420	B-153
3400	3478／3420	B-155
3400	3479／3420	B-155
3400	3490／3420	B-157
3500	3576／3525	B-159
3500	3578／3520	B-159
3500	3578／3525	B-159
3500	3580／3525	B-157
3500	3586／3525	B-161
JS3500	JS3549A／JS3510	B-154

Inch series Tapered Roller Bearings (single row) index B-124

Inch series Tapered Roller Bearings (single row) index

M207000	JM207049／JM207010	B-167
H211700	[illegible]	B-171
HM212000	HM212044／HM212011	B-169
HM212000	HM212046／HM212011	B-169
HM212000	HM212049／HM21210	B-171
L217800	L217849／L217810	B-177
LL217800	LL217849／LL217810	B-177
HM218200	HM218248／HM218210	B-177
HH221400	HH221430／HH221410	B-175
HH221400	HH221431／HH221410	B-175
HH221400	HH221440／HH221410	B-179
HH221400	HH221449／HH221410	B-179
HH221400	HH221449A／HH221410	B-179
HH224300	HH224334／HH224310	B-179
HH224300	HH224335／HH224310	B-179
HH224300	HH224346／HH224310	B-181
HH228300	HH228349／HH228310	B-181
M231600	M2316592.09388.1 7 BT 7.2 0 0 8 110.22 496.09 T_{η} /F388.1 1 T 0297 T ET -0.000100T3 BT 7.2 0 0 8 110.42 496.09 5.80878.0 1 T (HH228310) T ET BTT 7.	

Inch series Tapered Roller Bearings (four row) index

Series number	Cone / cup number	Page of bearing dimension table
8500	T-8576D/8520/8520D	B-205
46700	46791D/46720/46721D	B-203
48200	T-48290D/48220/48220D	B-203
48300	T-48393D/48320/48320D	B-203
48600	T-48680D/48620/48620D	B-203
67700	67791D/67720/67721D	B-203
67800	T-67885D/67820/67820D	B-205
81000	81576D/81962/81963D	B-203
82600	82681D/82620/82620D	B-203
126000	EE126096D/126150/126151D	B-205
127000	EE127097D/127137/127137D	B-205
132000	EE132082D/132125/132126D	B-205
134000	EE134102D/134143/134144D	B-207
L163100	L163149D/L163110/L163110D	B-209
170000	EE171000D/171450/17145D	B-205
220000	EE221027D/221575/221576D	B-207
M224700	M224749D/M224710/M224710D	B-203
M231600	T-M231649D/M231610/M231610D	B-203
M238800	M238849D/M238810/M238810D	B-203
M241500	M241538D/M241510/M241510D	B-205
M244200	T-M244249D/M244210/M244210D	B-205
LM247700	LM247748D/LM247710/LM247710DA	B-205
M249700	T-M249748D/M249710/M249710D	B-205
HM252300	HM252349D/HM252310/HM252310D	B-207
M252300	T-M252349D/M252310/M252310D	B-207
M255400	M255449D/M255410/M255410DA	B-207
HM256800	T-HM256849D/HM256810/HM256810DG2	B-207
M257100	M257149D/M257110/M257110D	B-207
M257200	M257248D/M257210/M257210D	B-209
LM258600	LM258649D/LM258610/LM258610D	B-209
HM259000	T-HM259049D/HM259010/HM259010D	B-209
HM261000	HM261049D/HM261010/HM261010DA	B-209
M262400	M262449D/M262410/M262410D	B-209
HM262700	T-HM262749D/HM262710/HM262710DG2	B-209
LM263100	LM263149D/LM263110/LM263110D	B-209

Series number	Cone / cup number	Page of bearing dimension table
M263300	M263349D/M263310/M263310D	B-209
HM265000	HM265049D/HM265010/HM265010D	B-211
HM266400	T-HM266449D/HM266410/HM266410DG2	B-211
M268700	T-M268749D/M268710/M268710DG2	B-211
M270700	M270749D/M270710/M270710DAG2	B-211
LM272200	LM272249D/LM272210/LM272210DG2	B-213
M274100	M274149D/M274110/M274110DG2	B-213
LM274400	LM274449D/LM274410/LM274410D	B-213
275000	EE275106D/275155/275156D	B-207
275000	EE275109D/275160/275161D	B-207
M275300	M275349D/M275310/M275310DG2	B-213
M276400	M276449D/M276410/M276410DG2	B-213
M278700	M278749D/M278710/M278710DAG2	B-213
LM278800	LM278849D/LM278710/LM278710D	B-215
280000	EE280700D/281200/281201D	B-203
M280000	M280049D/M280010/M280010DG2	B-215
L281100	L281149D/L281110/L281110DG2	B-215
M281600	M281649D/M281610/M281610DG2	B-215
LM281800	LM281849D/LM281810/LM281810DG2	B-215
M282200	M282249D/M282210/M282210DG2	B-215
M283400	M283449D/M283410/M283410DG2	B-215
LM283600	LM283649D/LM283610/LM283610DG2	B-215
M284200	M284249D/M284210/M284210DG2	B-215
M285800	M285848D/M285810/M288510DG2	B-215
LM286200	LM286249D/LM286210/LM286210DG2	B-217
LM287600	LM287649D/LM2876100/LM287610DG2	B-217
LM288900	LM288949D/LM288910/LM288910DG2	B-217
290000	EE291202D/291750/291751D	B-207
329000	EE329119D/329172/329173D	B-207
LM377400	LM377449D/LM377410/LM377410DG2	B-213
LM451300	T-LM451349D/LM451310/LM451310D	B-207
526000	EE526131D/526190/52619D	B-209
547000	EE547341D/547480/547481DG2	B-217
640000	T-EE640193D/640260/640261DG2	B-203
649000	EE649241D/649310/649311DG2	B-215

Inch series Tapered Roller Bearings (four row) index

2FB	20.5	22	36.5	35	38	2	3	1	1	9.5	0.29	2.11	1.16	0.098
2DB	22.5	23	34.5	33	37	2	2	1	1	9.5	0.35	1.74	0.96	0.08
2DD	22.5	23	34.5	33	37	2	3	1	1	11.5	0.31	1.92	1.06	0.102
	22.5	22	34.5	33	36.5	2	3	1	1	11	0.35	1.74	0.96	0.104
2FB	22.5	24	41.5	40	42	3	3.5	1	1	10.5	0.29	2.11	1.16	0.134
3CC	24.5	25	37.5	36	39	3	3	0.6	0.6	10.5	0.37	1.60	0.88	0.097
2DB	25.5	27	41.5	40	44	2	3	1	1	11.5	0.35	1.74	0.96	0.127
2DD	25.5	26	41.5	39	43	2	4	1	1	12.5	0.33	1.81	1.00	0.16
2FB	28.5	28	43.5	42.5	47.5	3	3	1.5	1.5	10.5	0.30	2.00	1.10	0.176
	28.5	27.5	43.5	39.5	48	3	4	1.5	1.5	13.5	0.55	1.10	0.60	0.17

d 30～45mm

30

32

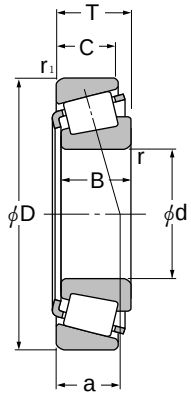
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	38.5	39.5	63.5	57	67	3	5.5	1.5	1.5	17.5	0.47	1.27	0.70	0.398
7FB	38.5	39	63.5	55	68	3	6.5	1.5	1.5	23.5	0.83	0.73	0.40	0.398
2FD	38.5	38	63.5	59	66	3	5.5	1.5	1.5	18.5	0.31	1.90	1.05	0.583
5FD	38.5	37	63.5	57	68	2	5.5	1.5	1.5	23	0.55	1.10	0.60	0.592
	38.5	37	63.5	57	67.5	2	5.5	1.5	1.5	23	0.61	0.99	0.54	0.594
4CC	37.5	38	52.5	50	55	3	4	1	1	14.5	0.45	1.32	0.73	0.181
2DE	37.5	38	59.5	55	62	5	5.5	1	1	17	0.35	1.73	0.95	0.395
5FD	40.5	39	66.5	61	71	3	6.5	1.5	1.5	23	0.55	1.10	0.60	0.659
2BD	39.5	40	50.5	48	52.5	2.5	2.5	0.6	0.6	10.5	0.29	2.06	1.13	0.121
4CC	40.5	40	56.5	54	59	4	4	1	1	15.5	0.45	1.32	0.73	0.224
2CE	40.5	40.5	56.5	52	59	3	4	1	1	14	0.31	1.97	1.08	0.263
3DB	43.5	44	63.5	62	67	3	3	1.5	1.5	15	0.37	1.60	0.88	0.344
3DC	43.5	43	63.5	61	67	3	5	1.5	1.5	17.5	0.37	1.60	0.88	0.457
5DC	43.5	42	63.5	59	68	3	6	1.5	1.5	21.5	0.58	1.03	0.57	0.461
	43.5	42	63.5	59	68	3	6	1.5	1.5	20.5	0.55	1.10	0.60	0.461
2DE	43.5	42	63.5	61	68	5	6	1.5	1.5	18.5	0.35	1.70	0.93	0.531
2FB														

M t c



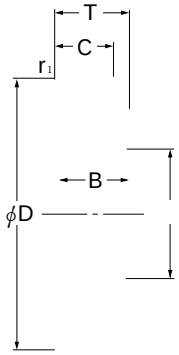
d 45～60mm

d	D	T	B	C	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	Ba c dynamic kN C_r	Ba c static kN C_{or}	ad a dynamic kgf C_r	ad a static kgf C_{or}	L i r d grease min^{-1}	L i r d oil min^{-1}	B a b
45	75	20	20	15.5	1	1	57.5	76.5	5 850	7 800	4 800	6 400	4T-32009X
	75	24	24	19	1	1	66.0	93.5	6 750	9 550	4 800	6 400	4T-33009
	80	26	26	20.5	1.5	1.5	84.5	115	8 650	11 700	4 700	6 200	4T-33109
	85	20.75	19	16	1.5	1.5	67.5	78.5	6 900	8 000	4 400	5 900	4T-30209
	85	24.75	23	19	1.5	1.5	82.0	100	8 350	10 200	4 400	5 900	4T-32209
	85	32	32	25	1.5	1.5	107	141	10 900	14 400	4 400	5 900	4T-33209
	100	27.25	25	22	2	1.5	111	126	11 300	12 800	4 000	5 300	4T-30309
	100	27.25	25	18	2	1.5	96.0	109	9 800	11 100	3 500	4 600	4T-30309D
	100	38.25	36	30	2	1.5	154	191	15 700	19 500	4 000	5 300	32309U
50	72	15	15	12	0.6	0.6	35.5	57.0	3 650	5 800	4 700	6 300	* 32910XU
	72	15	14	12	0.6	0.6	31.5	50.5	3 200	5 150	4 700	6 300	32910 [2]
	80	20	20	15.5	1	1	62.5	88.0	6 400	9 000	4 400	5 800	4T-32010X
	80	24	24	19	1	1	69.5	103	7 100	10 500	4 400	5 800	4T-33010
	85	26	26	20	1.5	1.5	86.5	121	8 850	12 400	4 200	5 600	4T-33110
	90	21.75	20	17	1.5	1.5	77.0	93.0	7 850	9 450	4 000	5 300	4T-30210
	90	24.75	23	19	1.5	1.5	87.5	109	8 900	11 100	4 000	5 300	4T-32210
	90	32	32	24.5	1.5	1.5	115	158	11 700	16 100	4 000	5 300	4T-33210
	100	36	35	30	2.5	2.5	151	190	15 400	19 400	3 800	5 100	4T-T2ED050
	105	32	29	22	3	3	107	132	10 900	13 500	3 400	4 500	4T-T7FC050
	110	29.25	27	23	2.5	2	133	152	13 500	15 500	3 600	4 800	4T-30310
	110	29.25	27	19	2.5	2	113	130	11 600	13 300	3 200	4 200	4T-30310D
	110	42.25	40	33	2.5	2	184	232	18 700	23 600	3 600	4 800	32310U
55	80	17	17	14	1	1	44.5	73.5	4 550	7 500	4 300	5 700	32911XU
	90	23	23	17.5	1.5	1.5	80.5	118	8 200	12 000	4 000	5 400	4T-32011X
	90	27	27	21	1.5	1.5	91.5	138	9 350	14 100	4 000	5 400	4T-33011
	95	30	30	23	1.5	1.5	111	155	11 300	15 800	3 900	5 200	4T-33111
	100	22.75	21	18	2	1.5	93.0	111	9 500	11 300	3 600	4 900	4T-30211
	100	26.75	25	21	2	1.5	108	134	11 000	13 700	3 600	4 900	4T-32211
	100	35	35	27	2	1.5	138	188	14 100	19 100	3 600	4 900	4T-33211
	120	31.5	29	25	2.5	2	155	179	15 800	18 300	3 300	4 400	4T-30311
	120	31.5	29	21	2.5	2	132	154	13 500	15 700	2 900	3 800	4T-30311D
	120	45.5	43	35	2.5	2	215	275	21 900	28 000	3 300	4 400	32311U
60	85	17	17	14	1	1	51.0	83.0	5 200	8 450	4 000	5 300	32912XA [2]
	95	23	23	17.5	1.5	1.5	82.0	123	8 350	12 500	3 700	4 900	4T-32012X
	95	27	27	21	1.5	1.5	93.5	145	9 550	14 700	3 700	4 900	4T-33012
	100	30	30	23	1.5	1.5	113	164	11 600	16 700	3 600	4 700	4T-33112

1) Minimal allowable dimension for chamfer dimension r or r_1.
2) This bearing does not incorporate the subunit dimensions.

3CC	50.5	51	69.5	67	72	4	4.5	1	1	16.5	0.39	1.53	0.84	0.346
2CE	50.5	51	69.5	67	71	4	5	1	1	16	0.29	2.04	1.12	0.398
3CE	53.5	52	71.5	69	77	4	5.5	1.5	1.5	19.5	0.38	1.57	0.86	0.542
3DB	53.5	54	76.5	74	80	3	4.5	1.5	1.5	18	0.40	1.48	0.81	0.495
3DC	53.5	53	76.5	73	81	3	5.5	1.5	1.5	20	0.40	1.48	0.81	0.607
3DE	53.5	52	76.5	72	81	5	7	1.5	1.5	22	0.39	1.56	0.86	0.783
2FB	55	59	91.5	86	93	3	5	2	1.5	21	0.35	1.74	0.96	1.01
7FB	55	56	91.5	79	96	3	9	2	1.5	32.5	0.83	0.73	0.40	0.958
2FD	55	56	91.5	82	93	3	8	2	1.5	25.5	0.35	1.74	0.96	1.46
2BC	54.5	55	67.5	63.5	69	3	3	0.6	0.6	13.5	0.34	1.76	0.97	0.191
	54.5	55	67.5	63.5	69.5	3	3	0.6	0.6	14.5	0.36	1.67	0.92	0.192
3CC	55.5	56	74.5	72	77	4	4.5	1	1	17.5	0.42	1.42	0.78	0.366
2CE	55.5	56	74.5	72	76	4	5	1	1	17.5	0.32	1.90	1.04	0.433
3CE	58.5	56	76.5	74	82	4	6	1.5	1.5	20.5	0.41	1.46	0.80	0.58
3DB	58.5	58	81.5	79	85	3	4.5	1.5	1.5	19.5	0.42	1.43	0.79	0.563
3DC	58.5	58	81.5	78	85	3	5.5	1.5	1.5	21	0.42	1.43	0.79	0.648
3DE	58.5	57	81.5	77	87	5	7.5	1.5	1.5	23.5	0.41	1.45	0.80	0.852
2ED	62	59	88	84	94	6	6	2	2	25.5	0.34	1.75	0.96	1.31
7FC	64	60	91	78	100	4	10	2.5	2.5	36.5	0.87	0.69	0.38	1.23
2FB	62	65	100	95	102	3	6	2	2	23	0.35	1.74	0.96	1.31
7FB	62	62	100	87	105	3	10	2	2	35	0.83	0.73	0.40	1.25
2FD	62	62	100	90	102	3	9	2	2	28.5	0.35	1.74	0.96	1.92
2BC	60.5	60.5	74.5	70.5	76.5	3	3	1	1	14.5	0.31	1.94	1.07	0.274
3CC	63.5	63	81.5	81	86	4	5.5	1.5	1.5	20	0.41	1.48	0.81	0.563
2CE	63.5	63	81.5	81	86	5	6	1.5						

M



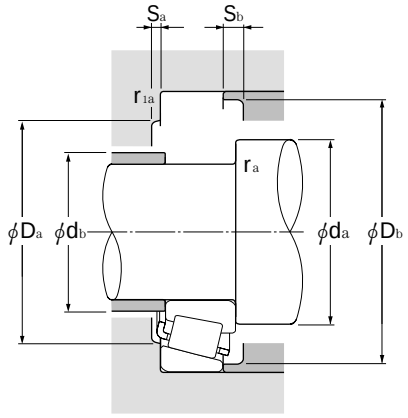
d 60～75mm

							Basic load rating				Limiting speed		Bearing number
							dynamic	static	dynamic	static			
			mm				kN		kgf		min^{-1}		
d	D	T	B	C	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{or}	C_r	C_{or}	grease	oil	
60	110	23.75	22	19	2	1.5	105	125	10 700	12 700	3 400	4 500	4T-30212
	110	29.75	28	24	2	1.5	130	164	13 200	16 800	3 400	4 500	32212U
	110	38	38	29	2	1.5	161	223	16 400	22 700	3 400	4 500	33212U
	115	40	39	33	2.5	2.5	188	249	19 200	25 400	3 200	4 300	4T-T2EE060
	125	37	33.5	26	3	3	145	186	14 800	18 900	2 800	3 700	4T-T7FC060
	130	33.5	31	26	3	2.5	180	210	18 300	21 400	3 000	4 000	30312U
	130	33.5	31	22	3	2.5	150	176	15 300	17 900	2 700	3 600	4T-30312D
	130	48.5	46	37	3	2.5	244	315	24 900	32 000	3 000	4 000	32312U
65	90	17	17	14	1	1	48.5	85.0	4 900	8 700	3 700	4 900	32913XU
	100	23	23	17.5	1.5	1.5	83.0	128	8 450	13 000	3 400	4 600	4T-32013X
	100	27	27	21	1.5	1.5	97.5	156	9 950	16 000	3 400	4 600	4T-33013
	110	34	34	26.5	1.5	1.5	144	211	14 700	21 500	3 300	4 400	4T-33113
	120	24.75	23	20	2	1.5	123	148	12 500	15 000	3 100	4 200	4T-30213
	120	32.75	31	27	2	1.5	159	206	16 200	21 000	3 100	4 200	32213U
	120	41	41	32	2	1.5	195	265	19 900	27 100	3 100	4 200	33213U
	140	36	33	28	3	2.5	203	238	20 700	24 300	2 800	3 700	30313U
	140	36	33	23	3	2.5	173	204	17 700	20 900	2 500	3 300	4T-30313D
	140	51	48	39	3	2.5	273	350	27 800	36 000	2 800	3 700	32313U
70	100	20	20	16	1	1	68.5	110	7 000	11 200	3 400	4 600	32914XU
	110	25	25	19	1.5	1.5	105	160	10 700	16 400	3 200	4 200	4T-32014X
	110	31	31	25.5	1.5	1.5	127	204	12 900	20 800	3 200	4 200	4T-33014
	125	26.25	24	21	2	1.5	131	162	13 400	16 500	2 900	3 900	4T-30214
	125	33.25	31	27	2	1.5	166	220	16 900	22 400	2 900	3 900	32214U
	125	41	41	32	2	1.5	201	282	20 500	28 700	2 900	3 900	33214U
	140	39	35.5	27	3	3	173	231	17 600	23 500	2 400	3 200	4T-T7FC070
	150	38	35	30	3	2.5	230	272	23 400	27 800	2 600	3 500	30314U
	150	38	35	25	3	2.5	193	229	19 600	23 300	2 300	3 000	4T-30314D
	150	54	51	42	3	2.5	310	405	31 500	41 000	2 600	3 500	32314U
75	105	20	20	16	1	1	69.5	114	7 100	11 600	3 200	4 300	32915XU
	115	25	25	19	1.5	1.5	106	167	10 800	17 000	3 000	4 000	32015XU
	115	31	31	25.5	1.5	1.5	111	186	11 300	19 000	3 000	4 000	33015U
	130	27.25	25	22	2	1.5	139	175	14 200	17 900	2 700	3 600	4T-30215
	130	33.25	31	27	2	1.5	168	224	17 100	22 800	2 700	3 600	32215U
	130	41	41	31	2	1.5	208	298	21 200	30 500	2 700	3 600	33215U
	160	40	37	31	3	2.5	255	305	26 000	31 000	2 400	3 200	30315U
	160	40	37	26	3	2.5	215	256	21 900	26 100	2 100	2 800	30315DU

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

d 75～95mm

75	160	58	55	45	3	2.5	355	470	36 000	47 500	2 400	3 200	**32315U**
	110	20	20	16	1	1	72.0	121	7 350	12 400	3 000	4 000	**32916XU**
	125	29	29	22	1.5	1.5	139	216	14 200	22 000	2 800	3 700	**32016XU**
	125	36	36	29.5	1.5	1.5	173	284	17 600	29 000	2 800	3 700	**33016U**
	140	28.25	26	22	2.5	2	160	200	16 300	20 400	2 500	3 400	**30216U**
80	140	35.25	33										
85													
90													
95													



2GD	89	91	148	133	149	4	13	2.5	2	39	0.35	1.74	0.96	5.35
2BC	85.5	85	104.5	99	106.5	4	4	1	1	20	0.35	1.71	0.94	0.54
3CC	88.5	89	116.5	112	120	6	7	1.5	1.5	27	0.42	1.42	0.78	1.28
2CE	88.5	89	116.5	112	119	6	6.5	1.5	1.5	25	0.28	2.16	1.19	1.6
3EB	92	91	130	124	132	4	6	2	2	27.5	0.42	1.43	0.79	1.72
3EC	92	90	130	122	134	4	7	2	2	31	0.42	1.43	0.79	2.18
3EE	92	89	130	119	135	7	11	2	2	35	0.43	1.41	0.78	2.92
2GB	94	102	158	148	159	4	9.5	2.5	2	34	0.35	1.74	0.96	4.41
7GB	94	97	158	134	159	6	15.5	2.5	2	53.5	0.83	0.73	0.40	4.11
2GD	94	98	158	142	159	4	13.5	2.5	2	41.5	0.35	1.74	0.96	6.41
2BC	93.5	92	111.5	111	115	4	5	1.5	1.5	21	0.33	1.83	1.01	0.773
4CC	93.5	94	121.5	117	125	6	7	1.5	1.5	28.5	0.44	1.36	0.75	1.35
2CE	93.5	94	121.5	118	125	6	6.5	1.5	1.5	26	0.29	2.06	1.13	1.7
3EB	97	97	140	132	141	5	6.5	2	2	30	0.42	1.43	0.79	2.14
3EC	97	96	140	130	142	5	8.5	2	2	33.5	0.42	1.43	0.79	2.75
3EE	97	95	140	128	144	7	12	2	2	37.5	0.42	1.43	0.79	3.58
2GB	103	107	166	156	167	5	10.5	3	2.5	35.5	0.35	1.74	0.96	5.2
7GB	103	103	166	143	169	6	16.5	3	2.5	56	0.83	0.73	0.40	4.85
2GD	103	102	166	150	167	5	14.5	3	2.5	43	0.35	1.74	0.96	7.15
2BC	98.5	96	116.5	112.5	120.5	4	5	1.5	1.5	22	0.34	1.75	0.96	0.817
3CC	100	100	131.5	125	134	6	8	2	1.5	30	0.42	1.42	0.78	1.79
2CE	100	100	131.5	127	135	7	6.5	2	1.5	28	0.27	2.23	1.23	2.18
3FB	102	103	150	140	150	5	6.5	2	2	32	0.42	1.43	0.79	2.66
3FC	102	102	150	138	152	5	8.5	2	2	36	0.42	1.43	0.79	3.49
2GB	108	113	176	165	177	5	10.5	3	2.5	37.5	0.35	1.74	0.96	6.03
7GB	108	109	176	151	179	6	16.5	3	2.5	59	0.83	0.73	0.40	5.66
2GD	108	108	176	157	177	5	14.5	3	2.5	45.5	0.35	1.74	0.96	8.57
2BC	103.5	101	121.5	117	125.5	4	5	1.5	1.5	23.5	0.36	1.68	0.92	0.851
4CC	105	105	136.5	130	140	6	8	2	1.5	31.5	0.44	1.36	0.75	1.83
2CE	105	104	136.5	131	139	7	6.5	2	1.5	28.5	0.28	2.16	1.19	2.27
3FB	109	110	158	149	159	5	7.5	2.5	2	34	0.42	1.43	0.79	3.07
3FC	109	108	158	145	161	5	8.5	2.5	2	39	0.42	1.43	0.79	4.3
2GB	113	118	186	172	186	5	11.5	3	2.5	40	0.35	1.74	0.96	6.98
	113	118	186	172	186	5	11.5	3	2.5	40	0.35	1.73	0.95	6.58
7GB	113	114	186	154	187	6	17.5	3	2.5	62.5	0.83	0.73	0.40	6.47

d 95～120mm

95	200	71.5	67	55	4	3	505	670	51 500	68 500	1 900	2 500	**32319U**
100	140	25	25	20	1.5	1.5	121	206	12 300	21 000	2 400	3 200	＊ **32920XU**
	140	25	24	20	1.5	1.5	97.5	162	9 950	16 500	2 400	3 200	**32920**[2)]
	145	24	22.5	17.5	3	3	107	153	10 900	15 600	1 800	2 400	**4T-T4CB100**
	150	32	32	24	2	1.5	170	281	17 300	28 600	2 200	3 000	**32020XU**
	150	39	39	32.5	2	1.5	224	390	22 800	39 500	2 200	3 000	**33020U**
	180	37	34	29	3	2.5	258	335	26 300	34 500	2 000	2 700	**30220U**
	180	49	46	39	3	2.5	330	**465**	33 500	47 500	2 000	2 700	**32220U**
	215	51.5	47	39	4	3	410	500	41 500	51 000	1 800	2 400	**30320U**
	215	51.5	47	39	3	3	345	400	35 000	40 500	1 800	2 400	**30320**[2)]
	215	56.5	51	35	4	3	355	**435**	36 000	44 000	1 800	2 400	**31320XU**
	215	77.5	73	60	4	3	570	770	58 500	78 500	1 800	2 400	**32320U**
105	145	25	25	20	1.5	1.5	126	219	12 800	22 400	2 300	3 000	**32921XA**[2)]
	160	35	35	26	2.5	2	201	335	20 500	34 000	2 100	2 800	**32021XU**
	160	43	43	34	2.5	2	245	420	25 000	43 000	2 100	2 800	**33021U**
	190	39	36	30	3	2.5	287	380	29 300	38 500	1 900	2 500	**30221U**
	190	53	50	43	3	2.5	380	540	38 500	55 500	1 900	2 500	**32221U**
	225	53.5	49	41	4	3	435	530	44 500	54 500	1 700	2 300	＊ **30321U**
	225	53.5	49	41	3	3	365	420	37 000	43 000	1 700	2 300	**30321**[2)]
	225	58	53	36	4	3	380	**470950**	39 000	47 500	1 700	2 300	＊ **31321XU**
	225	81.5	77	63	4	3	610	825	62 500	84 500	1 700	2 300	**32321U**
110	150	25	25	20	1.5	1.5	127	226	13 000	23 100	2 200	2 900	**32922XA**[2)]
	170	38	38	29	2.5	2	236	390	24 000	39 500	2 000	2 700	**32022XU**
	170	47	47	37	2.5	2	288	500	29 400	51 000	2 000	2 700	**33022U**
	200	41	38	32	3	2.5	325	435	33 000	44 000	1 800	2 400	**30222U**
	200	56	53	46	3	2.5	420	605	43 000	62 000	1 800	2 400	**32222U**
	240	54.5	50	42	4	3	480	590	49 000	60 000	1 600	2 200	＊ **3032 8 523 BT39**
120													

2GD	113	113	186	166	186	5	16.5	3	2.5	49	0.35	1.74	0.96	10.1
2CC	108.5	107.5	131.5	127.5	135.5	4	5	1.5	1.5	24.5	0.33	1.82	1.00	1.14
	108.5	107.5	131.5	127.5	135.5	4	5	1.5	1.5	25	0.35	1.73	0.95	1.08
4CB	114	109	131	130	140	4	6.5	2.5	2.5	30	0.47	1.27	0.70	1.15
4CC	110	109	141.5	134	144	6	8	2	1.5	32.5	0.46	1.31	0.72	1.91
2CE	110	108	141.5	135	143	7	6.5	2	1.5	29.5	0.29	2.09	1.15	2.37
3FB	114	116	168	157	168	5	8	2.5	2	36	0.42	1.43	0.79	3.78
3FC	114	114	168	154	171	5	10	2.5	2	41.5	0.42	1.43	0.79	5.12
2GB	118	127	201	184	200	5	12.5	3	2.5	41.5	0.35	1.74	0.96	8.56
	118	127	201	184	200	5	12.5	3	2.5	42	0.35	1.73	0.95	7.72
7GB	118	121	201	168	202	7	21.5	3	2.5	69	0.83	0.73	0.40	8.67
2GD	118	121	201	177	200	5	17.5	3	2.5	53	0.35	1.74	0.96	12.7
	113.5	113.5	136.5	131.5	140.5	5	5	1.5	1.5	25	0.34	1.76	0.97	1.20
4DC	117	116	150	143	154	6	9	2	2	34.5	0.44	1.35	0.74	2.42
2DE	117	116	150	145	153	7	9	2	2	31	0.28	2.12	1.17	3.00
3FB	119	122	178	165	178	6	9	2.5	2	38	0.42	1.43	0.79	4.39
3FC	119	119	178	161	180	6	10	2.5	2	44	0.42	1.43	0.79	6.25
2GB	123	132	211	193	209	6	12.5	3	2.5	43.5	0.35	1.74	0.96	9.79
	123	132	211	193	209	6	12.5	3	2.5	43.5	0.35	1.73	0.95	8.93
7GB	123	126	211	176	211	7	22	3	2.5	71.5	0.83	0.73	0.40	9.68
2GD	123	128	211	185	209	6	18.5	3	2.5	55	0.35	1.74	0.96	14.5
	118.5	117.5	141.5	137	145.5	5	5	1.5	1.5	26.5	0.36	1.69	0.93	1.23
4DC	122	122	160	152	163	7	9	2	2	36.5	0.43	1.39	0.77	3.07
2DE	122	121	160	152	161	7	10	2	2	33.5	0.29	2.09	1.15	3.80
3FB	124	129	188	174	188	6	9	2.5	2	40	0.42	1.43	0.79	5.18
3FC	124	126	188	170	190	6	10	2.5	2	47	0.42	1.43	0.79	7.43
2GB	128	141	226	206	222	6	12.5	3	2.5	45.5	0.35	1.74	0.96	11.4
	128	141	226	206	222	6	12.5	3	2.5	44	0.35	1.73	0.95	10.5
7GB	128	135	226	188	224	7	25	3	2.5	76	0.83	0.73	0.40	11.9
2GD	128	135	226	198	222	6	19.5	3	2.5	57.5	0.35	1.74	0.96	18.0

d 120～170mm

120	215	61.5	58	50	3	2.5	460	680	47 000	69 500	1 700	2 200	**32224U**
	260	59.5	55	46	4	3	560	695	57 000	71 000	1 500	2 000	**30324U**
	260	59.5	55	46	3	3	465	550	47 500	56 000	1 500	2 000	**30324**[2)]
	260	68	62	42	4	3	515	655	52 500	67 000	1 500	2 000	**31324XU**
	260	90.5	86	69	4	3	815	1					
130													
140													
150													
160													
170													

4FD	134	136	203	181	204	6	11.5

d 170～300mm

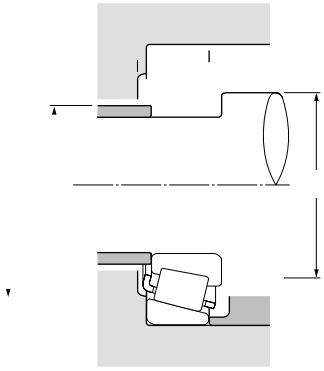
d												
170	260	57	57	43	3	2.5	500	895	51 000	91 000	1 300	1 700	**32034X**
	310	57	52	43	5	4	610	845	62 000	86 500	1 100	1 500	**30234U**
	310	91	86	71	5	4	1 000	1 600	102 000	163 000	1 100	1 500	**32234U**
	360	80	72	62	5	4	1 010	1 320	103 000	135 000	1 000	1 400	* **30334U**
	360	80	72	62	4	4	845	1 100	86 000	113 000	1 000	1 400	**30334**[2)]
180	250	45	45	34	2.5	2	350	700	36 000	71 500	1 300	1 700	**32936XU**
	280	64	64	48	3	2.5	645	1 170	66 000	119 000	1 200	1 600	**32036XUE1**
	320	57	52	43	5	4	630	890	64 000	91 000	1 100	1 400	**30236U**
	320	91	86	71	5	4	1 030	1 690	105 000	172 000	1 100	1 400	**32236U**
190	260	45	45	34	2.5	2	355	710	36 000	72 000	1 200	1 600	*
20													
220													
240													
260													
280													
300													

4EC	184	187	248

d 320～360mm

320	440	76	76	57	4	3	1 010	2 150	103 000	219 000	670	900	＊ **32964XUE1**
	440	76	72	63	3	3	865	1 880	88 000	192 000	670	900	**32964E1**[2)]
	480	100	100										
340													
360													

S_a



3FD	338	344	426	398	426	13	19	3	2.5	85	0.42	1.44	0.79	33.1
	338	344	426	398	425	13	13	3	2.5	85	0.39	1.55	0.85	31.7
4GD	342	344.5	462	418.5	463	15	26	4	3	104	0.46	1.31	0.72	60.2
4FD	358	362	446	417	446	13	19	3	2.5	90.5	0.44	1.37	0.75	34.9
	358	362	446	414	445.5	13	13	3	2.5	87	0.39	1.55	0.85	36.0
4FD	378	381	466	436	466	13	19	3	2.5	96.5	0.46	1.31	0.72	36.6

d 12.700～22.225mm

12.700	34.	10.	10.	.730	12.3	11.6	1 260	1 1 0	12 000	16 000
14.989	34.	10.	10.	.730	12.3	11.6	1 260	1 1 0	12 000	16 000
15.875	41.275	14.2	14.6 1	11.112	20.3	1 .7	2 070	1 10	10 000	13 000
	42. 62	14.2	14.2	.525	17.6	17.5	1 00	1 7 0	700	12 000
	42. 62	16.670	16.670	1557 5	26.7	26.0	2 720	2 650	00	15 000
	47.000	14.3 1	14.3 1	11.112	24.0	24.2	2 440	2 460	600	11 000
	4 .225	1 . 45	21.53	14.2	3 .5	3 .0	3 00	3 50	500	11 000
16.993	47.000	14.3 1	14.3 1	11.112	24.0	24.2	2 440	2 460	600	11 000
17.462	3 . 7	155 43	14.605	10.66	23.	24.2	2 420	2 470	10 000	15 000
19.050	3 . 2	12.014	11.153	.525	12.	12.	1 310	1 300	10 000	15 000
	45.237	15.4 4	16.637	12.065	2 .3	2 .6	2 0	2 20	00	12 000
	47.000	14.3 1	14.3 1	11.112	24.0	24.2	2 440	2 460	600	11 000
	4 .225	1 .034	1 .050	14.2	3 .5	3 .0	3 00	3 50	500	11 000
	4 .225	1 . 45	21.53	14.2	3 .5	3 .0	3 00	3 50	500	11 000
	4 .225	21.20	1 .050	17.462	3 .5	3 .0	3 00	3 50	500	11 000
	53. 75	22.225	21. 3	15. 75	40.0	3 .0	4 100	3 50	000	11 000
	56. 6	1 .36	1 . 37	15. 75	42.5	46.5	4 350	4 750	7 200	600
19.987	47.000	14.3 1	14.3 1	11.112	24.0	24.2	2 440	2 460	600	11 000
20.000	50.005	1557 5	14.260	.525	26.0	27.	2 650	2 50		
20.625										
20.638										
21.430										
21.986										
22.225										

d 22.225～28.575mm

22.225
22.606
23.812
24.981
25.000
25.159
25.400
26.157
26.162
26.988
28.575

d 28.575～31.750mm

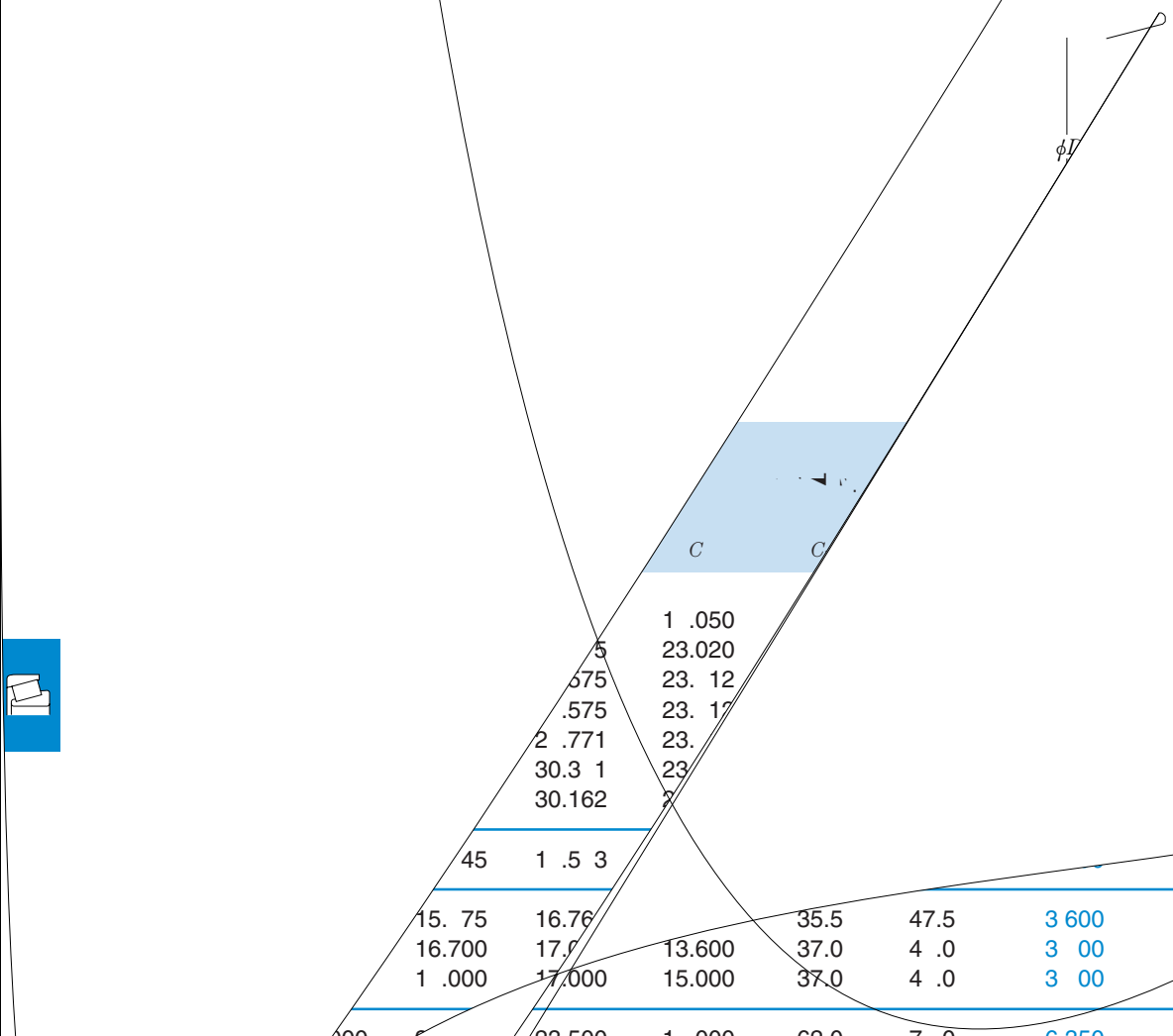
28.575	5 .73	1 .050	1 .355	15.0 0	40.5	44.5	4 150	4 550	6 700	00
	60.325	1 . 42	17.462	15. 75	3 .5	45.5	4 050	4 650	6 700	00
	60.325	1 . 45	1 .355	15. 75	40.5	44.5	4 150	4 550	6 700	00
	62.000	1 .050	20.63	14.2	46.5	54.0	4 750	5 500	6 100	200
	64.2 2	21.433	21.433	16.670	51.5	64.5	5 250	6 600	6 100	100
	66.421	23. 12	25.433	1 .050	64.5	72.5	6 550	7 400	6 200	200
	6 .262	22.225	22.225	17.462	57.0	67.0	5 00	6 50	5 00	7 700
	6 .262	22.225	23. 12	17.462	57.5	65.5	5 50	6 700	5 700	7 700
	6 . 50	23. 12	25.357	1 .050	6 .0	1.5	7 050	300	5 700	7 600
	72.626	24.60	24.257	17.462	5 .0	55.5	5 00	5 700	5 00	7 700
	73.025	22.225	22.225	17.462	56.5	6 .0	5 750	6 00	5 300	7 000
29.000	50.2 2	14.224	14.732	10.66	2 .0	35.5	2 60	3 600	7 200	600
29.367	66.421	23. 12	25.433	1 .050	64.5	72.5	6 550	7 400	6 200	200
29.987	62.000	16.002	16.566	14.2	3 .0	42.0	3 50			
30.000										
30.112										
30.162										
30.213										
30.226										
31.750										

d 31.750～34.925mm

	62.000	1 .050	20.63	14.2	46.5	54.0	4 750	5 500	6 100	200
	66.421	25.400	25.357	20.63	6 .0	1.5	7 050	300	5 700	7 600
	6 .262	22.225	22.225	17.462	57.0	67.0	5 00	6 50	5 00	7 700
	6 .262	22.225	22.225	17.462	57.0	67.0	5 00	6 50	5 00	7 700
	6 .012	1 . 45	1 .5 3	15. 75	4 .5	5 .0	4 00	5 00	5 600	7 400
	6 .012	1 . 45	1 .5 3	15. 75	4 .5	5 .0	4 00	5 00	5 600	7 400
	6 . 50	23. 12	25.357	1 .050	6 .0	1.5	7 050	300	5 700	7 600
31.750	6 . 50	23. 12	25.357	1 .050	6 .0	1.5	7			
33.338										
34.925										

Ta e ed R lle Bea i g

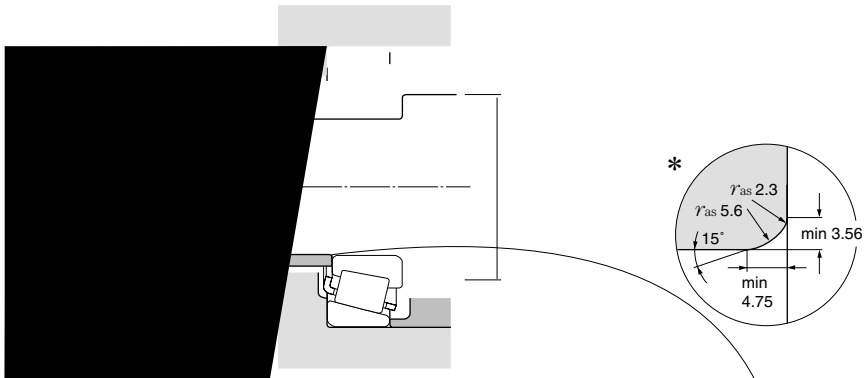
I ch e ie
J e ie



			1 .050						
		5	23.020						
		575	23. 12						
		.575	23. 1						
		2 .771	23.						
		30.3 1	23						
		30.162							
	45	1 .5 3					5 00	5 600	7 400
	15. 75	16.76		35.5	47.5	3 600	4 50	6 100	100
	16.700	17.0	13.600	37.0	4 .0	3 00	4 00	5 00	7 00
	1 .000	17.000	15.000	37.0	4 .0	3 00	4 00	5 00	7 00
000		23.500	1 .000	62.0	7 .0	6 350	7 50	5 500	7 300
.375		25.400	1 .050	76.5	7.5	7 00	50	4 00	6 400
0	00	22.403	17. 26	6 .0	75.0	6 50	7 650	4 700	6 300
	.5.400	25.400	1 . 42	65.0	4.5	6 600	600	5 400	7 200
	25.400	25.400	1 . 42	65.0	4.5	6 600	600	5 400	7 200
5	23. 12	24.60	1 .050	71.0	5.0	7 200	700	5 300	7 100
200	23. 12	25.654	1 .050	73.0	0.5	7 450	200	5 100	6 00
	76.200	2 .370	2 .575	23.020	7 .0	105	7 50	10 700	5 100	6 00
	76.200	2 .370	2 .575	23.020	7 .0	105	7 50	10 700	5 100	6 00
.512	76.200	2 .370	2 .575	23. 12	0.5	7.0	200	00	5 100	6 00
	7 .375	2 .370	2 . 2	22.664	6.5	104	00	10 600	5 000	6 600
	7 .375	2 .370	2 .771	23. 12	3.0	114	450	11 600	4 00	6 600
	.500	25.400	23.6	17.462	70.5	7 .0	7 200	7 50	4 000	5 300
38.000	63.000	17.000	17.000	13.500	3 .5	52.5	3 50	5 350	5 700	7 600
	63.500	12.700	11. 0	.525	25.	33.5	2 640	3 400	5 500	7 300
	65.0	1 .034	1 .2	13. 70	43.5	57.0	4 400	5 00	5 500	7 400
38.100	6 .012	1 .050	1 .050	15.0 3	47.5	5 .5	4 50	6 050	5 300	7 100
	6 .012	1 .050	1 .050	15.0 3	47.5	5 .5	4 50	6 050	5 300	7 100
	71.43	15. 75	16.520	11. 0	43.5	51.0	4 400	5 200	5 400	7 200
	72.000	1 .000	20.63	14.237	4 .0	5 .5	4 00	5 50	5 300	7 000

d 38.100～41.275mm

38.100	76.200	20.63	20. 40	15.507	55.5	63.0	5 650	6 450	5 000	6 700
	76.200	23. 12	25.654	1 .050	73.0	0.5	7 450	200	5 100	6 00
	76.200	23. 12	25.654	1 .050	73.0	0.5	7 450	200	5 100	6 00
	7 .375	23. 12	25.400	1 .050	76.5	7.5	7 00	50	4 00	6 400
	7 .375	2 .370	2 .771	23. 12	3.0	114	450	11 600	4 00	6 600
	0.000	21.006	20. 40	15. 75	55.5	63.0	5 650	6 450	5 000	6 700
	0.035	24.60	23.6	1 .512	67.0	2.5	6 50	400	4 00	6 400
	2.550	2 .370	2 .575	23.020	7.0	117	50	11 00	4 700	6 200
	2. 31	23. 12	25.400	1 .050	76.0	.0	7 750	10 000	4 500	6 000
	5.725	30.162	30.162	23. 12	105	132	10 700	13 400	4 500	6 000
	7.312	30.162	30. 6	23. 12	4.0	117	600	12 000	4 400	5 00
	.500	25.400	23.6	17.462	70.5	7 .0	7 200	7 50	4 000	5 300
	.500	26.	2 .0 3	22.225	5.5	107	750	10 00	4 600	6 100
39.688	76.200	23. 12	25.654	1 .050	73.0	0.5	7 450	200	5 100	6 00
	77.534	2 .370	30.3 1	23. 12	5.0	112	700	11 400	4 00	6 400
	7 .375	23. 12	25.400	1 .050	76.5	7.5	7 00	50	4 00	6 400
	0.035	2 .370	30.3 1	23. 12	5.0	112	700	11 400	4 00	6 400
	0.167	2 .370	30.3 1	23. 12	5.0	112	700	11 400	4 00	6 400
	.500	25.400	23.6	17.462	70.5	7 .0	7 200	7 50	4 000	5 300
40.000	76.200	20.63	20. 40	15.507	55.5	63.0	5 650	6 450	5 000	6 700
	0.000	21.000	22.403	17. 26	6 .0	75.0	6 50	7 650	4 700	6 300
	5.000	20.63	21.6 2	17.462	6 .5	7 .5	7 100	100	4 400	5 00
	.500	26.	2 .0 3	22.225	5.5	107	750	10 00	4 600	6 100
	107. 50	36.512	36. 57	2 .575	141	177	14 400	1 100	3 600	4 00
40.483	2.550	2 .370	2 .575	23.020	7.0	117	23.020			
40.988										
41.275										



be	Ab e a d fille di e i-						L ad Ca- a ce e		A ial l ad fac		Ma . l
	d_a	d_b	D_a	D_b	r_{as} min	r_{1as} min	a	e	Y_2	Y_o	( )
8300	45.5	43.5	6	71	1.5	1.3	4.	0.40	1.4	0. 2	0.405
20	52	43.5	66	70	4.3	3.3	7.	0.30	1.	1.0	0.4 5
20	50	43.5	66	70	3.5	3.3	7.	0.30	1.	1.0	0.4 7
26822	45	44.5	71	74	0.	0.	7.4	0.32	1.	1.04	0.574
420	52	45.5	67	74	3.5	3.3	.7	0.37	1.64	0. 0	0.6 3
/28315	45.5	43.5	6	73	1.5	1.5	4.	0.40	1.4	0. 2	0.467
/27820	4	47	6	75	0.	1.5	2.5	0.56	1.07	0.5	0.562
01346/HM801310	51	4	6	7	0.	3.3	4.7	0.55	1.10	0.60	0.767
2/25520	46	46	74	77	0.	0.	6.2	0.33	1.7	0.	0.645
5/3820	4 .5	4 .5	73	1	0.	3.3	.1	0.40	1.4	0. 2	0. 57
0/3525	4	45.5	75	1	1.5	3.3	10.0	0.31	1. 6	1.0	0. 1
50/44348	55	51	75	4	2.3	1.5	2. [1]	0.7	0.77	0.42	0.711
8/414	51	44.5	77	0	3.5	1.5	.1	0.26	2.2	1.25	0. 4
789/2720	52	45	66	70	3.5	3.3	7.	0.30	1.	1.0	0.477
382/3321	52	45.5	6	75	3.5	3.3	11.2	0.27	2.20	1.21	0.66
6880/26822	4	45.5	71	74	1.5	0.	7.4	0.32	1.	1.04	0.554
8382/3339	52	45.5	71	75	3.5	1.5	11.2	0.27	2.20	1.21	0.666
3386/3320	46.5	45.5	70	75	0.	3.3	11.2	0.27	2.20	1.21	0.66
-44158/44348	5	51	75	4	3.5	1.5	2. [1]	0.7	0.77	0.42	0.6 1
T-28158/28300	47.5	45	6	71	1.5	1.3	4.	0.40	1.4	0. 2	0.3 6
T-344/332	52	45.5	73	75	3.5	1.3	6.6	0.27	2.20	1.21	0.47
4T-350A/354A	47.5	46.5	77	0	0.	1.3	5.1	0.31	1. 6	1.0	0.562
4T-420/414	52	46	77	0	3.5	1.5	.1	0.26	2.2	1.25	0. 13
4T-543/532X	57	50	4	100	3.5	3.3	12.3	0.30	2.02	1.11	1.77
4T-HM801349/HM801310	5	4	6	7	3.5	3.3	4.7	0.55	1.10	0.60	0.731
4T-LM300849 /LM300811	52	45	61	65	*	1.5	3.6	0.35	1.72	0. 5	0.23
4T-18590/18520	53	46	66	6	3.5	1.5	2.	0.35	1.71	0. 4	0.2 1
4T-LM501349/LM501310	53	46.5	67	70	3.5	0.	3.3	0.40	1.50	0. 3	0.335
4T-LM501349/LM501314	53	46.5	66	70	3.5	0.	3.3	0.40	1.50	0. 3	0.355
4T-11162/11300	4	46.5	67	71	1.5	1.5	0.7	0.4	1.23	0.6	0.337
4T-24780/24720	54	47	6	72	3.5	0.	4.5	0.3	1.53	0. 4	0.432
4T-26882/26823	54	47	6	73	3.5	1.5	7.4	0.32	1.	1.04	0.4
4T-26885/26822	4	47	71	74	0.	0.	7.4	0.32	1.	1.04	0.535
4T-11162/11315	4	46.5	6	73	1.5	1.5	0.7	0.4	1.23	0.6	0.3

d 41.275～44.450mm

	0.000	21.000
41.275		
42.070		
42.862		
42.875		
44.450		

4T-336/332	47	46	73	75	0.	1.3	6.6	0.27	2.20	1.21	0.46
4T-26882/26824	54	47	70	74	3.5	1.3	7.4	0.32	1.	1.04	0.542
4T-M802048/M802011	57	51	70	7	3.5	3.3	3.2	0.55	1.10	0.60	0.642
4T-3880/3820	52	50	73	1	0.	3.3	.1	0.40	1.4	0. 2	0. 1
4T-3576/3525	4	4	75	1	0.	3.3	10.0	0.31	1. 6	1.0	0. 34
4T-HM803145/HM803110	54	53	74	5	0.	3.3	4.6	0.55	1.10	0.60	0. 01
4T-4388/4335	57	51	77	5	3.5	3.3	15.0	0.2	2.11	1.16	1.25
4T-M903345/M903310	60	54	7		3.5	1.5	3.6[1)]	0. 3	0.72	0.40	0.75
4T-46162/46368	52	51	7	7	0.	3.3	7.1	0.40	1.4	0. 2	1.0
4T-HM804840/HM804810	61	54	1	1	3.5	3.3	3.7	0.55	1.10	0.60	1.0
4T-53162/53375	57	53	1		1.5	0.	0.5	0.74	0. 1	0.45	0. 75
4T-HM903245/HM903210	63	54	1	1	3.5	0.	0.4[1)]	0.74	0. 1	0.45	1.05
4T-4395/4335	5	51	77	5	3.5	3.3	15.0	0.2	2.11	1.16	1.24
4T-22780/22720	56	50	71	77	3.5	3.3	6.4	0.40	1.4	0. 2	0.617
4T-25578/25520	53	4 .5	74	77	2.3	0.	6.2	0.33	1.7	0.	0.5 4
4T-3579/3525	56	4 .5	75	1	3.5	3.3	10.0	0.31	1. 6	1.0	0. 05
4T-26884/26822	55	4 .5	71	74	3.5	0.	7.4	0.32	1.	1.04	0.51
4T-25577/25520	55	4	74	77	3.5	0.	6.2	0.33	1.7	0.	0.5 1
4T-12175/12303	52	4 .5	6	73	1.5	1.5	0.2[1)]	0.51	1.1	0.65	0.30
4T-18685/18620	54	4 .5	71	74	2.	1.5	2.2	0.37	1.60	0.	0.345
4T-25580/25520	57	50	74	77	3.5	0.	6.2	0.33	1.7	0.	0.56
4T-25582/25520	60	50	74	77	5	0.	6.2	0.33	1.7	0.	0.556
4T-3578/3520	57	51	74	0	3.5	3.3	10.0	0.31	1. 6	1.0	0.6
4T-355/354A	54	50	77	0	2.3	1.3	5.1	0.31	1. 6	1.0	0.511
4T-3578/3525	57	51	75	1	3.5	3.3	10.0	0.31	1. 6	1.0	0.77
4T-HM803149/HM803110	62	53	74	5	3.5	3.3	4.6	0.55	1.10	0.60	0. 4
4T-3782/3720	5	52	2		3.5	3.3	.3	0.34	1.77	0. 7	0. 61
4T-46175/46368	55	54	7	7	0.	3.3	7.1	0.40	1.4	0. 2	1.04
4T-33885/33821	53	53	5	0	0.	2.3	.0	0.33	1. 2	1.00	0. 7
4T-438/432	57	51	3	7	3.5	2.3	.2	0.2	2.11	1.16	0. 53
4T-HM804842/HM804810	57	57	1	1	0.	3.3	3.7	0.55	1.10	0.60	1.04
4T-53177/53375	63	53	1		3.5	0.	0.5	0.74	0. 1	0.45	0. 25
4T-HM903249/HM903210	65	54	1	1	3.5	0.	0.4[1)]	0.74	0. 1	0.45	1
4T-527/522	5	53		5	3.5	3.3	12.	0.2	2.10	1.16	1.37
4T											

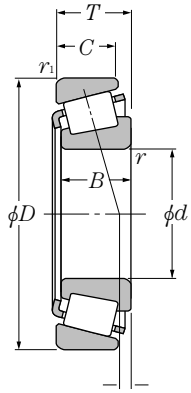
d 44.450～47.625mm

44.450
44.983
45.000
45.237
45.242
45.618
45.987
46.038
47.625

d 47.625～50.800mm

47.625	104.775	30.162	30. 5	23. 12	130	16	13 200	17 300	3 500	4 700
	111.125	30.162	26. 0	20.63	104	136	10 600	13 00	3 200	4 200
	123. 25	36.512	32.7 1	25.400	154	1	15 700	1 200	2 00	3 00
48.412	5.250	30.162	2 .370	23.020	10	147	11 100	15 000	4 000	5 300
	5.250	30.162	2 .370	23.020	10	147	11 100	15 000	4 000	5 300
49.212	3.264	30.162	30.302				(30.302)	0.0004	0 0 5	30.302 423. 4
49.987										
50.000										
50.800										

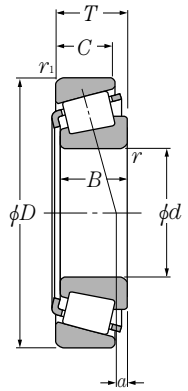
4T-45282/45220	63	57	3		3.5	3.3	7.	0.33	1. 0	0.	1.2
4T-55187C/55437	6	62	2	105	3.5	3.3	7.4[1)]	0.	0.6	0.37	1.4
4T-72188C/72487	6	67	102	116	0.	3.3	1.5[1)]	0.74	0. 1	0.45	2.16
4T-HM804848/HM804810	63	57	1	1	2.3	3.3	3.7	0.55	1.10	0.60	0. 67
4T-HM804849/HM804810	66	57	1	1	3.5	3.3	3.7	0.55	1.10	0.60	0. 64
4T-3781/3720	62	56	2		3.5	3.3	.3	0.34	1.77	0. 7	0. 77
4T-5395/5335	66	60		7	3.5	3.3	16.1	0.30	2.02	1.11	1.75
4T-HM807044/HM807010	6	63		100	3.5	3.3	7.4	0.4	1.23	0.6	1.52
4T-65390/65320	70	60	7	107	3.5	3.3	12.5	0.43	1.3	0.77	2.23
4T-HH506348/HH506310	71	61	7	107	3.5	3.3	13.3	0.40	1.4	0. 2	2.33
4T-LM104947A /LM104911	55	55	75	7	0.5	1.3	5.	0.31	1. 7	1.0	0.434
4T-28579 /28521	60	56	3	7	2.3	0.	4.6	0.3	1.5	0. 7	0.71
4T-HH506349 /HH506310	72	61	7	107	3.5	3.3	13.3	0.40	1.4	0. 2	2.27
# 4T-JLM104948/JLM104910 #	60	55	76	7	3	0.5	5.4	0.31	1. 7	1.0	0.42



d 50.800～55.000mm

50.800	101.600	31.750	31.750	25.400	110	136	11 200	13 900	3 700	5 000
	101.600	34.925	36.068	26.988	135	165	13 800	16 800	3 800	5 000
	104.775	30.162	29.317	24.605	115	148	11 700	15 000	3 500	4 700
	104.775	30.162	30.958	23.812	130	169	13 200	17 300	3 500	4 700
	104.775	36.512	36.512	28.575	138	189	14 000	19 300	3 600	4 800
	104.775	36.512	36.512	28.575	143	178	14 500	18 100	3 700	4 900
	107.950	36.512	36.957	28.575	141	177	14 400	18 100	3 600	4 800
	111.125	30.162	28.575	20.638	104	136	10 600	13 900	3 200	4 200
	112.712	30.162	26.909	20.638	104	136	10 600	13 900	3 200	4 200
	112.712	30.162	30.048	23.812	119	174	12 200	17 800	3 200	4 300
	112.712	30.162	30.162	23.812	138	195	14 100	19 800	3 200	4 200
	117.475	33.338	31.750	23.812	130	153	13 200	15 600	3 300	4 400
	120.650	41.275	41.275	31.750	172	213	17 500	21 700	3 300	4 400
	123.825	36.512	32.791	25.400	154	188	15 700	19 200	2 900	3 900
	123.825	38.100	36.678	30.162	158	216	16 100	22 000	3 000	4 100
51.592	88.900	20.638	22.225	16.513	76.5	90.5	7 800	9 250	4 100	5 500
52.388	92.075	24.608	25.400	19.845	83.5	116	8 550	11 800	4 000	5 300
	93.264	30.162	30.302	23.812	102	134	10 400	13 700	4 000	5 300
	95.250	27.783	28.575	22.225	107	139	10 900	14 200	3 900	5 200
53.975	88.900	19.050	19.050	13.492	61.0	82.5	6 200	8 450	4 000	5 300
	95.250	27.783	28.575	22.225	107	139	10 900	14 200	3 900	5 200
	96.838	21.000	21.946	15.875	78.0	96.5	7 950	9 850	3 700	5 000
	104.775	30.162	30.958	23.812	130	169	13 200	17 300	3 500	4 700
	104.775	36.512	36.512	28.575	138	189	14 000	19 300	3 600	4 800
	107.950	36.512	36.957	28.575	141	177	14 400	18 100	3 600	4 800
	120.650	41.275	41.275	31.750	172	213	17 500	21 700	3 300	4 400
	122.238	33.338	31.750	23.812	134	163	13 700	16 600	3 100	4 200
	122.238	43.658	43.764	36.512	194	283	19 700	28 900	3 100	4 100
	123.825	36.512	32.791	25.400	154	188	15 700	19 200	2 900	3 900
	123.825	38.100	36.678	30.162	158	216	16 100	22 000	3 000	4 100
	130.175	36.512	33.338	23.812	156	186	15 900	19 000	2 700	3 600
	140.030	36.512	33.236	23.520	171	212	17 400	21 600	2 600	3 400
54.488	104.775	36.512	36.512	28.575	138	189	14 000	19 300	3 600	4 800
55.000	90.000	23.000	23.000	18.500	77.5	109	7 900	11 100	3 900	5 300

Inch series
J series

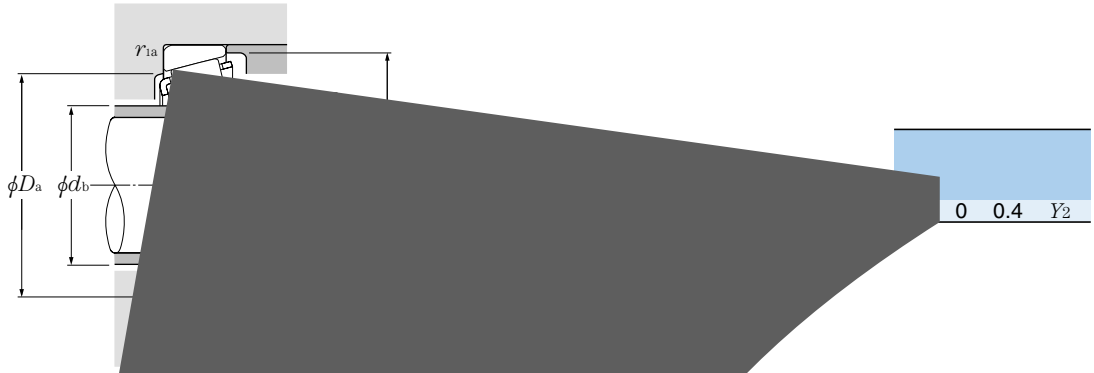


d 55.000～60.000mm

Boundary dimensions					Basic load ratings				Limiting speeds	
d	D	T	B	C	Cr	Cor	Cr	Cor		
55.000	95.000	29.000	29.000	23.500	107	144	10 900	14 700	3 800	5 100
	96.838	21.000	21.946	15.875	78.0	96.5	7 950	9 850	3 700	5 000
	110.000	39.000	39.000	32.000	173	219	17 600	22 400	3 500	4 600
55.562	97.630	24.608	24.608	19.446	88.5	128	9 000	13 000	3 700	4 900
	123.825	36.512	32.791	25.400	154	188	15 700	19 200	2 900	3 900
	127.000	36.512	36.512	26.988	163	228	16 600	23 300	2 900	3 800
55.575	96.838	21.000	21.946	15.875	78	96.5	7 950	9 850	3 700	5 000
57.150	96.838	21.000	21.946	15.875	78	96.5	7 950	9 850	3 700	5 000
	96.838	21.000	21.946	15.875	78	96.5	7 950	9 850	3 700	5 000
	96.838	21.000	21.946	15.875	78	96.5	7 950	9 850	3 700	5 000
	96.838	21.000	21.946	15.875	78	96.5	7 950	9 850	3 700	5 000
	97.630	24.608	24.608	19.446	88.5	128	9 000	13 000	3 700	4 900
	104.775	30.162	29.317	24.605	115	148	11 700	15 000	3 500	4 700
	104.775	30.162	29.317	24.605	115	148	11 700	15 000	3 500	4 700
	104.775	30.162	30.958	23.812	130	169	13 200	17 300	3 500	4 700
	107.950	27.783	29.317	22.225	115	148	11 700	15 000	3 500	4 700
	110.000	22.000	21.996	18.824	89.5	120	9 150	12 300	3 200	4 300
	110.000	27.795	29.317	27.000	115	148	11 700	15 000	3 500	4 700
	112.712	30.162	30.048	23.812	119	174	12 200	17 800	3 200	4 300
	112.712	30.162	30.162	23.812	138	195	14 100	19 800	3 200	4 200
	112.712	30.162	30.162	23.812	138	195	14 100	19 800	3 200	4 200
	117.475	30.162	30.162	23.812	117	175	11 900	17 900	3 000	4 000
	117.475	33.338	31.750	23.812	130	153	13 200	15 600	3 300	4 400
	120.650	41.275	41.275	31.750	172	213	17 500	21 700	3 300	4 400
	123.825	36.512	32.791	25.400	154	188	15 700	19 200	2 900	3 900
	123.825	38.100	36.678	30.162	158	216	16 100	22 000	3 000	4 100
	140.030	36.512	33.236	23.520	171	212	17 400	21 600	2 600	3 400
57.531	96.838	21.000	21.946	15.875	78.0	96.5	7 950	9 850	3 700	5 000
59.972	122.238	33.338	31.750	23.812	134	163	13 700	16 600	3 100	4 200
59.987	146.050	41.275	39.688	25.400	199	234	20 300	23 900	2 400	3 200
60.000	95.000	24.000	24.000	19.000	83.0	122	8 500	12 400	3 700	4 900
	107.950	25.400	25.400	19.050	91.5	140	9 350	14 200	3 200	4 300

d 60.000～65.000mm

60.000	110.000	22.000	21.996	18.824	89.5	120	9 150	12 300	3 200	4 300
	130.000	34.100	30.924	22.650	156.0	186	15 900	19 000	2 700	3 600
60.325	100.000	25.400	25.400	19.845	90.5	134	9 200	13 600	3 500	4 700
	112.712	30.162	30.048	23.812	119	174	12 200	17 800	3 200	4 300
	122.238	38.100	38.354	29.718	187	244	19 100	24 900	3 100	4 100
	122.238	43.658	43.764	36.512	194	283	19 700	28 900	3 100	4 100
	123.825	38.100	36.678	30.162	158	216	16 100	22 000	3 000	4 100
	127.000	36.512	36.512	26.988	163	228	16 600	23 300	2 900	3 800
	127.000	44.450	44.450	34.925	203	263	20 700	26 800	3 100	4 200
	130.175	36.512	33.338	23.812	156	186	15 900	19 000	2 700	3 600
61.912	110.000	22.000	21.996	18.824	89.5	120	9 150	12 300	3 200	4 300
	136.525	46.038	46.038	36.512	224	355	22 800	36 500	2 600	3 500
	146.050	41.275	39.688	25.400	199	234	20 300	23 900	2 400	3 200
61.976	101.600	24.608	24.608	19.845	90.5	134	9 200	13 600	3 500	4 700
62.738	101.600	25.400	25.400	19.845	90.5	134	9 200	13 600	3 500	4 700
63.500	94.458	19.050	19.050	15.083	60.5	103	6 150	10 500	3 600	4 800
	107.950	25.400								
65.000										



Bearing n	nsions			Load center	Constant	Axial load factors		Mass
	D_b	r_{as}	r_{1as}	a	e	Y_2	Y_o	i (.)
4T-397/394A	04	0.8	1.3	0.7	0.40	1.49	0.82	0.91
# 4T-JHM911	23	3.5	3.3	7.6[1]	0.82	0.73	0.40	2.01
4T-28985/2	96	3.5	3.3	2.5	0.43	1.41	0.78	0.772
4T-3980/3	6	3.5	3.3	4.5	0.40	1.49	0.82	1.33
4T-HM212	6	8	3.3	11.1	0.34	1.78	0.98	2.02
4T-5583/5		3.5	3.3	13.3	0.36	1.67	0.92	2.44
4T-558/5		2.3	3.3	9.4	0.35	1.73	0.95	2.1
4T-HM81		3.5	3.3	3.7	0.50	1.20	0.66	2.21
4T-6523		3.5	3.3	9.3	0.49	1.23	0.68	2.65
4T-HM9			3.3	5.2[1]	0.82	0.73	0.40	2.12
4T-392/			1.3	0.7	0.40	1.49	0.82	0.879
4T-H71			3.3	8.7	0.47	1.27	0.70	3.47
4T-H91				4.3[1]	0.78	0.77	0.42	3.17
4T-289				1.7	0.43	1.41	0.78	0.768
4T-28					0.43	1.41	0.78	0.764
4T-L6						1.41	0.78	0.449
4T-29						1.31	0.72	0.924
4T-29							0.72	0.929
4T-39							0.82	0.851
4T-29								0.982
4T-398								1.26
4T-395								
4T-477								
4T-483/								
4T-HM2								
4T-5584/								
4T-559/55								
4T-565/563								
4T-HM81384								
4T-639/632								
4T-78250/78551								
# 4T-JLM710949/JLM71								
# 4T-JM511946/JM511910								

1) "—"

d 65.000～70.000mm

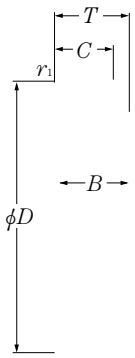
65.000
65.088
66.675
68.262
69.850
69.952
70.000

# 4T-JH211749/JH211710	80	74	107	114	3	2.5	10.9	0.34	1.78	0.98	1.90
4T-6379/6320	84	77	117	126	3.5	3.3	18.8	0.32	1.85	1.02	3.71
4T-L812148/L812111	74	72	96	99	1.5	0.8	3.7[1)]	0.49	1.23	0.68	0.48
4T-29590/29520	80	73	96	103	3.5	3.3	0.6	0.46	1.31	0.72	0.86
4T-395A/394A	73	73	101	104	0.8	1.3	0.7	0.40	1.49	0.82	0.796
4T-3984/3925	80	74	101	106	3.5	0.8	4.5	0.40	1.49	0.82	1.19
4T-3994/3920	84	74	99	106	5.5	3.3	4.5	0.40	1.49	0.82	1.18
4T-39590/39520	80	74	101	107	3.5	3.3	6.6	0.34	1.77	0.97	1.19
4T-HM212049/HM212010	82	75	110	116	3.5	1.5	11.1	0.34	1.78	0.98	1.86
4T-560/552A	81	75	109	116	3.5	3.3	9.4	0.35	1.73	0.95	1.92
4T-HM813844/HM813810	85	78	111	121	3.5	3.3	3.7	0.50	1.20	0.66	2.03
4T-641/633	83	77	116	124	3.5	3.3	11.4	0.36	1.66	0.91	2.41
4T-6386/6320	87	77	117	126	4.3	3.3	18.8	0.32	1.85	1.02	3.64
4T-641/632	83	77	118	125	3.5	3.3	11.4	0.36	1.66	0.91	2.74
4T-H414242/H414210	85	81	121	129	3.5	3.3	11.0	0.36	1.67	0.92	2.75
4T-399A/394A	78	74	101	104	2.3	1.3	0.7	0.40	1.49	0.82	0.764
4T-480/472	82	75	107	114	3.5	2	3.9	0.38	1.56	0.86	1.37
4T-560S/552A	83	76	109	116	3.5	3.3	9.4	0.35	1.73	0.95	1.87
4T-H414245/H414210	86	82	121	129	3.5	3.3	11.0	0.36	1.67	0.92	2.7
4T-H715343/H715311	90	84	118	132	3.5	3.3	8.7	0.47	1.27	0.70	3.24
4T-29675/29620	80	77	101	109	1.5	3.3	0.9[1)]	0.49	1.23	0.68	0.949

d 70.000～76.200mm

4T-484/472	80	77	107	114	2	2	3.9	0.38	1.56	0.86	1.33
# 4T-JH913848/JH913811	82	82	126	146	2	3.3	4.3[1]	0.78	0.77	0.42	3.08
4T-33281/33462	85	79	104	112	3.5	3.3	2.6	0.44	1.38	0.76	1.24
4T-47490/47420	86	79	107	114	3.5	3.3	6.1	0.36	1.67	0.92	1.42
4T-567A/563	86	80	112	120	3.5	3.3	8.3	0.36	1.65	0.91	1.87
4T-644/632	87	81	118	125	3.5	3.3	11.4	0.36	1.66	0.91	2.57

Inch series
J series



d 76.200～83.345mm

Boundary dimensions					Basic load ratings				Limiting speeds	
d	D	T	B	C	C_r	C_{or}	C_r	C_{or}		
76.200	149.225	53.975	54.229	44.450	287	410	29 300	41 500	2 500	3 400
	161.925	53.975	55.100	42.862	310	460	31 500	47 000	2 300	3 000
	180.975	53.975	53.183	35.720	325	415	33 000	42 500	1 900	2 600
	190.500	57.150	57.531	46.038	445	610	45 000	62 000	1 900	2 600
77.788	117.475	25.400	25.400	19.050	99.5	162	10 200	16 500	2 900	3 900
	121.442	24.608	23.012	17.462	91.0	127	9 300	13 000	2 900	3 800
	127.000	30.162	31.000	22.225	135	194	13 800	19 800	2 800	3 700
	136.525	30.162	29.769	22.225	129	189	13 200	19 300	2 600	3 500
	136.525	46.038	46.038	36.512	224	355	22 800	36 500	2 600	3 500
79.375	146.050	41.275	41.275	31.750	206	295	21 000	30 000	2 500	3 300
	161.925	47.625	48.260	38.100	270	385	27 500	39 000	2 300	3 100
	190.500	57.150	57.531	46.038	445	610	45 000	62 000	1 900	2 600
80.000	130.000	35.000	34.000	28.500	166	249	16 900	25 400	2 700	3 600
80.962	133.350	33.338	33.338	26.195	153	235	15 600	24 000	2 600	3 500
	136.525	30.162	29.769	22.225	129	189	13 200	19 300	2 600	3 500
	139.992	36.512	36.098	28.575	178	265	18 100	27 100	2 600	3 400
	150.089	44.450	46.672	36.512	261	360	26 600	37 000	2 400	3 200
82.550	125.412	25.400	25.400	19.845	102	163	10 400	16 600	2 700	3 600
	133.350	33.338	33.338	26.195	153	235	15 600	24 000	2 600	3 500
	133.350	39.688	39.688	32.545	177	305	18 000	31 000	2 600	3 500
	136.525	30.162	29.769	22.225	129	189	13 200	19 300	2 600	3 500
	139.992	36.512	36.098	28.575	178	265	18 100	27 100	2 600	3 400
	139.992	36.512	36.098	28.575	178	265	18 100	27 100	2 600	3 400
	146.050	41.275	41.275	31.750	206	295	21 000	30 000	2 500	3 300
	150.089	44.450	46.672	36.512	261	360	26 600	37 000	2 400	3 200
	152.400	39.688	36.322	30.162	180	279	18 300	28 400	2 300	3 100
	152.400	41.275	41.275	31.750	206	295	21 000	30 000	2 500	3 300
	161.925	47.625	48.260	38.100	270	385	27 500	39 000	2 300	3 100
	161.925	53.975	55.100	42.862	310	460	31 500	47 000	2 300	3 000
	168.275	53.975	56.363	41.275	340	460	34 500	46 500	2 200	3 000
83.345	125.412	25.400	25.400	19.845	102	163	10 400	16 600	2 700	3 600
	125.412	25.400	25.400	19.845	102	163	10 400	16 600	2 700	3 600
	125.412	25.400	25.400	19.845	102	163	10 400	16 600	2 700	3 600

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2. A

4T-6461/6420	96	89	129	140	3.5	3.3	14.8	0.36	1.66	0.91	4.26
4T-6576/6535	99	92	141	154	3.5	3.3	12.8	0.40	1.50	0.82	5.44
4T-H917840/H917810††	110	100	152	170	3.5	3.3	0.5[1)]	0.73	0.82	0.45	6.57
4T-HH221430/HH221410	101	95	171	179	3.5	3.3	14.4	0.33	1.79	0.99	8.69
4T-LM814849/LM814810	91	85	105	113	3.5	3.3	2.3[1)]	0.51	1.18	0.65	0.932
4T-34306/34478	90	84	110	116	3.5	2	1.2[1)]	0.45	1.33	0.73	0.943
4T-42690/42620	91	85	114	121	3.5	3.3	2.8	0.42	1.43	0.79	1.41
4T-495AS/493	93	87	122	130	3.5	3.3	0.7	0.44	1.35	0.74	1.78
4T-H715348/H715311	98	88	118	132	3.5	3.3	8.7	0.47	1.27	0.70	2.84
4T-661/653	96	90	131	139	3.5	3.3	8.0	0.41	1.47	0.81	2.91
4T-756A/752	106	91	144	150	8	3.3	12.0	0.34	1.76	0.97	4.55
4T-HH221431/HH221410	103	97	171	179	3.5	3.3	14.4	0.33	1.79	0.99	8.52
# 4T-JM515649/JM515610	94	88	117	125	3	2.5	4.9	0.39	1.54	0.85	1.73
4T-47681/47620	95	89	119	128	3.5	3.3	3.9	0.40	1.48	0.82	1.78
4T-496/493											

	136.525	30.162	29.769	22.225	129	189	13 200	19 300	2 600	3 500
	130.000	30.000	29.000	24.000	135	214	13 700	21 900	2 600	3 500
	140.000	39.000	38.000	31.500	197	297	20 100	30 500	2 500	3 400
	150.089	44.450	46.672	36.512	261	360	26 600	37 000	2 400	3 200
	133.350	30.162	29.769	22.225	129	189	13 200	19 300	2 600	3 500
	142.138	42.862	42.862	34.133	216	350	22 000	35 500	2 500	3 300
	146.050	41.275	41.275	31.750	206	295	21 000	30 000	2 500	3 300
	152.400	39.688	36.322	30.162	180	279	18 300	28 400	2 300	3 100
	161.925	47.625	48.260	38.100	270	385	27 500	39 000	2 300	3 100
	148.430	28.575	28.971	21.433	138	215	14 100	21 900	2 300	3 100
	121.442	15.083	15.083	11.112	56.5	88.0	5 750	9 000	2 700	3 600
	123.825	20.638	20.638	16.670	80.0	141	8 150	14 400	2 700	3 500
	148.430	28.575	28.971	21.433	138	2				

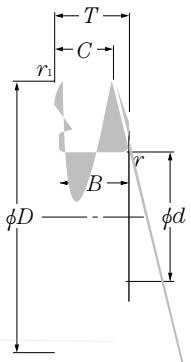
4T-498/493	98	91	122	130	3.5	3.3	0.7	0.44	1.35	0.74	1.6
# 4T-JM716648/JM716610	104	92	117	125	6	2.5	0.2	0.44	1.35	0.74	1.37
# 4T-JHM516849/JHM516810	100	94	125	134	3	2.5	5.9	0.41	1.47	0.81	2.3
4T-749/742	101	95	134	142	3.5	3.3	12.0	0.33	1.84	1.01	3.25
4T-497/492A	99	93	120	128	3.5	3.3	0.7	0.44	1.35	0.74	1.43
4T-HM617049/HM617010	106	95	125	137	4.8	3.3	6.9	0.43	1.39	0.76	2.69
4T-665/653	102	95	131	139	3.5	3.3	8.0	0.41	1.47	0.81	2.65
4T-596/592A	102	96	135	144	3.5	3.3	2.6	0.44	1.36	0.75	2.9
4T-758/752	103	97	144	150	3.5	3.3	12.0	0.34	1.76	0.97	4.26
4T-42346/42584	103	98	134	142	3	3	′ 3.0[1)]	0.49	1.22	0.67	1.99
4T-LL217849/LL217810	97	94	115	117	1.5	1.5	′ 2.9[1)]	0.33	1.81	1.00	0.452
4T-L217849/L217810	97	94	116	119	1.5	1.5	′ 0.7[1)]	0.33	1.82	1.00	0.737
4T-42350/42584	104	98	134	142	3	3	′ 3.0[1)]	0.49	1.22	0.67	1.96
4T-593/592A	104	98	135	144	3.5	3.3	2.6	0.44	1.36	0.75	2.78
4T-759/752	106	99	144	150	3.5	3.3	12.0	0.34	1.76	0.97	4.09
4T-6580/6535	109	102	141	154	3.5	3.3	12.8	0.40	1.50	0.82	4.73
4T-850/832											

d 95.250～109.538mm

95.250	130.175	20.638	21.433	16.670	81.0	147	8 300	15 000	2 500	3 300
	146.050	33.338	34.925	26.195	163	266	16 700	27 100	2 400	3 100
	147.638	35.717	36.322	26.192	180	279	18 300	28 400	2 300	3 100
	148.430	28.575	28.971	21.433	138	215	14 100	21 900	2 300	3 100
	152.400	39.688	36.322	30.162	180	279	18 300	28 400	2 300	3 100
	157.162	36.512	36.116	26.195	188	305	19 200	31 000	2 200	2 900
	168.275	41.275	41.275	30.162	222	340	22 700	35 000	2 100	2 800
	190.500	57.150	57.531	46.038	445	610	45 000	62 000	1 900	2 600
96.838	148.430	28.575	28.971	21.433	138	215	14 100	21 900	2 300	3 100
	188.912	50.800	46.038	31.750	281	365	28 700	37 000	1 800	2 400
98.425	157.162	36.512	36.116	26.195	188	305	19 200	31 000	2 200	2
99.974										
100.000										
100.012										
101.600										
104.775										
107.950										
109.538										

d 109.987～133.350mm

Inch series
J series



d 133.350～196.850mm

Boundary dimensions					Basic load ratings				Limiting speeds	
d	D	T	B	C	C_r	C_{or}	C_r	C_{or}		
133.350	190.500	39.688	39.688	33.338	236	475	24 100	48 500	1 700	2 300
	196.850	46.038	46.038	38.100	310	550	31 500	56 500	1 700	2 200
	196.850	46.038	46.038	38.100	310	550	31 500	56 500	1 700	2 200
	215.900	47.625	47.625	34.925	320	540	32 500	55 000	1 600	2 100
	234.950	63.500	63.500	49.212	525	825	53 500	84 000	1 500	2 000
136.525	190.500	39.688	39.688	33.338	236	475	24 100	48 500	1 700	2 300
	228.600	57.150	57.150	44.450	445	735	45 500	75 000	1 500	2 000
139.700	215.900	47.625	47.625	34.925	320	540	32 500	55 000	1 600	2 100
	228.600	57.150	57.150	44.450	445	735	45 500	75 000	1 500	2 000
	254.000	66.675	66.675	47.625	550	910	56 000	92 500	1 400	1 800
142.875	200.025	41.275	39.688	34.130	239	490	24 300	50 000	1 600	2 100
	200.025	41.275	39.688	34.130	239	490	24 300	50 000	1 600	2 100
146.050	193.675	28.575	28.575	23.020	165	340	16 800	35 000	1 600	2 200
	254.000	66.675	66.675	47.625	550	910	56 000	92 500	1 400	1 800
152.400	192.088	25.000	24.000	19.000	130	261	13 200	26 700	1 600	2 100
	222.250	46.830	46.830	34.925	315	585	32 000	60 000	1 500	2 000
158.750	205.583	23.812	23.812	18.258	126	247	12 900	25 200	1 500	2 000
	225.425	41.275	39.688	33.338	254	555	25 900	56 500	1 400	1 900
165.100	225.425	41.275	39.688	33.338	254	555	25 900	56 500	1 400	1 900
170.000	230.000	39.000	38.000	31.000	282	520	28 700	53 000	1 400	1 800
177.800	227.012	30.162	30.162	23.020	181	415	18 500	42 000	1 300	1 800
	247.650	47.625	47.625	38.100	340	690	35 000	70 500	1 300	1 700
180.000	250.000	47.000	45.000	37.000	370	710	37 500	72 500	1 300	1 700
190.000	260.000	46.000	44.000	36.500	365	720	37 000	73 500	1 200	1 600
196.850	241.300	23.812	23.017	17.462	160	330	16 300	33 500	1 200	1 600

: 1.
2. B J-series Table 6.6 page A-42.

4T-48385/48320	148	142	177	184	3.5	3.3	4.0	0.32	1.87	1.03	3.64
4T-67390/67322	149	143	180	189	3.5	3.3	6.3	0.34	1.74	0.96	4.63
4T-67391/67322	157	143	180	189	8	3.3	6.3	0.34	1.74	0.96	4.59
4T-74525/74850	152	146	196	208	3.5	3.3	/ 2.2[1)]	0.49	1.23	0.68	6.56
4T-95525/95925	166	148	209	217	9.7	3.3	14.0	0.37	1.62	0.89	11.3
4T-48393/48320	151	144	177	184	3.5	3.3	4.0	0.32	1.87	1.03	3.43
4T-896/892	156	150	205	216	3.5	3.3	6.0	0.42	1.43	0.78	9.07
4T-74550/74850	158	151	196	208	3.5	3.3	/ 2.2[1)]	0.49	1.23	0.68	6.05
4T-898/892	160	153	205	216	3.5	3.3	6.0	0.42	1.43	0.78	8.76
4T-99550/99100	170	156	227	238	7	3.3	12.1	0.41	1.47	0.81	14.3
4T-48684/48620	166	151	185	193	8	3.3	3.1	0.34	1.78	0.98	3.85
4T-48685/48620	158	151	185	193	3.5	3.3	3.1	0.34	1.78	0.98	3.89
4T-36690/36620	155	153	182	188	1.5	1.5	/ 5.0[1)]	0.37	1.63	0.90	2.27
4T-99575/99100	175	162	227	238	7	3.3	12.1	0.41	1.47	0.81	13.5
4T-L630349/L630310	162	158	183	187	2	2	/ 10.0[1)]	0.42	1.44	0.79	1.53
4T-M231648/M231610	178	163	207	213	8	1.5	5.9	0.33	1.8	0.99	5.72
4T-L432349/L432310	168	166	195	199	1.5	1.5	/ 9.8[1)]	0.37	1.61	0.88	1.89
4T-46780/46720	176	169	209	218	3.5	3.3	/ 2.6[1)]	0.38	1.57	0.86	5.2
4T-46790/46720	181	174	209	218	3.5	3.3	/ 2.6[1)]	0.38	1.57	0.86	4.69
# 4T-JHM534149/JHM534110	184	178	217	224	3	2.5	/ 4.7[1)]	0.38	1.57	0.86	4.37
4T-36990/36920	188	186	214	221	1.5	1.5	/ 12.8[1)]	0.44	1.36	0.75	2.92
4T-67790/67720	194	188	229	240	3.5	3.3	/ 4.8[1)]	0.44	1.36	0.75	6.57
# 4T-JM736149/JM736110	196	190	232	243	3	2.5	/ 9.0[1)]	0.48	1.25	0.69	6.76
# 4T-JM738249/JM738210	206	200	242	252	3	2.5	/ 10.9[1)]	0.48	1.26	0.69	6.85
4T-LL639249/LL639210	205	203	232	236	1.5	1.5	/ 17.3[1)]	0.42	1.44	0.79	2.07

1) "—"

40～70mm

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55

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65

70

4T-430208X	48.5	75	3.5	1.5	0.6	38.5	0.37	1.80	2.68	1.76	0.929
4T-432208X	48.5	75	5.5	1.5	0.6	43	0.37	1.80	2.68	1.76	1.18
4T-430308DX	50	86.5	8	2	0.6	64.5	0.83	0.82	1.22	0.80	1.56
4T-430308	50	82	5	2	0.6	44.5	0.35	1.96	2.91	1.91	1.61
4T-430209	53.5	80	4.5	1.5	0.6	42	0.40	1.67	2.48	1.63	1.04
4T-432209	53.5	81	5.5	1.5	0.6	46	0.40	1.67	2.48	1.63	1.27
＊**4T-430309DX**	55	96	9	2	0.6	70	0.83	0.82	1.22	0.80	2.11
4T-430309	55	93	5	2	0.6	47.5	0.35	1.96	2.91	1.91	2.11
4T-430210	58.5	85	4.5	1.5	0.6	44.5	0.42	1.61	2.39	1.57	1.18
432210U	58.5	85	5.5	1.5	0.6	47.5	0.42	1.61	2.39	1.57	1.36
4T-430310DX	62	105	10	2	0.6	75	0.83	0.82	1.22	0.80	2.65
4T-430310	62	102	6	2	0.6	51	0.35	1.96	2.91	1.91	2.72
432310U	62	102	9	2	0.6	62.5	0.35	1.96	2.91	1.91	3.98
4T-430211X	65	94	4.5	2	0.6	47	0.40	1.67	2.48	1.63	1.55
432211U	65	95	5.5	2	0.6	51	0.40	1.67	2.48	1.63	1.85
4T-430311DX	67	113	10.5	2	0.6	83	0.83	0.82	1.22	0.80	3.42
430311XU	67	111	6.5	2	0.6	55.5	0.35	1.96	2.91	1.91	3.48
432311U	67	111	10.5	2	0.6	66.5	0.35	1.96	2.91	1.91	5.05
4T-430212X	70	103	4.5	2	0.6	49.5	0.40	1.67	2.48	1.63	1.99
432212U	70	104	5.5	2	0.6	56	0.40	1.67	2.48	1.63	2.49
4T-430312DX	74	124	11.5	2.5	1	88.5	0.83	0.82	1.22	0.80	4.22
430312U	74	120	7.5	2.5	1	59.5	0.35	1.96	2.91	1.91	4.31
432312U	74	120	11.5	2.5	1	71	0.35	1.96	2.91	1.91	6.29
4T-430213X	75	113	4.5	2	0.6	53.5	0.40	1.67	2.48	1.63	2.49
432213U	75	115	5.5	2	0.6	61.5	0.40	1.67	2.48	1.63	3.33
4T-430313DX	79	133	13	2.5	1	94.5	0.83	0.82	1.22	0.80	5.16

75～105mm

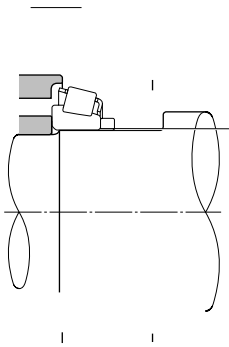
75	130	62	51.5	2	0.6	238	350	24 300	36 000	2 300	3 000
	130	74	61.5	2	0.6	288	445	29 300	45 500	2 300	3 000
	160	87	59	3	1	370	510	37 500	52 000	1 700	2 300
	160	87	69	3	1	435	605	44 500	62 000	2 000	2 700
	160	125	99	3	1	610	935	62 000	95 500	2 000	2 700
80	140	64	51.5	2.5	0.6	274	400	27 900	40 500	2 100	2 800
	140	78	63.5	2.5	0.6	340	530	35 000	54 000	2 100	2 800
	170	92	61	3	1	405	565	41 500	58 000	1 600	2 200
	170	92	73	3	1	500	700	51 000	71 500	1 900	2 500
	170	131	104	3	1	680	1 050	69 000	107 000	1 900	2 500
85	150	70	57	2.5	0.6	315	465	32 000	47 000	2 000	2 700
	150	86	69	2.5	0.6	385	600	39 000	61 500	2 000	2 700
	180	98	65	4	1	425	585	43 000	59 500	1 500	2 100
	180	98	77	4	1	520	725	53 000	74 000	1 800	2 400
	180	137	108	4	1	690	1 050	70 500	107 000	1 800	2 400
90	160	74	61	2.5	0.6	355	535	36 500	54 500	1 900	2 500
	160	94	77	2.5	0.6	450	720	46 000	73 500	1 900	2 500
	190	102	69	4	1	465	645	47 500	65 500	1 500	1 900
	190	102	81	4	1	580	815	59 000	83 000	1 700	2 300
	190	144	115	4	1	770	1 190	78 500	121 000	1 700	2 300
95	170	78	63	3	1	385	580	39 500	59 000	1 800	2 400
	170	100	83	3	1	515	835	52 500	85 000	1 800	2 400
	200	108	85	4	1	630	890	64 000	91 000	1 600	2 100
	200	108	85	3	1	540	735	55 500	75 000	1 600	2 100
	200	151	118	4	1	865	1 340	88 000	137 000	1 600	2 100
100	180	83	67	3	1	440	675	45 000	68 500	1 700	
105											

4T-430215	85	124	5	2	0.6	61.5	0.44	1.55	2.31	1.52	2.99
432215U	85	125	6	2	0.6	67	0.44	1.55	2.31	1.52	3.68
430315DU	89	151	14	2.5	1	107	0.83	0.82	1.22	0.80	7.31
430315XU	89	149	9	2.5	1	70.5	0.35	1.96	2.91	1.91	7.71
432315U	89	149	13	2.5	1	87.5	0.35	1.96	2.91	1.91	11.5
430216XU	92	132	6	2	0.6	63	0.42	1.61	2.39	1.57	3.65
432216XU	92	134	7	2	0.6	69.5	0.42	1.61	2.39	1.57	4.58
430316DU	94	159	15.5	2.5	1	114	0.83	0.82	1.22	0.80	8.99
430316XU	94	159	9.5	2.5	1	75.5	0.35	1.96	2.91	1.91	9.55
432316U	94	159	13.5	2.5	1	90.5	0.35	1.96	2.91	1.91	13.6
430217XU	97	141	6.5	2	0.6	69	0.42	1.61	2.39	1.57	4.59
432217XU	97	142	8.5	2	0.6	76	0.42	1.61	2.39	1.57	5.85
430317DU	103	169	16.5	3	1	121	0.83	0.82	1.22	0.80	10.6
430317XU	103	167	10.5	3	1	80	0.35	1.96	2.91	1.91	11.2
432317U	103	167	14.5	3	1	96	0.35	1.96	2.91	1.91	15.4
430218U	102	150	6.5	2	0.6	73	0.42	1.61	2.39	1.57	5.66
432218U	102	152	8.5	2	0.6	81	0.42	1.61	2.39	1.57	7.35
430318DU	108	180	16.5								

105～140mm

105	225	116	91	4	1	750	1 060	76 000	109 000	1 400	1 900
	225	170	133	3	1	955	1 470	97 500	150 000	1 400	1 900
	180	56	50	2.5	0.6	228	340	23 300	35 000	1 600	2 200
	180	70	56	2.5	0.6	298	485	30 500	49 500	1 600	2 200
	200	92	74	3							
110											
120											
130											
140											

E B 9 0 0 9 201.738 469.921 m (0) E B 9 0 0 9 1.738 469.925 m (9) E B 9 0 0 92123.069



* 430321XU	123	209	12.5	3	1	96.5	0.35	1.96	2.91	1.91	21.0
432321	119	208	18.5	2.5	1	117.5	0.35	1.96	2.90	1.91	30.2
413122	122	169	3	2	0.6	66.5	0.40	1.68	2.50	1.64	5.20
423122	122	166	7	2	0.6	66.5	0.33	2.03	3.02	1.98	6.38
430222XU	124	188	9	2.5	1	90	0.42	1.61	2.39	1.57	11.4
432222XU	124	190	10	2.5	1	102	0.42	1.61	2.39	1.57	15.5
* 430322U	128	222	12.5	3	1	100	0.35	1.96	2.91	1.91	24.5
430322	128	222	12.5	3	1	97.5	0.35	1.95	2.90	1.91	22.1
432322	128	222	19.5	3	1	124	0.35	1.95	2.90	1.91	35.6
* 432322U	128	222	19.5	3	1	127	0.35	1.96	2.91	1.91	38.2
413024	132	171	2.5	2	0.6	59	0.37	1.80	2.69	1.76	3.85
423024	132	170	6	2	0.6	66	0.37	1.80	2.69	1.76	4.41
413124	132	184	3.5	2	0.6	76.5	0.43	1.57	2.34	1.53	7.24
423124	132	188	8	2	0.6	76.5	0.37	1.80	2.69	1.76	8.96
430224XU	134	203	9.5	2.5	1	98	0.44	1.55	2.31	1.52	13.6
432224XU	134	204	11.5	2.5	1	112	0.44	1.55	2.31	1.52	18.9
430324XU	138	239	13.5	3	1	107	0.35	1.96	2.91	1.91	30.5
430324X	138	239	13.5	3	1	106	0.35	1.95	2.90	1.91	29.4
432324U	138	239	21.5	3	1	130	0.35	1.96	2.91	1.91	47.0
413026	142	186	3	2	0.6	66	0.37	1.80	2.69	1.76	5.55
423026	142	189	6.5	2	0.6	71.5	0.37	1.80	2.69	1.76	6.62
413126	142	196	3.5	2	0.6	69	0.33	2.03	3.02	1.98	7.83
423126	142	198	8	2	0.6	79.5	0.37	1.80	2.69	1.76	9.77
430226XU	148	218	9.5	3	1	102	0.44	1.55	2.31	1.52	15.9
432226XU	148	219	13.5	3	1	124	0.44	1.55	2.31	1.52	24.1
430326XU	152	255	14.5	4	1.5	116	0.35	1.96	2.91	1.91	37.9
413028	152	199	3	2	0.6	68.5	0.37	1.80	2.69	1.76	5.88
423028	152	197	6.5	2	0.6	75	0.37	1.84	2.74	1.80	7.11
413128	154	210	3.5	2.5	1	73.5	0.33	2.03	3.02	1.98	9.18
423128	154	209	8	2.5	1	88	0.37	1.80	2.69	1.76	11.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
* 430228XU	158	237	9.5	3	1	107	0.44	1.55	2.31	1.52	19.9
432228XU	158	238	13.5	3	1	131	0.44	1.55	2.31	1.52	30.1
* 430328XU	162	273	14.5	4	1.5	123	0.35	1.96	2.91	1.91	46.6
430328X	162	272	14.5	4	1.5	123	0.35	1.95	2.90	1.91	44.4

150～190mm

150	225	56	50	3	1	274	430	27 900	44 000	1 200	1 600
	225	70	56	3	1	355	630	36 000	64 500		
160											
170											
180											
190											

* 413030	164	213	3	2.5	1	73.5	0.37	1.80	2.69	1.76	6.66
423030	164	212	7	2.5	1	79.5	0.37	1.80	2.69	1.76	8.76
413130	164	231	4.5	2.5	1	82.5	0.33	2.03	3.02	1.98	14.3
423130	164	234	10	2.5	1	96.5	0.37	1.80	2.69	1.76	18.0
430230U	168	255	11	3	1	114	0.44	1.55	2.31	1.52	24.4
432230XU	168	254	17	3	1	139	0.44	1.55	2.31	1.52	37.3
* 430330U	172	292	17	4	1.5	132	0.35	1.96	2.91	1.91	55.4
430330	172	292	17	4	1.5	135	0.37	1.80	2.69	1.76	52.8
413032	174	227	3.5	2.5	1	79	0.37	1.80	2.69	1.76	8.29
423032	174	227	7.5	2.5	1	85.5	0.37	1.80	2.69	1.76	10.7
413132E1	174	254	5	2.5	1	98.5	0.40	1.68	2.50	1.64	18.2
423132E1	174	250	11	2.5	1	106	0.37	1.80	2.69	1.76	22.8
430232U	178	272	12	3	1	122	0.44	1.55	2.31	1.52	31.9
432232U	178	275	17	3	1	150	0.44	1.55	2.31	1.52	46.9
* 430332XU	182	310	17	4	1.5	138	0.35	1.96	2.91	1.91	65.5
430332X	182	311	17	4	1.5	141	0.37	1.80	2.69	1.76	62.4
413034	184	242	3.5	2.5	1	86.5	0.37	1.80	2.69	1.76	11.6
423034	184	244	8.5	2.5	1	93.5	0.37	1.80	2.69	1.76	14.3
413134E1	184	260	5	2.5	1	104	0.40	1.68	2.50	1.64	19.5
423134E1	184	260	11	2.5	1	109	0.37	1.80	2.69	1.76	24.7
430234U	192	288	14	4	1.5	132	0.44	1.55	2.31	1.52	38.0
432234XU	192	293	20	4	1.5	160	0.44	1.55	2.31	1.52	58.2
413036E1	194	260	4	2.5	1	94	0.37	1.80	2.69	1.76	

200～340mm

413040E1	214	288	4.5	2.5	1	101	0.37	1.80	2.69	1.76	20.6
423040E1	214	291	10.5	2.5	1	112	0.37	1.80	2.69	1.76	25.7
413140	218	320	6	3	1.5	125	0.40	1.68	2.50	1.64	38.6
423140	218	316	14	3	1.5	134	0.37	1.80	2.69	1.76	47.5
430240U	222	336	16	4	1.5	154	0.44	1.55	2.31	1.52	62.8
∗ **432240U**	222	340	22	4	1.5	180	0.41	1.66	2.47	1.62	95.2
432240	222	340	22	4	1.5	193	0.49	1.38	2.06	1.35	90.7
413044E1	238	318	5	3	1.5	112	0.37	1.80	2.69	1.76	26.7
423044E1	238	319	11.5	3	1.5	125	0.37	1.80	2.69	1.76	33.3
413144	242	346	6.5	4	1.5	135	0.40	1.68	2.50	1.64	47.8
423144	242	341	15	4	1.5	154	0.40	1.68	2.50	1.64	59.6
413048E1	258	339	5	3	1.5	117	0.37	1.80	2.69		

340～480mm

340

360

380

400

420

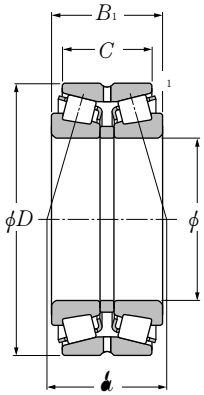
440

460

480

423068	368	489	16	5	2	184	0.37	1.80	2.69	1.76	113
413168	368	548	10.5	5	2	213	0.40	1.68	2.50	1.64	188
423168	368	542	24	5	2	237	0.40	1.68	2.50	1.64	235
413072	388	507	7	5	2	176	0.37	1.80	2.69	1.76	92.7
423072	388	509	17.5	5	2	192	0.37	1.80	2.69	1.76	120
413172	388	561	10.5	5	2	219	0.40	1.68	2.50	1.64	199
423172	388	560	24	5	2	240	0.40	1.68	2.50	1.64	248
413076	408	528	6.5	5	2	183	0.37	1.80	2.69	1.76	95.9
423076	408	529	18	5	2	196	0.37	1.80	2.69	1.76	126
413176	408	583	10.5	5	2	225	0.40	1.68	2.50	1.64	210
423176	408	578	24.5	5	2	249	0.40	1.68	2.50	1.64	262
413080	428	564	8	5	2	194	0.37	1.80	2.69	1.76	105
423080	428	564									

Back-to-back arrangement



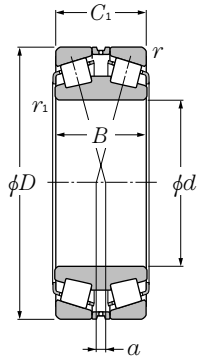
500mm

	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Limiting speeds min^{-1}	
	D	B_1	C	$_{s\,min}$[1]	$_{1s\,min}$[1]	C_r	C_{or}	C_r	C_{or}	grease	oil
500	720	167	149	6	3	2 610	5 400	266 000	550 000	320	420
	720	209	167	6	3	3 050	6 900	315 000	700 000	320	420
	830	264	235	7.5	4	5 200	10 500	530 000	1 070 000	290	390
	830	330	264	7.5	4	6 400	14 000	650 000	1 420 000	290	390

1) Minimum allowable dimension for chamfer dimension or $_1$.

d 11～28mm

110
120
130
140
150
160
170
180
190
200
220
240
260
280

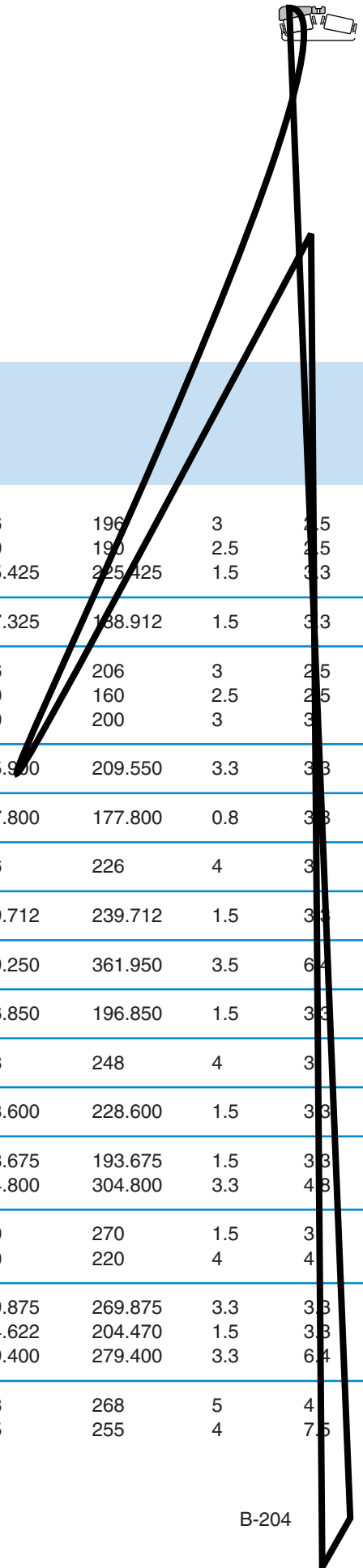


d 28～5 mm

	Boundary dimensions					Basic load ratings t t		t t		Limiting speeds -1	
d	D	B	C_1	$r_{1s\,min}$ [1)]	$r_{s\,min}$ [1)]	C_r	C_{or}	C_r	C_{or}		
280	0	1	1			1 0	0	1 000	000	0	0
300	0 00	11 1 0	11 1 0			1 10 2 100	1 0 0 0	1 000 21 000	20 000 1 000	0 0	0 10
320	0 0	121 1	121 1			1 0 2 00	100 00	1 2 000 2 000	1 000 00 000	0 00	10 0
340	20 0	1 1 0	1 1 0			1 0 0	0 00	1 000 000	0 000 0 000	00 0	0 20
360	0 00	1 1 2	1 1 2			2 0 0 200	200 00	20 000 2 000	0 000 0 000	0 0	20 0
380	0 20	1 1	1 1			2 0 0 0	0 00	21 000 0 000	000 000	0 10	0 0
400	00 0	1 200	1 200			2 0 0	0 0	2 000 000	000 00 000	10 0	0 10
420	20 00	1 0 22	1 0 22			2 0 00	00 00	2 0 000 0 000	00 000 0 000	0 0	20 0
440	0 20	1 22	1 22			2 00 000	0 10 00	2 000 10 000	0 000 1 0 0 000	0 0	0 0
460	0 0	1 2 0	1 2 0	.	.	0 0 00	00 10 00	10 000 00 000	0 000 1 0 0 000	0 20	0 0
480	00 0	1 2	1 2	.	.	0 0 00	00 11 100	10 000 0 000	000 1 1 0 000	0 10	0 10
500	20 0	1 2	1 2	.	.	0 0 00	00 1 000	1 000 0 000	00 000 1 20 000	20 2 0	20 0

1 387137

				3				
			174.625	1.5	1.5			
			165	3	2.5	775		
			173	2.5	2.5	1 100	2 27	
			275	0.8	3.3	745	2 220	76 0
				3	2.5	835	2 200	85 500
				2.5	2.5	1 150	2 420	117 000
								224 0
								247 000
	7.650	1		1.5	3.3	1 000	2 760	102 000
	279.400	23		5	3.3	1 420	3 400	145 000
	304.800	238			3.3	1 580	3 100	161 000
	254	185			2.5	910	2 390	93 000
	300	280			3	2 160	4 800	220 000
								281 000
								345 000
								320 000
								244 000
								490 000
187.325	269.875	211.138			3	1 240	3 400	127 000
								345 000



d 190～260mm

190	268	196	196	3	2.5	1 060	2 850	108 000	291 000
	270	190	190	2.5	2.5	1 080	2 940	111 000	300 000
	292.100	225.425	225.425	1.5	3.3	1 570	4 150	160 000	425 000
190.500	266.700	187.325	188.912	1.5	3.3	1 040	2 990	106 000	305 000
200	282	206	206	3	2.5	1 200	3 300	122 000	335 000
	290	160	160	2.5	2.5	925	2 210	94 500	226 000
	310	200	200	3	3	1 360	2 980	138 000	305 000
203.200	317.500	215.900	209.550	3.3	3.3	1 270	2 820	129 000	288 000
215.900	288.925	177.800	177.800	0.8	3.3	1 090	3 100	111 000	315 000
220	310	226	226	4	3	1 380	3 800	141 000	385 000
220.662	314.325	239.712	239.712	1.5	3.3	1 840	4 900	187 000	500 000
228.600	425.450	349.250	361.950	3.5	6.4	3 450	8 250	355 000	845 000
234.950	327.025	196.850	196.850	1.5	3.3	1 370	3 700	140 000	380 000
240	338	248	248	4	3	1 870	4 950	191 000	505 000
241.478	350.838	228.600	228.600	1.5	3.3	1 610	4 000	164 000	410 000
244.475	327.025	193.675	193.675	1.5	3.3	1 430	4 100	146 000	415 000
	381.000	304.800	304.800	3.3	4.8	2 220	5 750	227 000	590 000
250	365	270	270	1.5	3	2 150	6 150	219 000	630 000
	370	220	220	4	4	2 050	5 750	209 000	590 000
254	358.775	269.875	269.875	3.3	3.3	2 390	6 550	244 000	670 000
	368.300	204.622	204.470	1.5	3.3	1 350	3 250	138 000	330 000
	444.500	279.400	279.400	3.3	6.4	2 890	5 900	294 000	600 000
260	368	268	268	5	4	1 990	5 700	203 000	580 000
	400	255	255	4	7.5	2 210	5 300	225 000	540 000

Bearing numbers	Abutment and fillet dimensions mm			Mass kg
	d	D		(approx.)
E-625938	209	245.5	6	34.7
E-CRO-3812	205	250	6	34.7
∗ E-M241538D/M241510/M241510D	222	271	5	59.6
∗ T-E-67885D/67820/67820D	204	246	3	33.6
E-625940	219.5	258	6	40.5
E-CRO-4013	221	271	5	35.1
E-CRO-4014	222	284	6	48.4
∗ E-EE132082D/132125/132126D	224	294	9.5	62.5
∗ E-LM742749D/LM742714/LM742714D	227	267	5	34.3
E-625944	242	284.5	6	53.5
∗ T-E-M244249D/M244210/M244210D	235	293	4	60.2
∗ E-EE700090D/700167/700168D	263	381	3	232
∗ T-E-8576D/8520/8520D	250	305	5	53.6
E-625948A	260.5	312	6	70
∗ E-EE127097D/127137/127137D	262	325	6.5	76.4
∗ E-LM247748D/LM247710/LM247710DA	257	310	5	46.1
∗ E-EE126096D/126150/126151D	262	343	6.5	132
E-CRO-5004	275	339	5	82.1
E-CRO-5001	276	344	6	87
∗ T-E-M249748D/M249710/M249710D	272.5	335	5	85.6
∗ E-EE171000D/171450/171451D	269	340	6	71.8
∗ E-EE822101D/822175/822176D	289	406	8	185
E-625952	287	338.5	6	90.3
E-CRO-5215	290	359	8	106

Note: 1. Bearing numbers marked " ∗ " designate inch series bearings.

d 260.350～304.800mm

260.350
266.700
269.875
270
275
276.225
279.400

d 304.800～360mm

304.800	495.300	342.900	349.250	3.3	6.4
304.902					
305.003					
317.500					
320					
330					
330.200					
333.375					
340					
341.312					
342.900					
343.052					
346.075					
347.662					
355					
355.600					
360					

d 368.300～447.675mm

368.300	523.875	382.588	382.588	3.3	6.4	4 450	13 100	455 000	1 330 000
374.650	501.650	250.825	260.350	1.5	3.3	2 360	6 250	241 000	640 000
380	536 560	390 285	390 285	6 5	5 5	4 900 3 250	14 100 7 700	500 000 330 000	1 440 000 785 000
384.175	546.100	400.050	400.050	3.3	6.4	5 400	16 100	550 000	1 640 000
385.762	514.350	317.500	317.500	3.3	3.3	3 650	11 100	370 000	1 130 000
393.700	546.100	288.925	288.925	1.5	6.4	3 200	10 200	325 000	1 040 000
395									
400									
406.400									
409.575									
415.925									
420									
431.800									
432.003									
440									
447.675									

Bearing numbers	Abutment and fillet dimensions mm			Mass kg
	d	D		(approx.)
☆✳ E-HM265049D/HM265010/HM265010DG2	393.7	487	6	280
✳ E-LM765149D/LM765110/LM765110D	393	472	2	145
E-625976	410	495	8	277
E-CRO-7612	417	525	7	208
☆✳ T-E-HM266449D/HM266410/HM266410DG2	411	507	6.5	312
✳ E-LM665949D/LM665910/LM665910D	409	482	7	240
✳ E-LM767745D/LM767710/LM767710D	418	510	6.5	219
E-CRO-7901	434	508	3	200
☆ E-CRO-8005	436	515	8	300
E-625980	434	518.5	7	324
✳ E-LM767749D/LM767710/LM767710D	427	510	6.5	201
✳ E-EE833161D/833232/833233D	448	549	6.5	395
✳ E-EE911603D/912400/912401D	441	568	1.5	332
☆✳ E-M667947D/M667911/M667911DG2	431	510	5.5	226
☆✳ T-E-M268749D/M268710/M268710DG2	444	549	9	421
E-625984	457	545	7	374
E-CRO-8402	455	593	8	600
✳ J-E-LM869449D/LM869410/LM869410D	453	537	8	198
✳ E-LM769349D/LM769310/LM769310D	453	534	6.5	232
✳ E-EE736173D/736238/736239D	464	572	6.5	297
E-625988	479	572.5	8	430
☆ E-CRO-8807	484	607	9	400
E-CRO-8806	483	595	11	600
☆✳ E-M270749D/M270710/M270710DAG2	478	591	8	509

Note: 1. Bearing numbers marked " ✳ " designate inch series bearings.
2. Bearing numbers marked " ☆ " designate bearing with hollow rollers and pin type cages.

d 457.200～571.500mm

457.200	596.900 660.400	276.225 323.850	279.400 323.847	1.5 3.3	3.3 6.4	3 350 4 150	10 300 11 200	360 000 425 000	1 060 000 1 140 000
460	650	474	474	6	6	6 500	19 900	665 000	2 030 000
475	660	450	450	3	5	6 300	20 400	645 000	2 080 000
480	678 700	494 390	494 390	6 6	6 6	6 250 4 700	19 600 13 400	640 000 480 000	2 000 000 1 370 000
482.600	615.950	330.200	330.200	3.3	6.4	4 000	13 400	405 000	1 370 000
488.950	660.400	365.125	361.950	8	6.4	5 350	16 100	550 000	1 640 000
489.026	634.873	320.675	320.675	3.3	3.3	3 650	12 000	370 000	1 220 000
500	670 690 705 730	515 480 515 440	515 480 515 440	1.5 5 6 6	5 5 6 6	6 900 6 000 8 450 7 200	24 600 19 900 27 100 20 600	700 000 610 000 860 000 735 000	2 510 000 2 020 000 2 760 000 2 100 000
501.650	711.200	520.700	520.700	3.3	6.4	8 650	27 300	885 000	2 790 000
514.350	673.100	422.275	422.275	3.3	6.4	5 950	20 500	605 000	2 090 000
519.112	736.600	536.575	536.575	3.3	6.4	9 100	28 700	925 000	2 930 000
520	735								
536.575									
558.800									
570									
571.500									

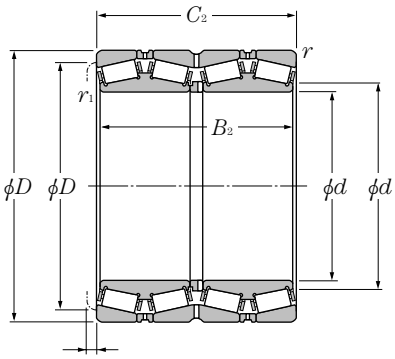
Bearing numbers	Abutment and fillet dimensions mm			Mass kg
	d	D		(approx.)
☆✳ E-L770849D/L770810/L770810DG2	478	567	5.5	209
✳ E-EE737179D/737260/737260D	495	616	6.5	379
E-625992A	499	598.5	7	493
E-CRO-9501	506	614	10	465
E-625996	525	623	7	563
E-CRO-9602	517	645	8	436
☆✳ E-LM272249D/LM272210/LM272210DG2	504	585	6.5	250
☆✳ T-E-EE640193D/640260/640261DG2	519	624	9	364
✳ E-LM772749D/LM772710/LM772710DA	513	600	6.5	268
E-CRO-10008	520	616	8	598
E-CRO-10005	530	640	7	600
☆ E-6259/500	553	649.5	7.5	632
☆ E-CRO-10003	550	683	11	535
☆✳ E-M274149D/M274110/M274110DG2	534	663	9.5	726
✳ E-LM274449D/LM274410/LM274410D	540	648	8	390
☆✳ E-M275349D/M275310/M275310DG2	552	684	9.5	761
☆ E-CRO-10402	558	688	11	750
☆✳ E-M276449D/M276410/M276410DG2	564	711	9.5	890
✳ E-EE843221D/843290/843291D	585	699	8.5	388
☆✳ E-LM377449D/LM377410/LM377410DG2	588	696	8	502
☆ E-CRO-11402	609	733	7.5	625
☆ E-CRO-11403	620	760	10	845
☆✳ E-M278749D/M278710/M278710DAG2	609	756	11	1 080

Note: 1. Bearing numbers marked " ✳ " designate inch series bearings.
2. Bearing numbers marked " ☆ " designate bearing with hollow rollers and pin type cages.

d 584.200～840mm

584.200	762.000	396.875	401.638	3.3	6.4	6 550	22 300	670 000	2 280 000
585.788	771.525	479.425	479.425	3.3	6.4	8 550	29 000	875 000	2 960 000
595.312	844.550	615.950	615.950	3.3	6.4	12 600	40 500	1 290 000	4 100 000
609.600	787.400	361.950	361.950	3.3	6.4	6 450	20 300	655 000	2 070 000
657.225	933.450	676.275	676.275	3.3	6.4	15 300	48 000	1 560 000	4 900 000
660	1 070	642	642	7.5	7.5	15 400	43 500	1 570 000	4 450 000
660.400	812.800	365.125	365.125	3.3	6.4	6 200	23 200	630 000	2 360 000
679.450	901.700	552.450	552.450	3.3	6.4	11 200	38 000	1 140 000	3 900 000
680	870	460	460	3	6	7 500	27 400	765 000	2 790 000
682.625	965.200	701.675	701.675	3.3	6.4	16 100	50 500	1 640 000	5 150 000
685.800	876.300	352.425	355.600	3.3	6.4	6 050	21 800	615 000	2 220 000
710	900	410	410	2.5	5	7 650	26 900	780 000	2 740 000
711.200	914.400	317.500	317.500	3.3	6.4	5 350	17 900	545 000	1 820 000
730	1 070	642	642	7.5	7.5	15 400	46 500	1 570 000	4 750 000
730.250	1 035.050	755.650	755.650	3.3	6.4	18 100	59 500	1 850 000	6 050 000
749.300	990.600	605.000	605.000	3.3	6.4	12 600	45 500	1 290 000	4 650 000
762.000	1 079.500	787.400	787.400	4.8	12.7	19 200	65 000	1 960 000	6 600 000
800	1 120	820	820	7	7.5	21 000	72 500	2 140 000	7 400 000
825.500	1 168.400	844.550	844.550	4.8	12.7	22 300	76 500	2 270 000	7 800 000
840	1 170	840	840						

☆✳ **E-LM778549D/LM778510/LM778510DG2**	615	717	7	511
✳ **E-LM278849D/LM278810/LM278810D**	615			

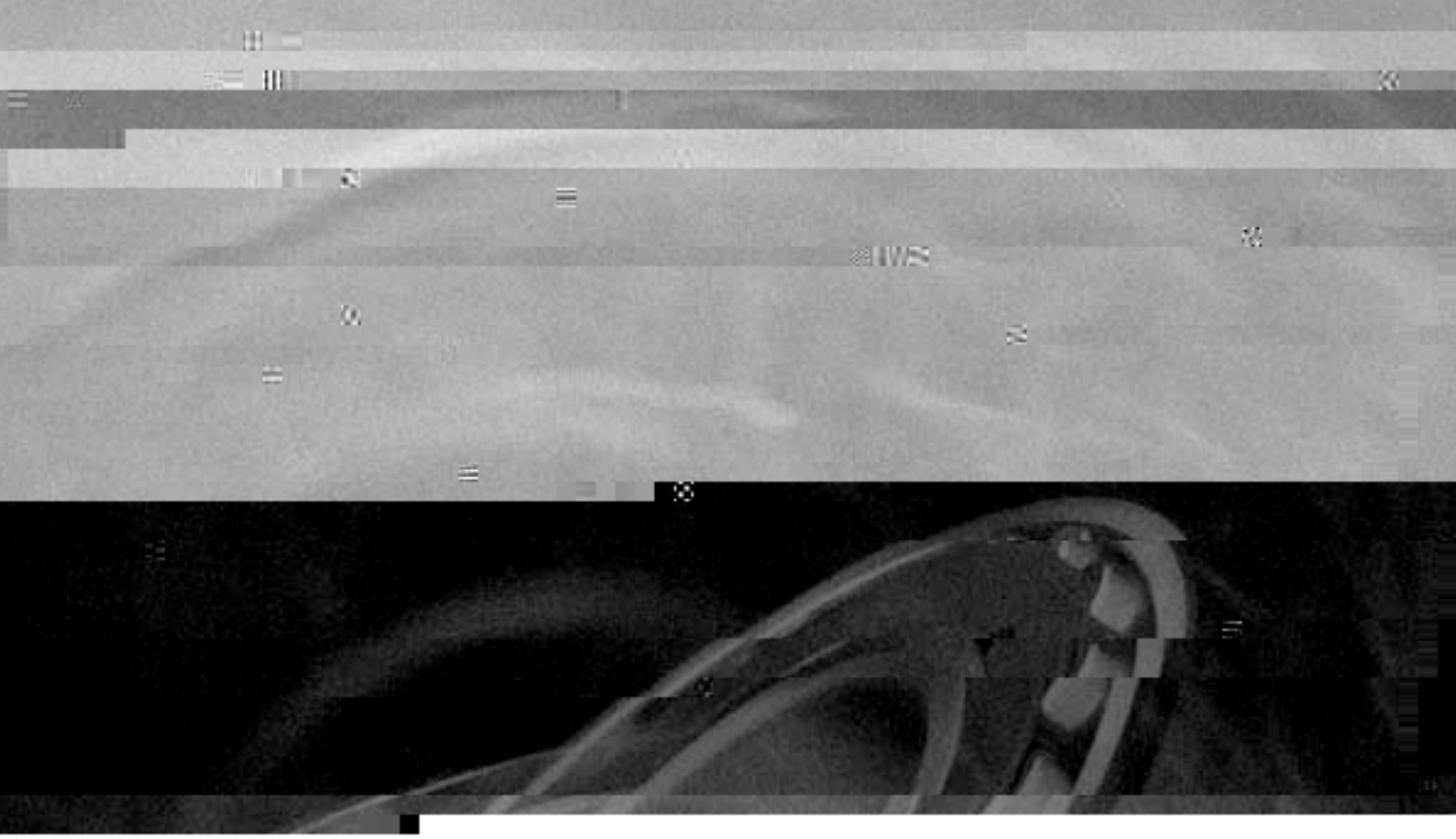


d 863.600～1 200.150mm

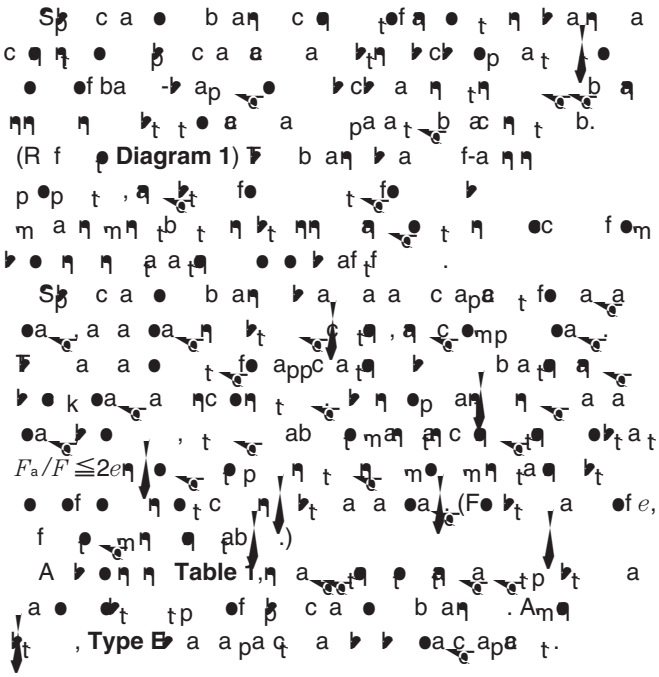
Boundary dimensions mm						Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf
d	D	B_2	C_2	$r_{1s\,min}$ 1)	$r_{s\,min}$ 1)	C_r	C_{or}	C_r	C_{or}
863.600	1 130.300	669.925	669.925	4.8	12.7	15 800	59 500	1 610 000	6 050 000
	1 219.200	876.300	889.000	4.8	12.7	24 100	83 000	2 450 000	8 450 000
938.212	1 270.000	825.500	825.500	4.8	12.7	22 500	80 000	2 300 000	8 150 000
950	1 360	880	880	4	7.5	27 000	89 000	2 750 000	9 050 000
1 200.150	1 593.850	990.600	990.600	4.8	12.7	33 500	132 000	3 400 000	13 500 000

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

Bearing numbers	Abutment and fillet dimensions			
☆✳ **E-LM286249D/LM286210/LM286210DG2** ☆✳ **E-EE547341D/547480/547481DG2**	906 918	1 065 1 135	11 6.5	1 950 3 640
☆✳ **E-LM287649D/LM287610/LM287610DG2**	990	1 190	10	4 100
☆ **E-CRO-19001**	1 030	1 278	12	4 100
☆✳ **E-LM288949D/LM288910/LM288910DG2**	1 260	1 500	13	6 130



1. Types, construction and characteristics

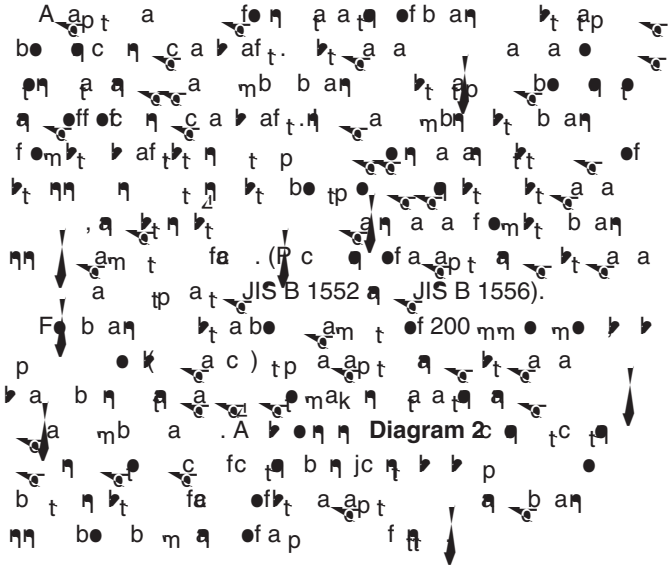


Type	Standard type (B type)	C type	213 type	E type
Construction				
Bearing series				
Rollers				
Roller guide method				
cage type				

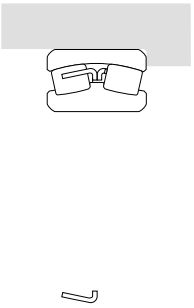
mm

Nominal bearing width		Oil groove width	Oil inlet diameter	Oil groove depth	
		W_o	d_o	h	
				Width series 1, 2, 3	Width series 4
—	30	6			
30	45	7			
45	60	9			
60	80	11			
80	100	14			
100	120	16			
120	160				
160	200				
200	315				
315	—				

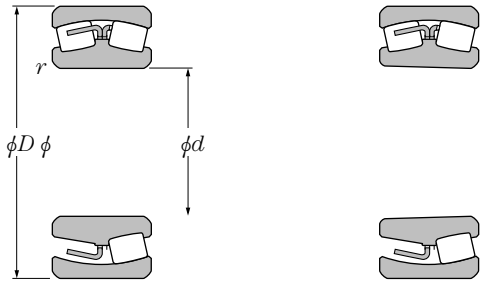
5. Adapters and withdrawal sleeves



d 25～75mm



31	—	—	46	1	0.35	1.92	2.86	1.88	0.186	0.182
36	—	—	56	1	0.33	2.07	3.09	2.03	0.287	0.282
42	—	—	65	1	0.32	2.09	3.11	2.04	0.446	0.437
47	—	—	73	1	0.29	2.35	3.50	2.30	0.526	0.515
48.5	—	—	81.5	1.5	0.26	2.55	3.80	2.50	0.705	0.694
48.5	—	—	81.5	1.5	0.38	1.76	2.62	1.72	0.974	0.951
52	—	—	78	1	0.27	2.50	3.72	2.44	0.584	0.572
53.5	—	—	91.5	1.5	0.26	2.60	3.87	2.54	0.927	0.912
53.5	—	—	91.5	1.5	0.36	1.86	2.77	1.82	1.33	1.3
57	—	—	83	1	0.25	2.69	4.01	2.63	0.63	0.616
60	—	—	100	2	0.26	2.64	3.93	2.58	1.21	1.19
60	—	—	100	2	0.37	1.80	2.69	1.76	1.79	1.75
63.5	67	89.5	91.5	1.5	0.24	2.83	4.21	2.76	0.808	0.79
63.5	—	—	91.5	1.5	0.28	2.42	3.61	2.37	0.85	0.832
65	—	—	110	2	0.25	2.69	4.01	2.63	1.71	1.69
65	—	—	110	2	0.40	1.68	2.50	1.64	2.3	2.25
68.5	72	98	101.5	1.5	0.25	2.75	4.09	2.69	1.09	1.07
68.5	—	—	101.5	1.5	0.27	2.49	3.71	2.44	1.15	1.13
72	—	—	118	2	0.25	2.69	4.00	2.63	2.1	2.07
72	—	—	118	2	0.42	1.62	2.42	1.59	2.9	2.83
73.5	78.5	107	111.5	1.5	0.25	2.71	4.04	2.65	1.43	1.4
73.5	—	—	111.5	1.5	0.28	2.42	3.60	2.37	1.5	1.47
77	—	—	128	2	0.25	2.69	4.00	2.63	2.55	2.51
77	—	—	128	2	0.38	1.79	2.67	1.75	3.45	3.37
78.5	83.5	112.5	116.5	1.5	0.24	2.86	4.25	2.79	1.51	1.47
78.5	—	—	116.5	1.5	0.26	2.55	3.80	2.50	1.55	1.52
82	—	—	138	2	0.25	2.69	4.00	2.63	3.18	3.14
82	—	—	138	2	0.37	1.81	2.70	1.77	4.22	4.12
83.5	89	117.5	121.5	1.5	0.22	3.00	4.47	2.94	1.59	1.55



d 75～120mm

Boundary dimensions mm				Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Limiting speeds[1] min^{-1}		Bearing numbers[4] cylindrical bore	Bearing numbers[4] tapered[2] bore
d	D	E	$r_{s\,min}$[3]	C_r	C_{or}	C_r	C_{or}	grease	oil		
75	130	31	1.5	166	223	16 900	22 800	3 200	4 200	LH-22215B	LH-22215BK
	160	37	2.1	239	287	24 300	29 300	2 700	3 500	21315	21315K
	160	55	2.1	330	410	33 500	42 000	2 500	3 200	22315B	22315BK
80	140	33	2	213	277	21 700	28 200	3 000	4 000	LH-22216E	LH-22216EK
	140	33	2	179	239	18 300	24 400	3 100	4 000	LH-22216B	LH-22216BK
	170	39	2.1	260	315	26 500	32 000	2 500	3 300	21316	21316K
	170	58	2.1	385	470	39 500	48 000	2 300	3 000	22316B	22316BK
85	150	36	2	251	320	25 600	33 000	2 800	3 800	LH-22217E	LH-22217EK
	150	36	2	206	272	21 000	27 800	2 900	3 800	LH-22217B	LH-22217BK
	180	41	3	289	355	29 500	36 000	2 400	3 100	21317	21317K
	180	60	3	415	510	42 500	52 000	2 200	2 900	22317B	22317BK
90	160	40	2	292	385	29 800	39 500	2 600	3 500	LH-22218E	LH-22218EK
	160	40	2	256	345	26 200	35 000	2 700	3 500	LH-22218B	LH-22218BK
	160	52.4	2	315	455	32 500	46 500	2 200	2 800	23218B	23218BK
	190	43	3	320	400	32 500	40 500	2 300	3 000	21318	21318K
	190	64	3	480	590	49 000	60 000	2 100	2 700	22318B	22318BK
95	170	43	2.1	294	390	30 000	39 500	2 500	3 300	22219B	22219BK
	200	45	3	335	420	34 000	43 000	2 100	2 700	21319	21319K
	200	67	3	500	615	51 000	63 000	1 900	2 500	22319B	22319BK
100	165	52	2	310	470	31 500	47 500	2 000	2 600	23120B	23120BK
	180	46	2.1	315	415	32 000	42 500	2 400	3 200	22220B	22220BK
	180	60.3	2.1	405	580	41 500	59 000	1 900	2 500	23220B	23220BK
	215	47	3	370	465	37 500	47 500	2 000	2 600	21320	21320K
	215	73	3	605	755	61 500	77 000	1 800	2 400	22320B	22320BK
110	170	45	2	282	455	28 800	46 500	2 200	2 800	23022B	23022BK
	180	56	2	370	580	37 500	59 500	1 800	2 400	23122B	23122BK
	180	69	2	450	755	46 000	77 000	1 800	2 400	24122B	24122BK30
	200	53	2.1	410	570	42 000	58 000	2 200	2 800	22222B	22222BK
	200	69.8	2.1	515	760	52 500	77 500	1 700	2 200	23222B	23222BK
	240	50	3	495	615	50 500	62 500	1 800	2 300	21322	21322K
	240	80	3	745	930	76 000	95 000	1 700	2 200	22322B	22322BK
120	180	46	2	296	495	30 000	50 500	2 000	2 600	23024B	23024BK

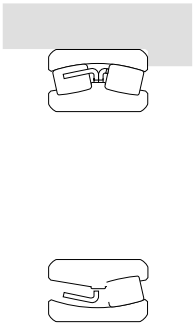
1) This value was achieved with machined cages and molded resin cages; for pressed cages, 75% of this value is allowable.
2) Bearings appended with "**K**" have a tapered bore ratio of 1:12. 3) Smallest allowable dimension for chamfer dimension r.
4) Bearing number with the prefix **LH** indicates LH series.

83.5	—	—	121.5	1.5	0.24	2.81	4.19	2.75	1.65	1.61
87	—	—	148	2	0.24	2.84	4.23	2.78	3.81	3.76
87	—	—	148	2	0.37	1.80	2.69	1.76	5.25	5.13
90	94.5	125.5	130	2	0.22	3.01	4.48	2.94	1.99	1.94
90	—	—	130	2	0.26	2.64	3.93	2.58	2.15	2.11
92	—	—	158	2	0.23	2.95	4.39	2.88	4.53	4.47
92	—	—	158	2	0.37	1.80	2.69	1.76	6.05	5.91
95	100.5	135	140	2	0.23	2.96	4.41	2.90	2.49	2.43
95	—	—	140	2	0.26	2.60	3.88	2.55	2.66	2.61
99	—	—	166	2.5	0.25	2.69	4.00	2.63	5.35	5.28
99	—	—	166	2.5	0.37	1.82	2.71	1.78	7.1	6.94
100	107.5	144	150	2	0.24	2.86	4.25	2.79	3.24	3.16
100	—	—	150	2	0.26	2.55	3.80	2.49	3.5	3.42
100	—	—	150	2	0.33	2.04	3.03	1.99	4.45	4.32
104	—	—	176	2.5	0.24	2.83	4.22	2.77	6.3	6.21
104	—	—	176	2.5	0.37	1.80	2.69	1.76	8.35	8.16
107	—	—	158	2	0.26	2.63	3.92	2.57	4.1	4.01
109	—	—	186	2.5	0.23	3.00	4.46	2.93	7.1	7
109	—	—	186	2.5	0.37	1.80	2.69	1.76	9.76	9.54
110	—	—	155	2	0.32	2.12	3.15	2.07	4.3	4.16
112	—	—	168	2	0.26	2.55	3.80	2.49	4.95	4.84
112	—	—	168	2	0.34	1.98	2.94	1.93	6.47	6.28
114	—	—	201	2.5	0.22	3.01	4.48	2.94	8.89	8.78
114	—	—	201	2.5	0.37	1.80	2.69	1.76	12.4	12.1
120	—	—	160	2	0.26	2.59	3.85	2.53	3.71	3.58
120	—	—	170	2	0.31	2.17	3.24	2.13	5.4	5.22
120	—	—	170	2	0.38	1.76	2.63	1.73	7.07	6.96
122	—	—	188	2	0.27	2.51	3.74	2.46	7.2	7.04
122	—	—	188	2	0.35	1.91	2.84	1.86	9.71	9.43
124	—	—	226	2.5	0.21	3.20	4.77	3.13	11.2	11.1
124	—	—	226	2.5	0.36	1.87	2.79	1.83	17.1	16.7
130	—	—	170	2	0.25	2.69	4.01	2.63	4.05	3.9

Note: Upon request, bearings with oil inlets and oil grooves on the outer ring can also be manufactured. In such cases, please add the suffix "**D1**" to the end of the bearing number.

d 120～160mm

120	180	60	2	390	670	39 500	68 500	1 800	2 300	**24024B**	**24024BK30**
	180	60	2	395	695	40 000	71 000	1 800	2 300	**24024C**	**24024CK30**
	200	62	2	455	705	46 500	71 500	1 600	2 100	**23124B**	**23124BK**
	200	80	2	575	945	58 500	96 500	1 600	2 100	**24124B**	**24124BK30**
	215	58	2.1	485	700	49 500	71 500	2 000	2 600	**22224B**	**22224BK**
	215	76	2.1	585	880	59 500	89 500	1 500	2 000	**23224B**	**23224BK**
	260	86	3	880	1 120	89 500	114 000	1 500	2 000	**22324B**	**22324BK**
130	200	52	2	375	620	38 500	63 500	1 800	2 300	**23026B**	**23026BK**
	200	69	2	505	895	51 500	91 000	1 600	2 100	**24026B**	**24026BK30**
	200	69	2	490	860	50 000	87 500	1 600	2 100	**24026C**	**24026CK30**
	210	64	2	495	795	50 500	81 000	1 500	2 000	**23126B**	**23126BK**
	210	80	2	585	995	60 000	102 000	1 500	2 000	**24126B**	**24126BK30**
	230	64	3	570	790	58 000	80 500	1 800	2 400	**22226B**	**22226BK**
	230	80	3	685	1 060	70 000	108 000	1 500	1 900	**23226B**	**23226BK**
	280	93	4	1 000	1 290	102 000	131 000	1 400	1 800	**22326B**	**22326BK**
140	210	53	2	405	690	41 000	70 500	1 700	2 200	**23028B**	**23028BK**
	210	69	2	510	945	52 000	96 500	1 500	1 900	**24028B**	**24028BK30**
	210	69	2	520	940	53 000	95 500	1 500	1 900	**24028C**	**24028CK30**
	225	68	2.1	540	895	55 000	91 000	1 400	1 800	**23128B**	**23128BK**
	225	85	2.1	670	1 150	68 500	117 000	1 400	1 800	**24128B**	**24128BK30**
	250	68	3	685	975	70 000	99 500	1 700	2 200	**22228B**	**22228BK**
	250	88	3	805	1 270	82 000	129				
150											
160											



130	170	2	0.33	2.06	3.07	2.02	5.48	5.39
130	170	2	0.32	2.12	3.15	2.07	5.48	4.91
130	190	2	0.31	2.17	3.24	2.13	7.7	7.46
130	190	2	0.40	1.68	2.50	1.64	10.3	10.1
132	203	2	0.27	2.47	3.68	2.42	9.1	8.89
132	203	2	0.36	1.89	2.82	1.85	12.1	11.7
134	246	2.5	0.37	1.80	2.69	1.76	21.5	21
140	190	2	0.26	2.63	3.92	2.57	5.9	5.69
140	190	2	0.34	1.98	2.95	1.94	8.08	7.95
140	190	2	0.32	2.12	3.15	2.07	7.91	7.78
140	200	2	0.30	2.23	3.32	2.18	8.47	8.2
140	200	2	0.38	1.78	2.65	1.74	11	10.8
144	216	2.5	0.28	2.39	3.56	2.33	11.2	10.9
144	216	2.5	0.35	1.92	2.86	1.88	14.3	13.9
148	262	3	0.37	1.81	2.69	1.77	26.8	26.2
150	200	2	0.25	2.73	4.06	2.67	6.35	6.12
150	200	2	0.32	2.09	3.12	2.05	8.57	8.43
150	200	2	0.30	2.23	3.32	2.18	8.48	7.66
152	213	2	0.30	2.25	3.35	2.20	10.2	9.86
152	213	2	0.38	1.80	2.68	1.76	13.3	13.1
154	236	2.5	0.28	2.39	3.55	2.33	14	13.7
154	236	2.5	0.36	1.90	2.83	1.86	18.8	18.2
158	282	3	0.37	1.80	2.69	1.76	33.8	33
162	213	2	0.24	2.76	4.11	2.70	7.73	7.45
162	213	2	0.33	2.06	3.07	2.02	10.7	10.5
162	213	2	0.30	2.25	3.34	2.20	10.5	10.3
162	238	2	0.32	2.11	3.15	2.06	15.6	15.1
162	238	2	0.40	1.69	2.51	1.65	20.2	20
164	256	2.5	0.27	2.46	3.66	2.4	18.1	17.7
164	256	2.5	0.36	1.88	2.79	1.83	24.1	23.4
168	302	3	0.35	1.92	2.86	1.88	42.7	41.8
170	210	2	0.18	3.69	5.49	3.61	5.5	5.33
172	228	2	0.25	2.74	4.09	2.68	9.42	9.09
172	228	2	0.32	2.10	3.13	2.06	13	12.8
172	228	2	0.31	2.18	3.24	2.13	12	11.8

Note: An oil groove is provided for outer rings of bearings with an outer diameter (D dimension) of 320 mm or more. See page **B-212** on dimensions. We can make bearings with oil hole or oil groove in the outer ring, per your request, for an outer diameter of 320mm or less. Such bearings are indicated by attaching "**D1**" to the end of the bearing number. (ex. **23032BD1**)

d 160～200mm

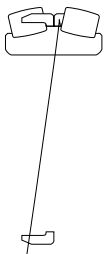
170

172	258	2	0.32	2.11	3.15	2.07	19.8	19.2
172	258	2	0.40	1.67	2.48	1.63	26	25.6
174	276	2.5	0.28	2.42	3.60	2.37	22.7	22.2
174	276	2.5	0.36	1.86	2.77	1.82	30	29.1
178	322	3	0.35	1.94	2.89	1.90	50.8	49.7
180	220	2	0.17	3.91	5.83	3.83	5.8	5.62
182	248	2	0.25	2.66	3.96	2.60	12.7	12.3
182	248	2	0.34	1.98	2.95	1.94	17.7	17.4
182	248	2	0.31	2.16	3.22	2.12	17.4	17.1
182	268	2	0.31	2.15	3.21	2.11	21.5	20.8
182	268	2	0.39	1.74	2.59	1.70	27.2	26.8
188	292	3	0.28	2.39	3.56	2.34	28	27.3
188	292	3	0.36	1.87	2.79	1.83	36.8	35.7
188	342	3	0.34	1.96	2.91	1.91	59.8	58.5
190	240	2	0.19	3.52	5.25	3.45	8.21	7.95
192	268	2	0.26	2.59	3.85	2.53	16.7	16.1
192	268	2	0.35	1.91	2.85	1.87	23.3	22.9
192	268	2	0.33	2.04	3.04	2.00	23	22.6
194	286	2.5	0.32	2.11	3.15	2.07	25.1	24.2
194	286	2.5	0.39	1.72	2.56	1.68	34.3	33.8
198	302	3	0.27	2.49	3.70	2.43	29.3	28.6
198	302	3	0.35	1.91	2.84	1.86	39	37.8
198	362	3	0.34	1.97	2.93	1.92	70	68.5
200	250	2	0.18	3.81	5.67	3.73	8.6	8.34
202	278	2	0.26	2.65	3.94	2.59	17.7	17.1
202	278	2	0.33	2.03	3.02	1.98	24.3	23.9
202	278	2	0.31	2.16	3.22	2.12	23	22.6
204	306	2.5	0.33	2.07	3.09	2.03	35.3	34.2
204	306	2.5	0.40	1.69	2.51	1.65	42.8	42.2
208	322	3	0.27	2.47	3.68	2.42	36.6	35.8
208	322	3	0.36	1.89	2.82	1.85	47.6	46.2
212	378	4	0.34	1.97	2.94	1.93	81	79.3
212	268	2						

d 200～280mm

d											
200	340	112	3	1 350	2 270	137 000	231 000	920	1 200	**23140B**	**23140BK**
	340	140	3	1 630	2 900	166 000	295 000	920	1 200	**24140B**	**24140BK30**
	360	98	4	1 310	2 010	134 000	205 000	1 100	1 500	4 **22240B**	**22240BK**
	360	128	4	1 610	2 640	165 000	269 000	920	1 200	**23240B**	**23240BK**
	420	138	5	2 040	3 050	208 000	310 000	850	1 100	**22340B**	**22340BK**
220	300	60	2.1	565	1 170	57 500	119 000	1 100	1 400	**23944**	**23944K**
	340	90	3	1 060	1 920	108 000	195 000	1 000	1 300	**23044B**	**23044BK**
	340	118	3	1 350	2 570	138 000	262 000	920	1 200	**24044B**	**24044BK30**
	370	120	4	1 540	2 670	157 000	272 000	850	1 100	**23144B**	**23144BK**
	370	150	4	1 880	3 400	192 000	345 000	850	1 100	**24144B**	**24144BK30**
	400	108	4	1 580	2 460	161 000	251 000	1 000	1 300	**22244B**	**22244BK**
	400	144	4	2 010	3 350	205 000	340 000	770	1 000	**23244B**	**23244BK**
	460	145	5	2 350	3 500	240 000	360 000	770	1 000	**22344B**	**22344BK**
240	320	60	2.1	565	1 190						
260											
280											

214	326	2.5	0.33	2.05	3.05	2.00	43.3	42
214	326	2.5	0.41	1.64	2.44	1.60	53.4	52.6
218	342	3	0.28	2.45	3.64	2.39	44	43
218	342	3	0.36					



$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

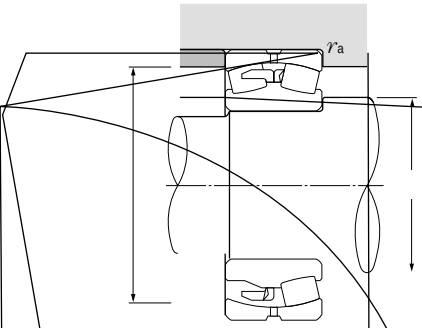
static
$P_{or} = F_r + Y_o F_a$
For values of e, Y_2 and Y_o see the table below.

Abutment and fillet dimensions mm			Constant	Axial load factors			Mass (approx.) kg	
d_a min	D_a max	r_{as} max	e	Y_1	Y_2	Y_o	cylindrical bore	tapered bore
302	478	4	0.36	1.90	2.83	1.86	150	145
308	552	5	0.31	2.16	3.22	2.12	224	220
314	406	2.5	0.20	3.34	4.98	3.27	40	38.7
318	442	3	0.25	2.66	3.96	2.60	72.4	70.2
318	442	3	0.34	1.97	2.93	1.92	98	96.4
322	478	4	0.32	2.11	3.15	2.07	131	127
322	478	4	0.40	1.69	2.51	1.65	161	159
322	518	4	0.26	2.57	3.83	2.51	141	138
322	518	4	0.36	1.88	2.79	1.83	193	187
336	584	6	0.32	2.13	3.17	2.08	270	265
334	426	2.5	0.19	3.50	5.21	3.42	43	41.7
338	462	3	0.25	2.73	4.06	2.67	78.2	75.5
338	462	3	0.33	2.06	3.07	2.02	103	101
342	518	4	0.33	2.06	3.07	2.02	167	162
342	518	4	0.40	1.67	2.48	1.63	207	204
342	558	4	0.26	2.57	3.83	2.51	172	168
342	558	4	0.36	1.86	2.77	1.82	243	236
354	446	2.5	0.17	3.91	5.83	3.83	44.7	43.3
362	498	4	0.25	2.68	3.99	2.62	104	100
362	498	4	0.34	1.98	2.95	1.94	140	138
362	558	4	0.33	2.05	3.06	2.01	210	204
362	558	4	0.42	1.61	2.39	1.57	269	265
368	592	5	0.37	1.84	2.75	1.80	300	291
374	466	2.5	0.17	3.99	5.93	3.90	47.2	45.7
382	518	4	0.24	2.78	4.14	2.72	110	106
382	518	4	0.33	2.06	3.07	2.02	147	145
382	578	4	0.32	2.11	3.15	2.07	222	215
382	578	4	0.40	1.67	2.48	1.63	281	277
388	622	5	0.36	1.87	2.78	1.83	339	329
398	502	3	0.19	3.54	5.27	3.46	69.9	67.7
402	538	4	0.24	2.87	4.27	2.80	115	111
402	538	4	0.30	2.23	3.32	2.18	153	150
402	598	4	0.31	2.16	3.22	2.12	235	228
402	598	4	0.39	1.73	2.58	1.69	292	287

Note: Please refer to page **B-220** for outer ring oil inlet and oil groove dimensions.

d 380～500mm

380	680	240	6	5 200	9 650	530 000	985 000	430	550	**23276B**	**23276BK**
	540	106	4	1 580	3 650	161 000	370 000	550	720	**23980**	**23980K**
	600	148	5	2 980	6 050	305 000	615 000	520	680	**23080B**	**23080BK**
400	600	200	5	3 850	8 400	390 000	855				
420											
440											
460											
480											
500											



$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

static
$P_{or} = F_r + Y_o F_a$
For values of e, Y_2 and Y_o see the table below.

Abutment and fillet dimensions mm			Constant	Axial load factors			Mass (approx.) kg	
d_a min	D_a max	r_{as} max	e	Y_1	Y_2	Y_o	cylindrical bore	tapered bore
408	652	5	0.36	1.89	2.82	1.85	380	369
418	522	3	0.18	3.71	5.53	3.63	73	70.7
422	578	4	0.24	2.80	4.16	2.73	149	144
422	578	4	0.32	2.09	3.11	2.04	202	200
428	622	5	0.31	2.21	3.28	2.16	264	256
428	622	5	0.38	1.77	2.63	1.73	329	324
428	692	5	0.37	1.81	2.69	1.77	457	443
438	542	3	0.17	3.95	5.88	3.86	76.2	73.8
442	598	4	0.24	2.85	4.24	2.78	157	152
442	598	4	0.32	2.13	3.18	2.09	210	207
448	672	5	0.32	2.11	3.15	2.07	354	343
448	672	5	0.40	1.69	2.51	1.65	440	433
456	724	6	0.36	1.86	2.77	1.82	544	528
458	582	3	0.18	3.66	5.46	3.58	101	98
468	622	5	0.24	2.85	4.24	2.78	181	175
468	622	5	0.32	2.11	3.15	2.07	245	241
468	692	5	0.31	2.15	3.21	2.11	370	358
468	692	5	0.39	1.75	2.61	1.71	456	449
476	754	6	0.36	1.88	2.80	1.84	600	582
478	602	3	0.17	3.95	5.88	3.86	107	104
488	652	5	0.23	2.88	4.29	2.82	206	200
488	652	5	0.31	2.15	3.21	2.11	276	272
496	724	6	0.31	2.14	3.19	2.10	443	429
496	724	6	0.39	1.71	2.55	1.67	550	541
496	794	6	0.36	1.87	2.78	1.83	704	683
502	628	4	0.18	3.85	5.73	3.76	123	119
508	672	5	0.23	2.94	4.38	2.88	217	209
508	672	5	0.30	2.22	3.30	2.17	285	280
516	754	6	0.31	2.15	3.21	2.11	492	477
516	754	6	0.39	1.74	2.59	1.70	608	600
516	834	6	0.36	1.87	2.78	1.83	814	790
522	648	4	0.17	4.02	5.98	3.93	131	127
528	692	5	0.23	2.98	4.44	2.91	226	218

Note: Please refer to page **B-220** for outer ring oil inlet and oil groove dimensions.

d 500～670mm

d											
500	720	218	6	4 750	10 900	485 000	1 110 000	350	460	**240/500B**	**240/500BK30**
	830	264	7.5	6 950	13 700	705 000	1 400 000	330	430	**231/500B**	**231/500BK**
	830	325	7.5	8 050	16 700	825 000	1 700 000	330	430	**241/500B**	**241/500BK30**
	920	336	7.5	9 400	17 800	960 000	1 820 000	310	400	**232/500B**	**232/500BK**
530	710	136	5	2 640	6 450	269 000	655 000	400	520	**239/530**	**239/530K**
	780	185	6	4 400	9 350	445 000	955 000	380	490	**230/530B**	**230/530BK**
	780	250	6	5 600	12 700	570 000	1 290 000	330	430	**240/530B**	**240/530BK30**
	870	272	7.5	7 000	14 200	715 000	1 450 000	310	400	**231/530B**	**231/530BK**
	870	335	7.5	8 300	17 400	850 000	1 770 000	310	400	**241/530B**	**241/530BK30**
	980	355	9.5	10 400	19 800	1 060 000	2 020 000	280	370	**232/530B**	**232/530BK**
560	750	140	5	2 830	6 700	288 000	680 000	380	490	**239/560**	**239/560K**
	820	195	6	4 800	10 500	490 000	1 070 000	350	450	**230/560B**	**230/560BK**
	820	258	6	6 100	14 100	620 000	1 440 000	310	400	**240/560B**	**240/560BK30**
	920	280	7.5	7 650	15 500	780 000	1 580 000	280	370	**231/560B**	**231/560BK**
	920	355	7.5	9 950	20 800	1 010 000	2 120 000	280	370	**241/560B**	**241/560BK30**
	1 030	365	9.5	11 100	21 100	1 130 000					
600											
630											
670											

528	692	5	0.30	2.28	3.40	2.23	295	290
536	794	6	0.32	2.12	3.16	2.08	584	566
536	794	6	0.39	1.72	2.57	1.69	716	705
536	884	6	0.39	1.74	2.59	1.70	1 000	971
552	688	4	0.17	3.94	5.87	3.86	157	152
558	752	5	0.22	3.03	4.52	2.97	306	295
558	752	5	0.30	2.24	3.33	2.19	413	406
566	834	6	0.30	2.22	3.30	2.17	653	633
566	834	6	0.38	1.79	2.67	1.75	800	788
574	936	8	0.39	1.74	2.59	1.70	1 200	1 170
582	728	4						

d 710～1060mm

710

750

800

850

900

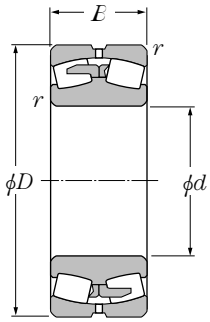
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1000

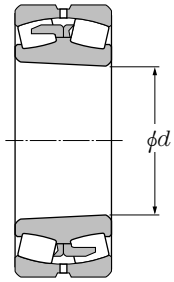
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046 1

738	922	5	0.18	3.85	5.73	3.76	375	363
746	994	6	0.22	3.02	4.50	2.96	663	640
746	994	6	0.29	2.36	3.51	2.31	884	870
754	1 106	8	0.29	2.32	3.45	2.27	1 420	1 380
754	1 106	8	0.37	1.80	2.69	1.76	1 800	1 770
764	1 226	10	0.35	1.91	2.84	1.87	2 540	2 470
778	972	5	0.17	3.90	5.81	3.81	412	399
786	1 054	6	0.21	3.20	4.76	3.13	790	763
786	1 054	6	0.29	2.35	3.49	2.29	1 060	1 040
794	1 176	8	0.29	2.32	3.45	2.27	1 700	1 650
814	1 296	12	0.35	1.92	2.86	1.88	3 050	2 960
828	1 032	5	0.17	4.05	6.04	3.96	487	471
386	1 154		0.28		3549		1 790	1 760
	854					1		1 10
	1 854		0.28				1	



Cylindrical bore

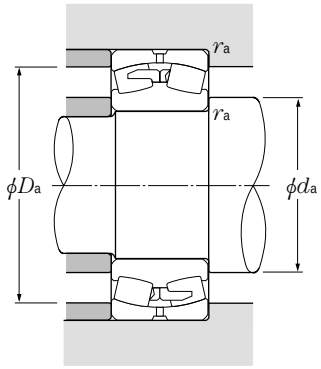


Tapered bore

d 1120～1400mm

Boundary dimensions mm				Basic load ratings kN		Basic load ratings kgf		Limiting speeds min^{-1}		Bearing numbers	
				dynamic	static	dynamic	static				
d	D	E	$r_{s\,min}$[2]	C_r	C_{or}	C_r	C_{or}	grease	oil	cylindrical bore	tapered[1] bore
1120	1 460	250	7.5	9 850	26 700	1 000 000	2 720 000	150	200	**239/1120**	**239/1120K**
	1 580	345	9.5	15 600	39 000	1 590 000	4 000 000	150	190	**230/1120B**	**230/1120BK**
	1 580	462	9.5	19 500	52 500	1 990 000	5 350 000	120	160	**240/1120B**	**240/1120BK30**
1180	1 540	272	7.5	11 000	29 800	1 120 000	3 050 000	140	180	**239/1180**	**239/1180K**
1250	1 630	280	7.5	12 100	33 500	1 230 000	3 400 000	120	160	**239/1250**	**239/1250K**
1320	1 720	300	7.5	13 600	38 000	1 390 000	3 900 000	120	150	**239/1320**	**239/1320K**
1400	1 820	315	9.5	15 100	43 000	1 540 000	4 400 000	100	130	**239/1400**	**239/1400K**

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



Equivalent radial load

dynamic

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

static

$P_{or} = F_r + Y_o F_a$

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

Abutment and fillet dimensions mm			Constant	Axial load factors			Mass (approx.) kg	
d_a min	D_a max	r_{as} max	e	Y_1	Y_2	Y_o	cylindrical bore	tapered bore
1 156	1 424	6	0.15	4.42	6.58	4.32	1 140	1 100
1 164	1 536	8	0.21	3.29	4.80	3.21	2 160	2 090
1 164	1 536	8	0.27	2.50	3.72	2.44	2 890	2 840
1 216	1 504	6	0.15	4.40	6.55	4.30	1 390	1 340
1 286	1 594	6	0.15	4.42	6.58	4.32	1 600	1 550
1 356	1 684	6	0.16	4.34	6.46	4.24	1 900	1 840
1 444	1 776	8	0.15	4.39	6.54	4.29	2 230	2 160

Note: Please refer to page **B-220** for outer ring oil inlet and oil groove dimensions.

d_1 75～115mm

75	63	110	18	LH-22217EK;**H 317X**	91	100.5	12	135	140	2	1.18
	63	110	18	LH-22217BK;**H 317X**	91	100.5	12	—	140	2	1.18
	63	110	18	21317K ;**H 317X**	91	110	6	—	166	2.5	1.18
	82	110	18	22317BK;**H2317X**	94	110	6	—	166	2.5	1.45
80	65	120	18	LH-22218EK;**H 318X**	96	107.5	10	144	150	2	1.37
	65	120	18	LH-22218BK;**H 318X**	96	107.5	10	—	150	2	1.37
	86	120	18	23218BK;**H2318X**	99	110	18	—	150	2	1.69
	65	120	18	21318K ;**H 318X**	96	116	6	—	176	2.5	1.37
	86	120	18	22318BK;**H2318X**	99	117	6	—	176	2.5	1.69
85	68	125	19	22219BK;**H 319X**	102	117	9	—	158	2	1.56
	68	125	19	21319K ;**H 319X**	102	123	7	—	186	2.5	1.56
	90	125	19	22319BK;**H2319X**	105	123	7	—	186	2.5	1.92
90	71	130	20	22220BK;**H 320X**	107	123	8	—	168	2	1.69
	97	130	20	23220BK;**H2320X**	110	122	19	—	168	2	2.15
	71	130	20	21320K ;**H 320X**	107	130	7	—	201	2.5	1.69
	97	130	20	22320BK;**H2320X**	110	129	7	—	201	2.5	2.15
100	81	145	21	23122BK;**H3122X**	117	127	7	—	170	2	2.25
	77	0(63)	22BK;								
110											
115											

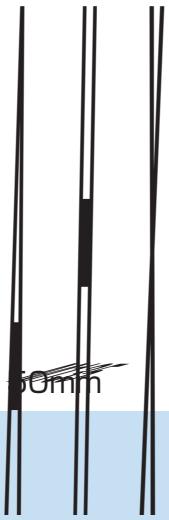
d_1 180

d_1 300～470mm

300	258	400	56	23264BK;**H3264**	343	393	13	558	4	39.3
320	187	400	58	23068BK;**H3068**	355	386	14	498	4	28.7
	254	440	72	23168BK;**H3168**	360	409	14	558	4	49.5
	288	440	72	23268BK;**H3268**	364	421	14	592	5	54.6
340	188	420	58	23072BK;**H3072**	375	408	14	518	4	30.5
	259	460	75	23172BK;**H3172**	380	432	14	578	4	54.2
	299	460	75	23272BK;**H3272**	385	442	14	622	5	60.2
360	193	450	62	23076BK;**H3076**	396	431	15	538	4	35.8
	264	490	77	23176BK;**H3176**	401	456	15	598	4	61.7
	310	490	77	23276BK;**H3276**	405	465	15	652	5	69.6
380	210	470	66	23080BK;**H3080**	417	454	15	578	4	41.3
	272	520	82	23180BK;						
400										
410										
430										
450										
470										

d_1 35～70mm

d_1												
35	M45 × 1.5	29	6	32	LH-22208CK ;**AH 308**	47	—	—	73	1	0.09	AN09
	M45 × 1.5	29	6	32	21308CK ;**AH 308**	48.5	—	—	81.5	1.5	0.09	AN09
	M45 × 1.5	40	7	43	22308CK ;**AH 2308**	48.5	—	—	81.5	1.5	0.128	AN09
40	M50 × 1.5	31	6	34	LH-22209CK ;**AH 309**	52	—	—	78	1	0.109	AN10
	M50 × 1.5	31	6	34	21309CK ;**AH 309**	53.5	—	—	91.5	1.5	0.109	AN10
	M50 × 1.5	44	7	47	22309CK ;**AH 2309**	53.5	—	—	91.5	1.5	0.164	AN10
45	M55 × 2	35	7	38	LH-22210CK ;**AHX 310**	57	—	—	83	1	0.137	AN11
	M55 × 2	35	7	38	21310CK ;**AHX 310**	60	—	—	100	2	0.137	AN11
	M55 × 2	50	9	53	22310CK ;**AHX 2310**	60	—	—	100	2	0.209	AN11
50	M60 × 2	37	7	40	LH-22211EK;**AHX 311**	63.5	67	89.5	91.5	1.5	0.161	AN12
	M60 × 2	37	7	40	LH-22211BK;**AHX 311**	63.5	—	—	91.5	1.5	0.161	AN12
	M60 × 2	37	7	40	21311K ;**AHX 311**	65	—	—	110	2	0.161	AN12
	M60 × 2	54	10	57	22311BK;**AHX 2311**	65	—	—	110	2	0.253	AN12
55	M65 × 2	40	8	43	LH-22212EK ;**AHX 312**	68.5	72	98	101.5	1.5	0.189	AN13
	M65 × 2	40	8	43	LH-22212BK ;**AHX 312**	68.5	—	—	101.5	1.5	0.189	AN13
	M65 × 2	40	8	43	21312K ;**AHX 312**	72	—	—	118	2	0.189	AN13
	M65 × 2	58	11	61								
60												
65												
70												



d_1 115～150mm

d_1											
M135	M130 × 2	93	13	102	24124BK30 ; **AH 24124**	130	190	2	1	AN26
115	M130 × 2	75	12	79	22224BK ; **AHX 3124**	132	203	2	0.95	AN26
	M135 × 2	90	13	9						
125										
135										
145										
150										

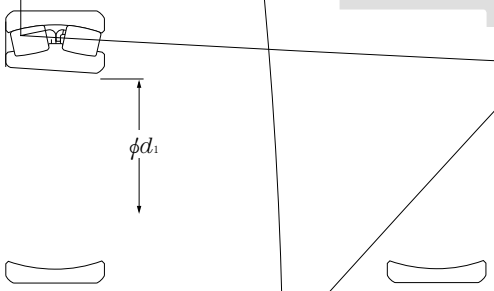
d_1 150～190mm

150	M170 × 3	124	15	135	24132BK30 ; **AH 24132**	172	258	2	3	AN34
	M180 × 3	103	16	108	22232BK ; **AH 3132**	174	276	2.5	3.21	AN36
	M180 × 3	124	20	130	23232BK ; **AH 3232**	174	276	2.5	4.08	AN36
	M180 × 3	140	24	146	22332BK ; **AH 2332**	178	322	3	4.72	AN36
160	M180 × 3	85	17	90	23034BK ; **AH 3034**	182	248	2	2.43	AN36
	M180 × 3	106	16	117	24034BK30 ; **AH 24034**	182	248	2	2.8	AN36
	M180 × 3	106	16	117	24034CK30 ; **AH 24034**	182	248	2	2.8	AN36
	M190 × 3	104	16	109	23134BK ; **AH 3134**	182	268	2	3.4	AN38
	M180 × 3	125	16	136	24134BK30 ; **AH 24134**	182	268	2	3.21	AN36
	M190 × 3	104	16	109	22234BK ; **AH 3134**	188	292	3	3.4	AN38
	M190 × 3	134	24	140	23234BK ; **AH 3234**	188	292	3	4.8	AN38
	M190 × 3	146	24	152	22334BK ; **AH 2334**	188	342	3	5.25	AN38
170	M190 × 3	92	17	98	23036BK ; **AH 3036**	192	268	2	2.81	AN38
	M190 × 3	116	16	127	24036BK30 ; **AH 24036**	192	268	2	3.1	AN38
	M190 × 3	116	16	127	24036CK30 ; **AH 24036**	192	268	2	3.1	AN38
	M200 × 3	116	19	122	23136BK ; **AH 3136**	194	286	2.5	4.22	AN40
	M190 × 3	134	16	145	24136BK30 ; **AH 24136**	194	286	2.5	3.68	AN38
	M200 × 3	105	17	110	22236BK ; **AH**					
180										
190										

Withdrawal Sleeves

NTN

(For spherical roller bearings)

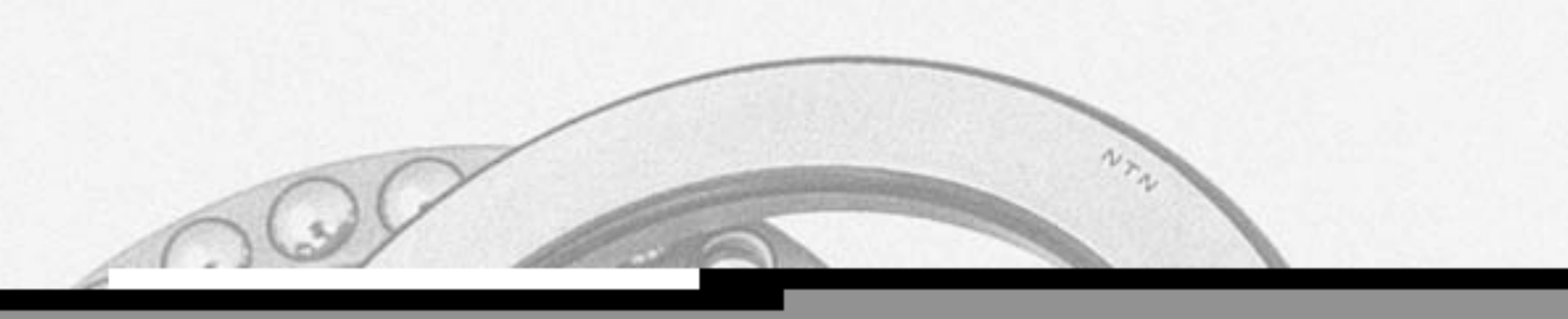


d_1 190～260mm

d_1	Boundary dimensions mm thread[1] G	B_3	G_1	B_4[2]	Bearing numbers	Abutment and fillet dimensions mm d_a min	D_a max	r_{as} max	Mass[3] kg (approx.)	Appro-priate nut no.[4]
190	Tr220 × 4	118	19	123	22240BK ;**AH 2240**	218	342	3	4.68	HN44
	Tr220 × 4	153	25	160	23240BK ;**AH 3240**	218	342	3	6.68	HN44
	Tr220 × 4	170	30	177	22340BK ;**AH 2340**	222	398	4	7.54	HN44
200	Tr235 × 4	111	20	117	23044BK ;**AH 3044**	234	326	2.5	7.4	HNL47
	Tr230 × 4	138	20	152	24044BK30 ;**AH 24044H**	234	326	2.5	8.25	HN46
	Tr240 × 4	145	23	151	23144BK ;**AH 3144**	238	352	3	10.4	HN48
	Tr230 × 4	170	20	184	24144BK30 ;**AH 24144H**	238	352	3	10.2	HN46
	Tr240 × 4	130	20	136	22244BK ;**AH 2244**	238	382	3	9.1	HN48
	Tr240 × 4	181	30	189	23244BK ;**AH 2344**	238	382	3	13.5	HN48
	Tr240 × 4	181	30	189	22344BK ;**AH 2344**	242	438	4	13.5	HN48
220	Tr260 × 4	116	21	123	23048BK ;**AH 3048**	254	346	2.5	8.75	HNL52
	Tr250 × 4	138	20	153	24048BK30 ;**AH 24048H**	254	346	2.5	8.98	HN50
	Tr260 × 4	154	25	161	23148BK ;**AH 3148**	258	382	3	12	HN52
	Tr260 × 4	180	20	195	24148BK30 ;**AH 24148H**	258	382	3	12.5	HN52
	Tr260 × 4	144	21	150	22248BK ;**AH 2248**	258	422	3	11.1	HN52
	Tr260 × 4	189	30	197	23248BK ;**AH 2348**	258	422	3	15.5	HN52
	Tr260 × 4	189	30	197	22348BK ;**AH 2348**	262	478	4	15.5	HN52
240	Tr280 × 4	128	23	135	23052BK ;**AH 3052**	278	382	3	10.7	HNL56
	Tr270 × 4	162	22	178	24052BK30 ;**AH 24052**	278	382	3	11.8	HN54
	Tr290 × 4	172	26	179	23152BK ;**AH 3152**	278	422	3	16.2	HN58
	Tr280 × 4	202	22	218	24152BK30 ;**AH 24152H**	278	422	3	15.4	HN56
	Tr290 × 4	155	23	161	22252BK ;**AH 2252**	282	458	4	14	HN58
	Tr290 × 4	205	30	213	23252BK ;**AH 2352**	282	458	4	19.6	HN58
	Tr290 × 4	205	30	213	22352BK ;**AH 2352**	288	512	5	19.6	HN58
260	Tr300 × 4	131	24	139	23056BK ;**AH 3056**	298	402	3	12	HNL60
	Tr290 × 4	162	22	179	24056BK30 ;**AH 24056H**	298	402	3	12.8	HN58
	Tr310 × 5	175	28	183	23156BK ;**AH 3156**	302	438	4	17.5	HN62
	Tr300 × 4	202	22	219	24156BK30 ;**AH 24156H**	302	438	4	16.3	HN60
	Tr310 × 5	155	24	163	22256BK ;**AH 2256**	302	478	4	15.2	HN62
	Tr310 × 5	212	30	220	23256BK ;**AH 2356**	302	478	4	21.6	HN62
	Tr310 × 5	212	30	220	22356BK ;**AH 2356**	308	552	5	21.6	HN62

d_1 400～480mm

400	Tr460 × 5	266	40	276	23184BK	;**AH 3184**	448	672	5	46.5	HN92
	Tr440 × 5	310	30	332	24184BK30	;**AH 24184H**	448	672	5	40.3	HN88
420	Tr470 × 5	194	35	205	23088BK	;**AHX 3088**	468	622	5	32	HNL94
	Tr460 × 5	242	30	264	24088BK30	;**AH 24088H**	468	622	5	31.9	HNL92
	Tr480 × 5	270	42	281	23188BK	;**AHX 3188**	468	692	5	49.8	HN96
440	Tr460 × 5	310	30	332	24188BK30	;**AH 24188H**	468	692	5	42.3	HN92
	Tr490 × 5	202	37	213	23092BK	;**AHX 3092**	488	652	5	35.2	HNL98
	Tr480 × 5	250	32	273	24092BK30	;**AH 24092H**	488	652	5	34.7	HNL96
	Tr510 × 6	285	43								
460											
480											


NTN

These bearings are designed primarily to support axial loads at contact angles between 30˚ and 90˚. Just as with radial bearings, these bearings differ according to the type of rolling element they use: there are thrust ball bearings that use balls and thrust roller bearings that use rollers.

The configuration and characteristics of each type of bearing are given.

With thrust bearings, it is necessary to supply an axial preload in order to prevent slipping movement between the bearing's rolling elements and raceways. For more detailed information on this point, please refer to the material concerning bearing preload on page A-62.

1. Single direction thrust ball bearings

As shown in **Diagram 1**, the steel balls of single direction thrust ball bearings are arranged between a pair of shaft housing washers (bearing shaft washer and housing shaft washer), and the normal contact angle is 90˚. Axial loads can

Table 1 Standard cage types for single direction thrust ball bearings

Bearing series	511	512	513	514
Molded resin cage	51100 ～51107	51200 ～51207	—	—
Pressed cage	51108 ～51152	51208 ～51224	51305 ～51320	51405 ～51415
Machined cage	51156 ～511/530	51226 ～51260	51322 ～51340	51416 ～51420

Note: Due to their material properties, molded resin cages can not be used in applications where temperatures exceed 120˚C.



Diagram 1. Single direction thrust ball bearing (with pressed cage)

Thrust Bearings

10～50mm

10	24	9	0.3	10.0	14.0	1 020	1 420	6 700	9 500	**51100**	24	11	18	16	0.3	0.021
	26	11	0.6	12.7	17.1	1 290	1 740	5 800	8 300	**51200**	26	12	20	16	0.6	0.03
12	26	9	0.3	10.3	15.4	1 050	1 570	6 400	9 200	**51101**	26	13	20	18	0.3	0.023
	28	11	0.6	13.2	19.0	1 340	1 940	5 600	8 000	**51201**	28	14	22	18	0.6	0.034
15	28	9	0.3	10.5	16.8	1 070	1 710	6 200	8 800	**51102**	28	16	23	20	0.3	0.024
	32	12	0.6	16.6	24.8	1 690	2 530	5 000	7 100	**51202**	32	17	25	22	0.6	0.046
17	30	9	0.3	10.8	18.2	1 100	1 850	6 000	8 500	**51103**	30	18	25	22	0.3	0.026
	35	12	0.6	17.2	27.3	1 750	2 780	4 800	6 800	**51203**	35	19	28	24	0.6	0.054
20	35	10	0.3	14.2	24.7	1 450	2 520	5 200	7 500	**51104**	35	21	29	26	0.3	0.04
	40	14	0.6	22.3	37.5	2 270	3 850	4 100	5 900	**51204**	40	22	32	28	0.6	0.081
25	42	11	0.6	19.6	37.0	1 990	3 800	4 600	6 500	500						
30																
35																
40																
45																
50																

50～90mm

50	95	31	1.1	96.5	202	9 850	20 600	1 800	2 600	**51310**	95	52	77
55													
60													
65													
70													
75													
80													
85													
90													

100～200mm

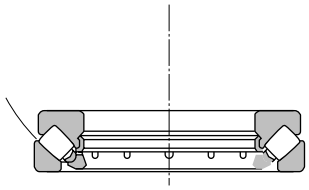
100	135 150	25 38	1 1.1	85.0	268	8 700	27 300	1 700	2 400	**51120**	135	102	121	114	1	0.987
110																
120																
130																
140																
150																
160																
170																
180																
190																
200																

200～530mm

200	280	62	2	315	1 110	32 000	113 000	700	990	＊ **51240**	277	204	248	232	2	11.8
	340	110	4	595	2 220	61 000	227 000	470	670	＊ **51340**	335	205	282	258	3	41.8
220	270	37	1.1	177	740	18 100	75 500	920	1 300	＊ **51144**	267	223	250	240	1	4.27
	300	63	2	325	1 210	33 000	123 000	660	950	＊ **51244**	297	224	268	252	2	13
240	300	45	1.5	228	935	23 200	95 000	780	1 100	＊ **51148**	297	243	276	264	1.5	6.87
	340	78	2.1	415	1 650	42 500	168 000	550	790	＊ **51248**	335	244	299	281	2	22.4
260	320	45	1.5	232	990	23 600	101 000	750	1 100	＊ **51152**	317	263	296	284	1.5	7.38
	360	79	2.1	440	1 810	45 000	184 000	530	760	＊ **51252**	355	264	319	301	2	24.2
280	350	53	1.5	305	1 270	31 000	130 000	650	940	＊ **51156**	347	283	322	308	1.5	11.8
	380	80	2.1	460	1 970	47 000	201 000	510	730	＊ **51256**	375	284	339	321	2	26.1
300	380	62	2	355	1 560	36 000	159 000	580	820	＊ **51160**	376	304	348	332	2	17.2
	420	95	3	590	2 680	60 000	273 000	440	630	＊ **51260**	415	304	371	349	2.5	40.6
320	400	63	2	365	1 660	37 000	169 000	550	790	＊ **51164**	396	324	368	352	2	18.4
340	420	64	2	375	1 760	38 000	179 000	530	760	＊ **51168**	416	344	388	372	2	19.7
360	440	65	2	380	1 860	39 000	190 000	510	730	＊ **51172**	436	364	408	392	2	21.1
380	460	65	2	380	1 910	39 000	195 000	500	710	＊ **51176**	456	384	428	412	2	
400																
420																
440																
460																
480																
500																
530																

d 60～160mm

60
65
70
75
80
85
90
100
110
120
130
140
150
160



d 340～500mm

Boundary dimensions mm				Basic load ratings dynamic kN		static kN		Limiting speeds min^{-1}	Bearing numbers	Dimensions mm				
d	D	T	$r_{s\,min}$ [1]	C_a	C_{oa}	C_a	C_{oa}	oil		D_1	d_1	B_1	C	A
340	460	73	3	1 240	5 800	126 000	590 000	820	**29268**	395	445	21	37	183
	540	122	5	2 650	10 700	270 000	1 090 000	610	**29368**	428	520	41	59	192
	620	170	7.5	4 400	17 500	445 000	1 790 000	500	**29468**	462	590	61	82	201
360	500	85	4	1 510	7 050	154 000	720 000	720	**29272**	423	485	25	44	194
	560	122	5	2 710	11 100	276 000	1 130 000	590	**29372**	448	540	41	59	202
	640	170	7.5	4 500	18 500	460 000	1 890 000	490	**29472**	480	610	61	82	210
380	520	85	4	1 590	7 650	162 000	780 000	700	**29276**	441	505	27	42	202
	600	132	6	3 200	13 300	325 000	1 360 000	550	**29376**	477	580	44	63	216
	670	175	7.5	4 900	19 700	500 000	2 010 000	470	**29476**	504	640	63	85	230
400	540	85	4	1 620	7 950	165 000	810 000	680	**29280**	460	526	27	42	212
	620	132	6	3 400	14 500	345 000	1 480 000	530	**29380**	494	596	44	64	225
	710	185	7.5	5 450	22 100	555 000	2 250 000	440	**29480**	534	680	67	89	236
420	580	95	5	2 100	10 400	214 000	1 060 000	620	**29284**	489	564	30	46	225
	650	140	6	3 600	15 500	365 000	1 580 000	500	**29384**	520	626	48	68	235
	730	185	7.5	5 500	22 800	560 000	2 330 000	430	**29484**	556	700	67	89	244
440	600	95	5	2 150	10 900	219 000	1 110 000	600	**29288**	508	585	30	49	235
	680	145	6	3 800	16 400	385 000	1 680 000	480	**29388**	548	655	49	70	245
	780	206	9.5	6 400	26 200	650 000	2 670 000	390	**29488**	588	745	74	100	260
460	620	95	5	2 150	11 000	219 000	1 120 000	590	**29292**	530	605	30	46	245
	710	150	6	4 200	18 500	430 000	1 880 000	460	**29392**	567	685	51	72	257
	800	206	9.5	6 600	27 900	670 000	2 840 000	380	**29492**	608	765	74	100	272
480	650	103	5	2 400	12 000	245 000	1 220 000	550	**29296**	556	635	33	55	259
	730	150	6	4 200	18 700	430 000	1 910 000	450	**29396**	590	705	51	72	270
	850	224	9.5	7 500	31 500	765 000	3 200 000	350	**29496**	638	810	81	108	280
500	670	103	5	2 540	13 000	259 000	1 330 000	530	**292/500**	574	654	33	55	268
	750	150	6	4 300	19 300	435 000	1 970 000	440	**293/500**	611	725	51	74	280
	870	224	9.5	7 850	33 000	805 000	3 350 000	340	**294/500**	661	830	81	107	290

1) Smallest allowable dimension for chamfer dimension r.

395	420	2.5	34.4
430	470	4	107
465	530	6	230
420	455	3	50.5
450	495	4	112
485	550	6	240
440	475	3	53.4
480	525	5	143

Locknuts, Lockwashers & Lockplates

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Locknuts, Lockwashers & Lockplates



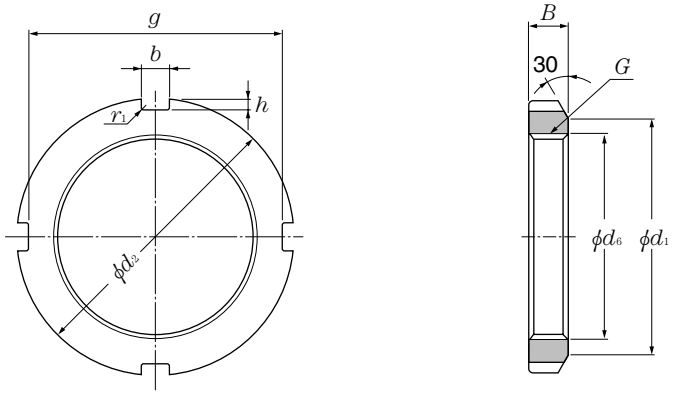
AN00	M10 × 0.75	18	13.5	14	3	2	10.5	4	0.4	0.005	—	**AW00**
AN01	M12 × 1	22	17	18	3	2	12.5	4	0.4	0.007	—	**AW01**
AN02	M15 × 1	25	21	21	4	2	15.5	5	0.4	0.01	—	**AW02**
AN03	M17 × 1	28	24	24	4	2	17.5	5	0.4	0.013	—	**AW03**
AN04	M20 × 1	32	26	28	4	2	20.5	6	0.4	0.019	04	**AW04**
AN05	M25 × 1.5	38	32	34	5	2	25.8	7	0.4	0.025	05	**AW05**
AN06	M30 × 1.5	45	38	41	5	2	30.8	7	0.4	0.043	06	**AW06**
AN07	M35 × 1.5	52	44	48	5	2	35.8	8	0.4	0.053	07	**AW07**
AN08	M40 × 1.5	58	50	53	6	2.5	40.8	9	0.5	0.085	08	**AW08**
AN09	M45 × 1.5	65	56	60	6	2.5	45.8	10	0.5	0.119	09	**AW09**
AN10	M50 × 1.5	70	61	65	6	2.5	50.8	11	0.5	0.148	10	**AW10**
AN11	M55 × 2	75	67	69	7	3	56	11	0.5	0.158	11	**AW11**
AN12	M60 × 2	80	72	74	7	3	61	11	0.5	0.174	12	**AW12**
AN13	M65 × 2	85	79	79	7	3	66	12	0.5	0.203	13	**AW13**
AN14	M70 × 2	92	85	85	8	3.5	71	12	0.5	0.242	14	**AW14**
AN15	M75 × 2	9										

Reference withdrawal sleeve No.								Shaft mm (for shaft)
AH30	AH240	AH31	AH241	AH2	AH32	AH3	AH23	
—	—	—	—	—	—	—	—	10
—	—	—	—	—	—	—	—	12
—	—	—	—	—	—	—	—	15
—	—	—	—	—	—	—	—	17
—	—	—	—	—	—	—	—	20
—	—	—	—	—	—	—	—	25
—	—	—	—	—	—	—	—	30
—	—	—	—	—	—	—	—	35
—	—	—	—	—	—	—	—	40
—	—	—	—	**AH208**	—	**AH 308**	**AH 2308**	45
—	—	—	—	**AH209**	—	**AH 309**	**AH 2309**	50
—	—	—	—	**AH210**	—	**AHX310**	**AHX2310**	55
—	—	—	—	**AH211**	—	**AHX311**	**AHX2311**	60
—	—	—	—	**AH212**	—	**AHX312**	**AHX2312**	65
—	—	—	—	—	—	—	—	70
—	—	—	—	**AH213**	—	**AH 313**	**AH 2313**	75
—	—	—	—	**AH214**	—	**AH 314**	**AHX2314**	80
—	—	—	—	**AH215**	—	**AH 315**	**AHX2315**	85
—	—	—	—	**AH216**	—	**AH 316**	**AHX2316**	90
—	—	—	—	**AH217**	—	**AHX317**	**AHX2317**	95
—	—	—	—	**AH218**	**AHX3218**	**AHX318**	**AHX2318**	100
—	—	—	—	**AH219**	—	**AHX319**	**AHX2319**	105
—	—	—	—	**AH220**	**AHX3220**	**AHX320**	**AHX2320**	110
—	—	—	**AH24122**	**AH221**	—	**AHX321**	—	115
—	—	**AHX3122**	—	**AH222**	—	**AHX322**	—	120
—	**AH24024**	—	—	—	**AHX3222**	—	**AHX2322**	125
AHX3024	—	**AHX3124**	**AH24124**	**AH224**	—	**AHX324**	—	130
—	**AH24026**	—	—	—	**AHX3224**	—	**AHX2324**	135
AHX3026	—	**AHX3126**	**AH24126**	**AH226**	—	**AHX326**	—	140
—	**AH24028**	—	—	—	**AHX3226**	—	**AHX2326**	145
AHX3028	—	**AHX3128**	**AH24128**	**AH228**	—	**AHX328**	—	150
—	**AH24030**	—	—	—	**AHX3228**	—	**AHX2328**	155
AHX3030	—	—	**AH24130**	**AH230**	—	—	—	160
—	—	**AHX3130**	—	—	**AHX3230**	**AHX330**	**AHX2330**	165
AH 3032	**AH24032**	—	**AH24132**	**AH232**	—	—	—	170
AH 3034	**AH24034**	**AH 3132**	**AH24134**	**AH234**	**AH 3232**	**AH 332**	**AH 2332**	180
AH 3036	**AH24036**	**AH 3134**	**AH24136**	**AH236**	**AH 3234**	**AH 334**	**AH 2334**	190
—	**AH24038**	**AH 3136**	**AH24138**	—	**AH 3236**	—	**AH 2336**	200

AN 44	Tr220 × 4	280	250	260	20	10	222	32	0.8	15	M 8 × 1.25	238	5.2
AN 48	Tr240 × 4	300	270	280	20	10	242	34	0.8	15	M 8 × 1.25	258	5.95
AN 52	Tr260 × 4	330	300	306	24	12	262	36	0.8	18	M10 × 1.5	281	8.05
AN 56	Tr280 × 4	350	320	326	24	12	282	38	0.8	18	M10 × 1.5	301	9.05

bore no.[3] of adapter	Reference lock-plate No.	Shaft mm (for shaft)
44	**AL 44**	220
48	**AL 44**	240
52	**AL 52**	260
56	**AL 52**	280
60	**AL 60**	300
64	**AL 64**	320
68	**AL 68**	340
72	**AL 68**	360
76	**AL 76**	380
80	**AL 80**	400
84	**AL 80**	420
88	**AL 88**	440
92	**AL 88**	460
96	**AL 96**	480
/500	**AL100**	500

(For adapter sleeve and shaft)
Series ANL



Bearing numbers	Dimensions									Mass	Reference		
	G [1]	d_2	d_1	g	b	h	d_6	B	r_1 min.	(kg) (approx.)			
ANL24	M120×2	145	133	135	12	5	121	20	0.7	0.78	24	**AWL24**	120
ANL26	M130×2	155	143	145	12	5	131	21	0.7	0.88	26	**AWL26**	130
ANL28	M140×2	165	151	153	14	6	141	22	0.7	0.99	28	**AWL28**	140
ANL30	M150×2	180	164	168	14	6	151	24	0.7	1.38	30	**AWL30**	150
ANL32	M160×3	190	174	176	16	7	161.5	25	0.7	1.56	32	**AWL32**	160
ANL34	M170×3	200	184	186	16	7	171.5	26	0.7	1.72	34	**AWL34**	170
ANL36	M180×3	210	192	194	18	8	181.5	27	0.7	1.95	36	**AWL36**	180
ANL38	M190×3	220	202	204	18	8	191.5	28	0.7	2.08	38	**AWL38**	190
ANL40	M200×3	240	218	224	18	8	201.5	29	0.7	2.98	40	**AWL40**	200

1) St t JIS B0207 (t t).
2) A t t H30.
3) A t t t t t t ("X").

ANL 44	220 × 4	260	242	242	20	9	222	30	0.8	12	M 6 × 1	229	3.09
ANL 48	240 × 4	290	270	270	20	10	242	34	0.8	15	M 8 × 1.25	253	5.16
ANL 52	260 × 4	310	290	290	20	10	262	34	0.8	15	M 8 × 1.25	273	5.67
ANL 56	280 × 4	330	310	310	24	10	282	38	0.8	15	M 8 × 1.25	293	6.78
ANL 60	300 × 4	360	336	336	24	12	302	42	0.8	15	M 8 × 1.25	316	9.62
ANL 64	320 × 5	380	356	356	24	12	322.5	42	0.8	15	M 8 × 1.25	335	9.94
ANL 68	340 × 5	400	376	376	24	12	342.5	45	1	15	M 8 × 1.25	355	11.7
ANL 72	360 × 5	420	394	394	28	13	362.5	45	1	15	M 8 × 1.25	374	12
ANL 76	380 × 5	450	422	422	28	14	382.5	48	1	18	M10 × 1.5	398	14.9
ANL 80	400 × 5	470	442	442	28	14	402.5	52	1	18	M10 × 1.5	418	16.9
ANL 84	420 × 5	490	462	462	32	14	422.5	52	1	18	M10 × 1.5	438	17.4
ANL 88	440 × 5	520	490	490	32	15	442.5	60	1	21	M12 × 1.75	462	26.2
ANL 92	460 × 5	540	510	510	32	15	462.5						

HN 42	Tr210 × 4	270	238	250	20	10	212	30	0.8	4.75	**AH24040**	**AH 3138**	**AH24140**
HN 44	Tr220 × 4	280	250	260	20	10	222	32	0.8	5.35	—	**AH 3140**	—
HN 46	Tr230 × 4	290	260	270	20	10	232	34	0.8	5.8	**AH24044H**	—	**AH24144H**
HN 48	Tr240 × 4	300	270	280	20	10	242	34	0.8	6.2	—	**AH 3144**	—
HN 50	250 × 4	320	[illegible]	[illegible]	[illegible]	10	252	36	0.8	7	**AH24048H**	—	—
HN 52	260 × 4	[illegible]	300	306	[illegible]	12	262	36	0.8	8.55	—	**AH 3148**	**AH24148H**
HN 54	270 × 4	340	[illegible]	316	[illegible]	12	272	38	0.8	9.2	**AH24052H**	—	—
HN 56	280 × 4	350	[illegible]	326	[illegible]	12	282						

LOCK NUT

Reference withdrawal sleeve no. AH22	AH32	AH23
AH2238	AH 3238	AH2338
AH2240	AH 3240	AH2340
—	—	—
AH2244	—	AH2344
—	—	—
AH2248	—	AH2348
—	—	—
—	—	—
AH2252	—	AH2352
—	—	—
AH2256	—	AH2356
—	—	—
AH2260	AH 3260	—
—	—	—
AH2264	AH 3264	—
—	—	—
—	AH 3268	—
—	—	—
—	AH 3272	—
—	AH 3276	—
—	AH 3280	—
—	AH 3284	—
—	AHX3288	—
—	—	—
—	AHX3292	—
—	AHX3296	—
—	AHX32/500	—

HNL 41	Tr205 × 4	250	232	234	18	8	207	30	0.8	3.43	**AH 3038**	—	**AH238**
HNL 43	Tr215 × 4	260	242	242	20	9	217	30	0.8	3.72	**AH 3040**	—	**AH240**
HNL 47	Tr235 × 4	280	262	262	20	9	237	34	0.8	4.6	**AH 3044**	—	**AH244**
HNL 52	Tr260 × 4	310	290	290	20	10	262	34	0.8	5.8	**AH 3048**	—	**AH248**
HNL 56	Tr280 × 4	330	310	310	24	10	282	38	0.8	6.72	**AH 3052**	—	**AH252**
HNL 60	Tr300 × 4	360	336	336	24	12	302	42	0.8	9.6	**AH 3056**	—	**AH256**
HNL 64	Tr320 × 5	380	356	356	24	12	322.5	42	1	10.3	**AH 3060**	—	—
HNL 69	Tr345 × 5	410	384	384	28	13	347.5	45	1	11.5	**AH 3064**	—	—
HNL 72	Tr360 × 5	420	394	394	28	13	362.5	45	1	12.1	—	**AH24068H**	—
HNL 73	Tr365 × 5	430	404	404	28	13	367.5	48	1	14.2	**AH 3068**	—	—
HNL 76	Tr380 × 5	450	422	422	28	14	382.5	48	1	16	—	**AH24072H**	—
HNL 77	Tr385 × 5	450	422	422	28	14	387.5	48	1	1			

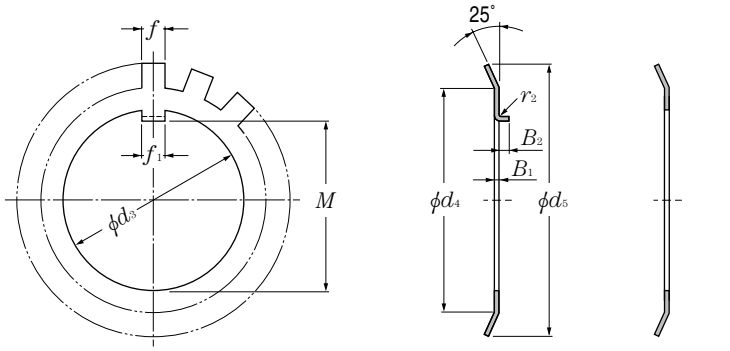
AW00	**AW00X**	10	8.5	3	1	3	13.5	21	0.5	2	9	0.131
AW01	**AW01X**	12	10.5	3	1	3	17	25	0.5	2	11	0.192
AW02	**AW02X**	15	13.5	4	1	4	21	28	1	2.5	13	0.253
AW03	**AW03X**	17	15.5	4	1	4	24	32	1	2.5	13	0.313
AW04	**AW04X**	20	18.5	4	1	4	26	36	1	2.5	13	0.35
AW05	**AW05X**	25	23	5	1.2	5	32	42	1	2.5	13	0.49
AW06	**AW06X**	30	27.5	5	1.2	5	38	49	1	2.5	13	0.78
AW07	**A**											

0.6 9 533.414 0 0 1 24 Tj ET BT 9 0 0 9 113.432 469.224 Tm (105) Tj ET BT 9 00 0 9 113.463 446.621 Tm (4) Tj ET BT 9 0 0 9 113.49 412.372 Tm (1.24) Tj ET BT 9 00

—	**AN00**	10
—	**AN01**	12
—	**AN02**	15
—	**AN03**	17

04

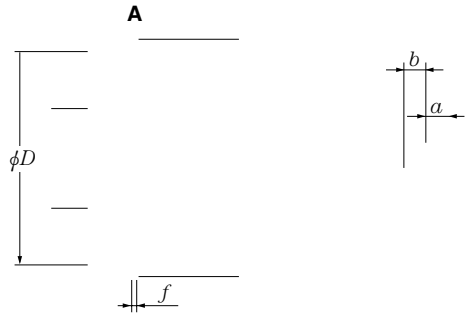
Series AWL



Bent inner tab type **Straight inner tab type**

Bearing numbers		Dimensions mm							NO.of tabs	Mass kg	Reference		
bent inner tab type	straight inner tab type	d_3	M	f_1	B_1	f	d_4	d_5	bent inner tab type r_2	bent inner tab type B_2	bent inner tab type	100 pieces (approx.)	bore no.[1] of adapter	locknut no.	shaft mm (for shaft)
AWL24	**AWL24X**	120	115	14	2	12	133	155	1.5	6	19	7.7	24	**ANL24**	120
AWL26	**AWL26X**	130	125	14	2	12	143	165	1.5	6	19	8.7	26	**ANL26**	130
AWL28	**AWL28X**	140	135	16	2	14	151	175	1.5	8	19	10.9	28	**ANL28**	140
AWL30	**AWL30X**	150	145	16	2	14	164	190	1.5	8	19	11.3	30	**ANL30**	150
AWL32	**AWL32X**	160	154	18	2.5	16	174	200	1.5	8	19	16.2	32	**ANL32**	160
AWL34	**AWL34X**	170	164	18	2.5	16	184	210	1.5	8	19	19	34	**ANL34**	170
AWL36	**AWL36X**	180	174	20	2.5	18	192	220	1.5	8	19	18	36	**ANL36**	180
AWL38	**AWL38X**	190	184	20	2.5	18	202	230	1.5	8	19	20.5	38	**ANL38**	190
AWL40	**AWL40X**	200	194	20	2.5	18	218	250	1.5	8	19	21.4	40	**ANL40**	200

1) Uses adapter series **H31, H32,** and **H23**.
Note: Wide slit type adapter sleeves without the suffix "**X**" can use either straight or bent inner tab washers.



Nominal bearing outer diameter D	Groove diameter D_1		Dimension series 18 Groove position a		Dimension series 19 Groove position a		Groove width b		Knuckle radius r_s
	max	min	max	min	max	min	max	min	max
22	20.8	20.5	—	—	1.05	0.90	1.05	0.8	0.2
24	22.8	22.5	—	—	1.05	0.90	1.05	0.8	0.2
28	26.7	26.4	—	—	1.30	1.15	1.20	0.95	0.25
30	28.7	28.4	—	—	1.30	1.15	1.20	0.95	0.25
32	30.7	30.4	1.30	1.15	—	—	1.20	0.95	0.25
34	32.7	32.4	1.30	1.15	—	—	1.20	0.95	0.25
37	35.7	35.4	1.30	1.15	1.70	1.55	1.20	0.95	0.25
39	37.7	37.4	—	—	1.70	1.55	1.20	0.95	0.25
40	38.7	38.4	1.30	1.15	—	—	1.20	0.95	0.25
42	40.7	40.4	1.30	1.15	1.70	1.55	1.20	0.95	0.25
44	42.7	42.4	1.30	1.15	—	—	1.20	0.95	0.25
45	43.7	43.4	—	—	1.70	1.55	1.20	0.95	0.25
47	45.7	45.4	1.30	1.15	1.70	1.55	1.20	0.95	0.25
52	50.7	50.4	1.30	1.15	1.70	1.55	1.20	0.95	0.25
55	53.7	53.4	—	—	1.70	1.55	1.20	0.95	0.25
58	56.7	56.4	1.30	1.15	—	—	1.20	0.95	0.25
62	60.7	60.3	—	—	1.70	1.55	1.20	0.95	0.25
65	63.7	63.3	1.30	1.15	—	—	1.20	0.95	0.25
68	66.7	66.3	—	—	1.70	1.55	1.20	0.95	0.25
72	70.7	70.3	1.70	1.55	1.70	1.55	1.20	0.95	0.25
78	76.2	75.8	1.70	1.55	—	—	1.6	1.3	0.4
80	77.9	77.5	—	—	2.1	1.9	1.6	1.3	0.4
85	82.9	82.5	1.70	1.55	2.1	1.9	1.6	1.3	0.4
90	87.9	87.5	1.70	1.55	2.1	1.9	1.6	1.3	0.4
95	92.9	92.5	1.70	1.55	—	—	1.6	1.3	0.4
100	97.9	97.5	1.70	1.55	2.5	2.3	1.6	1.3	0.4
105	102.6	102.1	—	—	2.5	2.3	1.6	1.3	0.4
110	107.6	107.1	2.1	1.9	2.5	2.3	1.6	1.3	0.4
115	112.6	112.1	2.1	1.9	—	—	1.6	1.3	0.4
120	117.6	117.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4
125	122.6	122.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4
130	127.6	127.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4
140	137.6	137.1	2.5	2.3	3.3	3.1	2.2	1.9	0.6
145	142.6	142.1	—	—	3.3	3.1	2.2	1.9	0.6
150	147.6	147.1	2.5	2.3	3.3	3.1	2.2	1.9	0.6
165	161.8	161.3	3.3	3.1	3.7	3.5	2.2	1.9	0.6
175	171.8	181.3	3.3	3.1	—	—	2.2	1.9	0.6
180	176.8	176.3	—	—	3.7	3.5	2.2	1.9	0.6
190	186.8	186.3	3.3	3.1	3.7	3.5	2.2	1.9	0.6
200	196.8	196.5	3.3	3.1	—	—	2.2	1.9	0.6

NR 30	27.9	0	— 0.4	3.25	3.10	1.12	1.02	3	34.7	30	0.4	0.3	0.06	2	—	10	9	8
NR 32	29.9	0	— 0.4	3.25	3.10	1.12	1.02	3	36.7	32	0.4	0.3	0.06	2	15	12	—	9
NR 35	32.9	0	— 0.4	3.25	3.10	1.12	1.02	3	39.7	35	0.4	0.3	0.06	2	17	15	10	—
NR 37	34.5	0	— 0.4	3.25	3.10	1.12	1.02	3	41.3	37	0.4	0.3	0.06	2	—	—	12	10
NR 40	37.8	0	— 0.4	3.25	3.10	1.12	1.02	3	44.6	40	0.4	0.3	0.06	2	—	17	—	—
NR 42	39.5	0	— 0.5	3.25	3.10	1.12	1.02	3	46.3	42	0.4	0.3	0.06	2	20	—	15	12
NR 44	41.5	0	— 0.5	3.25	3.10	1.12	1.02	3	48.3	44	0.4	0.3	0.06	2	22	—	—	—
NR 47	44.3	0	— 0.5	4.04	3.89	1.12	1.02	4	52.7	47	0.4	0.3	0.06	2.5	25	20	17	—
NR 50	47.3	0	— 0.5	4.04	3.89	1.12	1.02	4	55.7	50	0.4	0.3	0.06	2.5	—	22	—	—
NR 52	49.4	0	— 0.5	4.04	3.89	1.12	1.02	4	57.9	52	0.4	0.3	0.06	2.5	28	25	20	15
NR 55	52.3	0	— 0.5	4.04	3.89	1.12	1.02	4	60.7	55	0.4	0.3	0.06	2.5	30	—	—	—
NR 56	53 598.0 1 f (56) -0.3 c 90 0 9 159.247 381.781 ₹ή (0.3) 0.7																	

Catalog List and Appendix Table Contents

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Appendix table 7: Basic tolerance ····· D-12

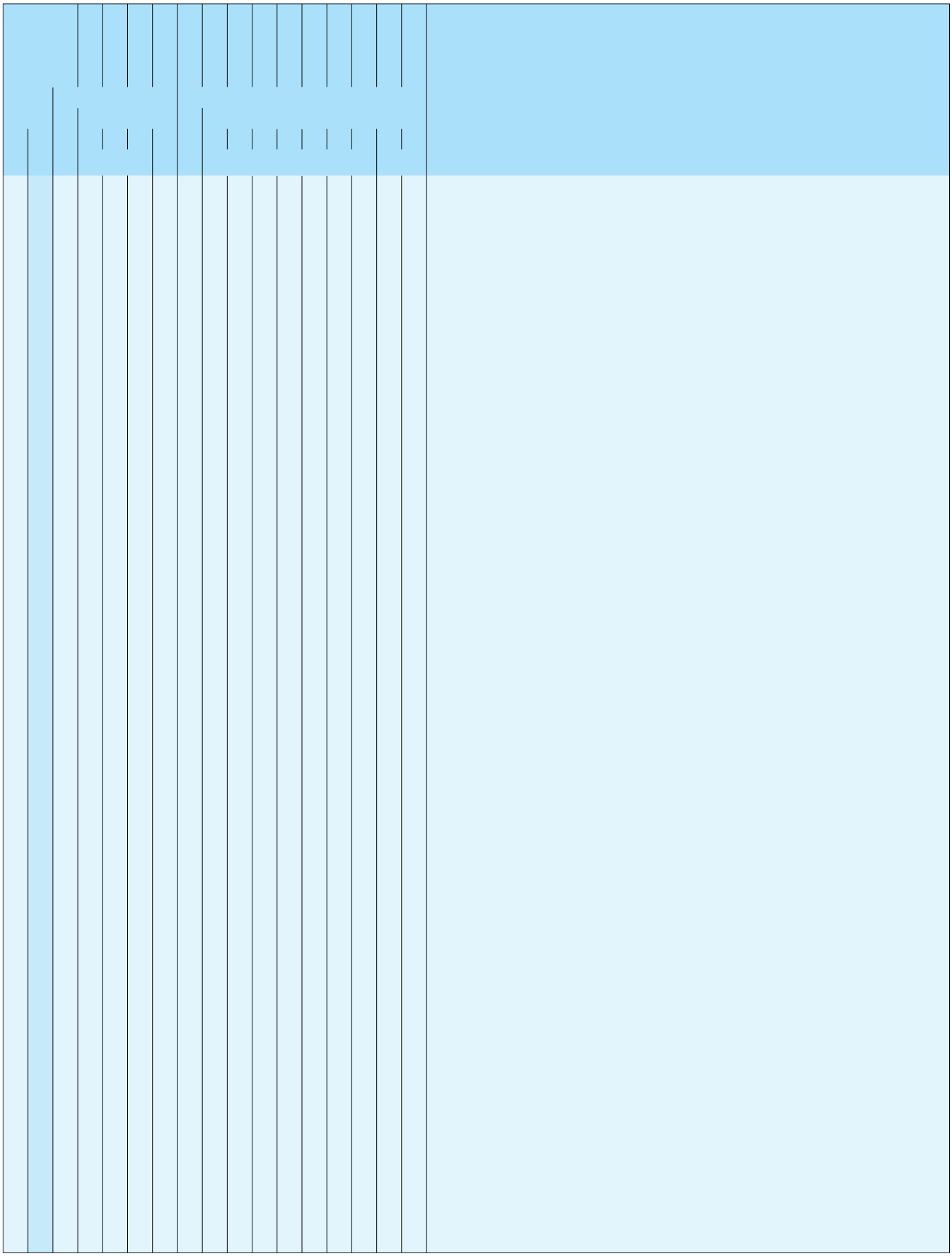
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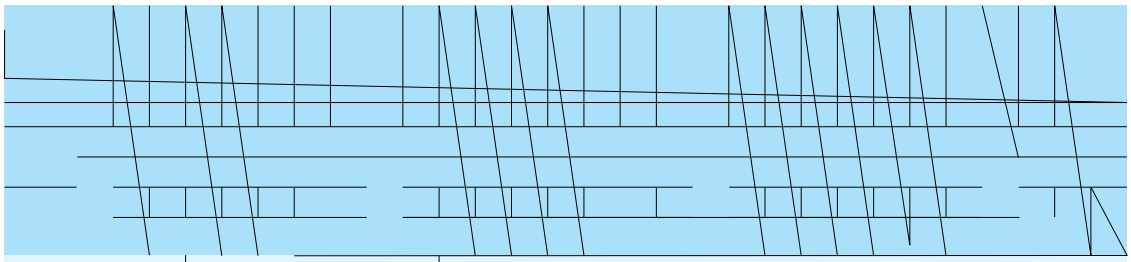
Catalog List & Appendix Taa

BALL AND ROLLER BEARINGS	
Ball and Roller Bearings	2202/C/E/I/P/S
Large Bearings	2250/E/P
Precision Rolling Bearings	2260/E/D
Miniature and Extra Small Ball Bearings	3013/E
Ball Bearings Shield and Seal Types	3015/E/S
Care and Maintenance of Bearings	3017/E/S/P
HL Bearings	3020/E
Miniature Molded Rubber Bearings	3014/E
Bearings with Solid Grease	3022/E/S/P
Bearings for Special Environment Uitra Final Series	3023/E
Large Size, Long Operating Life Bearing-EA type	3024/E/P
Long-life AS Series TAB/ETA Bearings	3025/E
Tapered Roller Bearings ECO-Top	3026/E/S/C
Self-Aligning Spherical Roller Bearings LH Series	3027/E/S/C
Bearings for Clean Environment Ultra Final Series	3028/E
Insulated Bearings MEGAOHM™ Series	3030/E/DF
New Standard Series of Spherical Roller Bearing S-TITAN™ Series	3031/JE
Type E Spherical Roller Bearings	3701/E
Sealed Self-Aligning Roller Bearings-WA Type	3702/E/S
FA Tapered Roller Bearings	3802/E/D/C
HUB BEARINGS	4601/E/C
The New Generation of NTN Bearings for wind Turbine	8404/JE
Railway Bearings	8501/E/C
Bearings for Mining Application	8601/E
Spherical Roller Bearings-UA Type	3710/E
Aerospace Bearings	8102/E
NEEDLE ROLLER BEARINGS	
Needle Roller Bearings	2300/E/I/P/S
Cam Followers & Roller Followers	3604/JE
HK-F Type Drawn Cup Needle Roller Bearings	3029/JE
Miniature Cam Followers	3601/E

●BEARING UNITS	
Bearing Units	2400/E/I/S
Bearing Units Steel Series	3902/E
Bearing Units Stainless Series	3903/E
Bearing Units Plastic Housing Series	3904/E
Triple-Sealed Bearings for Bearing Units	3905/E
●PLUMMER BLOCKS	
Plummer Blocks	2500E/S
●PARTS FEEDER	
Parts Feeder	7018/E
Parts Feeder Guide Book	7019/E
NTN Parts Feeder with Standard Attachments (for Bolts or Washer)	7016/E
●CLUTCHES	
One-way Clutches (Overrunning Clutches)	6402/E
●PLAIN BEARINGS	
"BEAREE" NTN Engineering Plastics	5100/E
Miniature Plastic Sliding Screws	5112/E
NTN "BEARPHITE" Oil Impregnated Sintered Bearings	5202/CE
Spherical Plain Bearings	5301/E
●HANDBOOK	
Bearing Units Handbook	9011/E/S
Rolling Bearings Handbook	9012/E
Needle Roller Bearings Handbook	9013/E
●GUIDE BOOK	



Appendix table 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-2



—	—		
1	—		
—	—		
2	—		
—	—		
3	3		
4	4		
5	5		
6	6		
7	7		
8	8		
9	9		
00	10		
01	12		
02	15		
03			
04			
/22			
05			
/28			
06			
/32			
07			
08			
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44			
48			
52			
56			
60			
64			
68			
72			
76			
80			
84			
88			
92			
96			
/500			
/530			
/560			
/600			
/630			
/670			
/710			
/750			
/800			
/850			
/900			
/950			
/1000			
/1060			
/1120			
/1180			
/1250			
/1320			
/1400			
/1500			

		Mass M	Time T	Acceleration	Force	Stress	Pressure	Energy
		kg	s	m/s^2	N	Pa	Pa	J
			s	Gal	dyn	dyn/cm^2	dyn/cm^2	erg
			s	m/s^2	kgf	kgf/m^2	kgf/m^2	kgf · m

Appendix table 2: Comparison of SI, CGS and gravity units-2

Quantity / Unit system	Power rate	Temperature	Viscosity	Dynamic viscosity	Magnetic flux	Flux density	Magnetic field strength
SI	W	K	Pa · s	m^2/s	Wb	T	A/m
CGS system	erg/s	˚C	P	St	Mx	Gs	Oe
Gravitation system	kgf · m/s	˚C	kgf · s/m^2	m^2/s	—	—	—

Appendix table 3: SI-customary unit conversion table-2

Quantity	Unit designation	Symbol	Conversion rate to SI	SI unit designation	Symbol
Viscosity	Poise	P	10^{-1}	Pascal second	Pa · s
	Centipoise	cP	10^{-3}		
	Kilogram force / square second per meter	kgf · 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	˚C	+273.15	Kelvin	K
Radioactive	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
Quantity of electricity	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 4: Tenth power multiples of SI unit

Multiples of unit	Prefix		Multiples of unit	Prefix	
	Name	Symbol		Name	Symbol
10^{18}	Exa	E	10^{-1}	Deci	d
10^{15}	Peta	P	10^{-2}	Centi	c
10^{12}	Tera	T	10^{-3}	Mili	m
10^{9}	Giga	G	10^{-6}	Micro	μ
10^{6}	Mega	M	10^{-9}	Nano	n
10^{3}	Kilo	k	10^{-12}	Pico	p
10^{2}	Hecto	h	10^{-15}	Femto	f
10	Deca	da	10^{-18}	Ato	a

Diameter division mm		a13		c12		d6		e6		e13		f5		f6		g5		g6	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
3	6	− 270	− 450	− 70	− 190	− 30	− 38	− 20	− 28	− 20									
6	10	− 280	− 500	− 80	− 230	− 40	− 49	− 25	− 34	− 25									
10	18	− 290	− 560	− 95	− 275	− 50	− 61	− 32	− 43	− 32						0			
18	30	− 300	− 630	−110	− 320	− 65	− 78	− 40	− 53	− 40									
30	40	− 310	− 700	−120	− 370	− 80	− 96	− 50	− 66	− 50									
40	50	− 320	− 710	−130	− 380														
50	65	− 340	− 800	−140	− 440	−100	−119	− 60	− 79	− 60						10			
65	80	− 360	− 820	−150	− 450														
80	100	− 380	− 920	−170	− 520	−120	−142	− 72	− 94	− 72									
100	120	− 410	− 950	−180	− 530														
120	140	− 460	−1 090	−200	− 600	−145	−170	− 85	−110	− 85						10			
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									
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						10			
280	315	−1 050	−1 860	−330	− 850														
315	355	−1 200	−2 090	−360	− 930	−210	−246	−125	−161	−125									
355	400	−1 350	−2 240	−400	− 970														
400	450	−1 500	−2 470	−440	−1 070	−230	−270	−135	−175	−135									
450	500	−1 650	−2 620	−480	−1 110														
500	560	−	−	−	−	−260	−304	−145	−189	−									
560	630																		
630	710	−	−	−	−	−290	−340	−160	−210			−		−					
710	800																		
800	900	−	−	−	−	−320	−376	−170	−226	−		−		−					
900	1 000																		
1 000	1 120	−	−	−	−	−350	−416	−195	−261	−		−		−					
1 120	1 250																		
1 250	1 400	−	−	−	−	−390	−468	−220	−298					−					
1 400	1 600																		

h4		h5		h6		h7		h8		h9		h10		h11		h13		js4			
high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	over	incl.
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	120 140 160	140 160 180
0	−14	0	−20	0	−29	0	− 46	0	− 72	0	−115	0	−185	0	−290	0	−720	+ 7	− 7	180 200 225	200 225 250
0	−16	0	−23	0	−32	0	− 52	0	− 81	0	−130	0	−210	0	−320	0	−810	+ 8	− 8	250 280	280 315
0	−18	0	−25	0	−36	0	− 57	0	− 89	0	−140	0	−230	0	−360	0	−890	+ 9	− 9	315 355	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	−44	0	− 70	0	−110	0	−175	0	−280	0	−440	0	−	−	−	500 560	560 630
−	−	−	−	0	−50	0	− 80	0	−125	0	−200	0	−320	0	−500	0	−	−	−	630 710	710 800
−	−	−	−	0	−56	0	− 90	0	−140	0	−230	0	−360	0	−560	0	−	−	−	800 900	900 1 000
−	−	−	−	0	−66	0	−105	0	−165	0	−260	0	−420	0	−660	0	−	−	−	1 000 1 120	1 120 1 250
−	−	−	−	0	−78	0	−125	0	−195	0	−310	0	−500	0	−780	0	−	−	−	1 250 1 400	1 400 1 600

m6		n5		n6		p5		p6		r6		r7		Basic tolerance				Diameter division mm	
high	low	high	low	high	low	high	low	high	low	high	low	high	low	IT2	IT3	IT5	IT7	over	incl.
+ 12	+ 4	+13	+ 8	+ 16	+ 8	+17		+ 20	+ 12	+ 23	+ 15	+ 27	+ 15	1.5	2.5	´5	12	3	6
+ 15	+ 6	+16	+10	+ 19	+10	+21		+ 24	+ 15	+ 28	+ 19	+ 34	+ 19	1.5	2.5	6	15	6	10
+ 18	+ 7	+20	+12	+ 23	+12	+26		+ 29	+ 18	+ 34	+ 23	+ 41	+ 23	2	3	8	18	10	18
+ 21	+ 8	+24	+15	+ 28	+15	+31		+ 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	+11	+33	+20	+ 39	+20	+45	+32	+ 51	+ 32					3	5	13	30		
+ 35	+13	+38	+23	+ 45	+23	+52	+37	+ 59	+ 37					4	6	15	35		
+ 40	+15	+45	+27	+ 52	+27	+61		+ 68	+ 43	+ 88 + 90 + 93	+ 63 + 65 + 68	+103 +105 +108	+ 63 + 65 + 68	5	8	18	40	120 140 160	140 160 180
+ 46	+17	+51	+31	+ 60	+31	+70		+ 79	+ 50	+106 +109 +113	+ 77 + 80 + 84	+123 +126 +130	+ 77 + 80 + 84	7	10	20	46	180 200 225	200 225 250
+ 52	+20	+57	+34	+ 66	+34	+79	+56	+ 88	+ 56					8	12	23	52		
+ 57	+21	+62	+37	+ 73	+37	+87	+62	+ 98	+ 62					9	13	25	57		
+ 63	+23	+67	+40	+ 80	+40	+95	+63	17 ET BT 8 0 68		212.41 Tj ET BT 8 0 0 846317 ET				12 T 8 15 8 212.425 295.963 T.0 1 Tf (77					
+ 70	+26	−	−	+ 88	+44	−	−	+122	+ 78					−	−	¼vë€ “	90	w‘ö ñ ¸ „E„r „„ö ´	
+ 80	+30	−	−	+100	+50	−	−	+138	+ 88					−	−	−	80		
+ 90	+34	−	−	+112	+56	−	−	+156	+100					−	−	−	90		
+106	+40	−	−	+132	+66	−	−	+186	+120					−	−	−	105		
+126	+48	−	−	+156	+78	−	−	+218	+140					−	−	−	125		

Unit μm

H7		H8		H9		H10		H11		H13		J6		Js6		J7		Js7		K5		Diameter division mm	
high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	over	incl.
+ 12	0	+ 18	0	+ 30	0	+ 48	0	+ 75	0	+180	0	+ 5	−3	+ 4	− 4	+ 6	− 6	+ 6	− 6	0	− 5	3	6
+ 15	0	+ 22	0	+ 36	0	+ 58	0	+ 90	0	+220	0	+ 5	−4	+ 4.5	− 4.5	+ 8	− 7	+ 7.5	− 7.5	+1	− 5	6	10
+ 18	0	+ 27	0	+ 43	0	+ 70	0	+110	0	+270	0	+ 6	−5	+ 5.5	− 5.5	+10	− 8	+ 9	− 9	+2	− 6	10	18
+ 21	0	+ 33	0	+ 52	0	+ 84	0	+130	0	+330	0	+ 8	−5	+ 6.5	− 6.5	+12	− 9	+10.5	−10.5	+1	− 8	18	30
+ 25	0	+ 39	0	+ 62	0	+100	0	+160	0	+390	0	+10	−6	+ 8	− 8	+14	−11	+12.5	−12.5	+2	− 9	30 40	40 50
+ 30	0	+ 46	0	+ 74	0	+120	0	+190	0	+460	0	+13	−6	+ 9.5	− 9.5	+18	−12	+15	−15	+3	−10	50 65	65 80
+ 35	0	+ 54	0	+ 87	0	+140	0	+220	0	+540	0	+16	−6	+11	−11	+22	−13	+17.5	−17.5	+2	−13	80 100	100 120
+ 40	0	+ 63	0	+100	0	+160	0	+250	0	+630	0	+18	−7	+12.5	−12.5	+26	−14	+20	−20	+3	−15	120 140 160	140 160 180
+ 46	0	+ 72	0	+115	0	+185	0	+290	0	+720	0	+22	−7	+14.5	−14.5	+30	−16	+23	−23	+2	−18	180 200 225	200 225 250
+ 52	0	+ 81	0	+130	0	+210	0	+320	0	+810	0	+25	−7	+16	−16	+36	−16	+26	−26	+3	−20	250 280	280 315
+ 57	0	+ 89	0	+140	0	+230	0	+360	0	+890	0	+29	−7	+18	−18	+39	−18	+28.5	−28.5	+3	−22	315 355	355 400
+ 63	0	+ 97	0	+155	0	+250	0	+400	0	+970	0	+33	−7	+20	−20	+43	−20	+31.5	−31.5	+2	−25	400 450	450 500
+ 70	0	+110	0	+175	0	+280	0	+440	0	−	0	−	−	+22	−22	−	−	+35	−35	−	−	500 560	560 630
+ 80	0	+125	0	+200	0	+320	0	+500	0	−	0	−	−	+25	−25	−	−	+40	−40	−	−	630 710	710 800
+ 90	0	+140	0	+230	0	+360	0	+560	0	−	0	−	−	+28	−28	−	−	+45	−45	−	−	800 900	900 1 000
+105	0	+165	0	+260	0	+420	0	+660	0	−	0	−	−	+33	−33	−	−	+52.5	−52.5	−	−	1 000 1 120	1 120 1 250
+125	0	+195	0	+310	0	+500	0	+780	0	−	0	−	−	+39	−39	−	−	+62.5	−62.5	−	−	1 250 1 400	1 400 1 600
+150	0	+230	0	+370	0	+600	0	+920	0	−	0	−	−	+46	−46	−	−	+75	−75	−	−	1 600 1 800	1 800 2 000

Appendix table 7: Basic tolerance

Unit μm

Diameter division 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

Kinematic viscosity mm^2/s			
2.7 4.3 5.9 7.4 8.9		32.2	
10.4 11.8 13.1 14.5 15.8			
17.0 18.2 19.4 20.6 23.0			
25.0 27.5 29.8 32.1 34.3			
36.5 38.8 41.0 43.2 47.5			
51.9 56.5 60.5 64.9 70.3			
75.8 81.2 86.8 92.0 97.4			

1 BT 8 0 0 8 174.94962.406 6.4062.406 6.406 BT 8 0 0 8 174.94962.406 8 643.206 Tm 4(23.0) Tj ET BT 8 0 0 62.406

kgf		N	kgf		N			
0.1020	**1**	9.8066	3.4670	**34**	333.43	6.8321		657.04
0.2039	**2**	19.613	3.5690	**35**	343.23	6.9341		666.85
0.3059	**3**	29.420	3.6710	**36**	353.04	7.0361		676.65
0.4079	**4**	39.227	3.7730	**37**	362.85	7.1380		686.46
0.5099	**5**	49.033	3.8749	**38**	372.65	7.2400		696.27
0.6118	**6**	58.840	3.9769	**39**	382.46	7.3420		706.08
0.7138	**7**	68.646	4.0789	**40**	392.27	7.4440		715.88
0.8158	**8**	78.453	4.1808	**41**	402.07	7.5459		725.69
0.9177	**9**	88.260	4.2828	**42**	411.88	7.6479		735.50
1.0197	**10**	98.066	4.3848	**43**	421.68	7.7499		745.30
1.1217	**11**	107.87	4.4868	**44**	431.49	7.8518		755.11
1.2237	**12**	117.68	4.5887	**45**	441.30	7.9538		764.92
1.3256	**13**	127.49	4.6907	**46**	451.10	8.0558		774.72
1.4276	**14**	137.29	4.7927	**47**	460.91	8.1578		784.53
1.5296	**15**	147.10	4.8946	**48**	470.72	8.2597		794.34
1.6316	**16**	156.91	4.9966	**49**	480.52	8.3617		
1.7335	**17**	166.71	5.0986	**50**	490.33	8.4637		
1.8355	**18**	176.52	5.2006	**51**	500.14	8.5656		
1.9375	**19**	186.33	5.3025	**52**	509.94	8.6676		
2.0394	**20**	196.13	5.4045	**53**	519.75	8.7696		
2.1414	**21**	205.94	5.5065	**54**	529.56	8.8716		
2.2434	**22**	215.75	5.6085	**55**	539.36	8.9735		
2.3454	**23**	225.55	5.7104	**56**	549.17	9.0755		
2.4473	**24**	235.36	5.8124	**57**	558.98	9.1775		
2.5493	**25**	245.17	5.9144	**58**	568.78	9.2794		
2.6513	**26**	254.97	6.0163	**59**	578.59	9.3814		
2.7532	**27**	264.78	6.1183	**60**	588.40	9.4834		
2.8552	**28**	274.59	6.2203	**61**	598.20	9.5854		
2.9572	**29**	284.39	6.3223	**62**	608.01	9.6873		
3.0592	**30**	294.20	6.4242	**63**	617.82	9.7893		
3.1611	**31**	304.01	6.5262	**64**	627.62	9.8913		
3.2631	**32**	313.81	6.6282	**65**	637.43	9.9932		
3.3651	**33**	323.62	6.7302	**66**	647.24	10.0952		

1/64	0.015625										
1/32	0.031250										
3/64	0.046875										
1/16	0.062500										
5/64	0.078125										
3/32	0.093750										
7/64	0.109375										
1/ 8	0.125000										
9/64	0.140625										
5/32	0.156250										
11/64	0.171875										
3/16	0.187500										
13/64	0.203125										
7/32	0.218750										
15/64	0.234375										
1/ 4	0.250000										
17/64	0.265625										
9/32	0.281250										
19/64	0.296875										
5/16	0.312500										
21/64	0.328125										
11/32	0.343750										
23/64	0.359375										
3/ 8	0.375000										
25/64	0.390625										
13/32	0.406250										
27/64	0.421875										
7/16	0.437500										
29/64	0.453125										
15/32	0.468750										
31/64	0.484375										
1/ 2	0.500000										
33/64	0.515625										
17/32	0.531250										
35/64	0.546875										
9/16	0.562500										
37/64	0.578125										
19/32	0.593750										
39/64	0.609375										
5/ 8											
41/64	0.140625										
21/32	0.156250										
43/64	0.171875										
11/16											
45/64	07203125										
23/32	07218750										
47/64	07234375										
3/ 4											
49/64	07265625										
25/32	07281250										
51/64	07296875										
13/16	08312500										
53/64	08328125										
27/32	08343750										
55/64											
7/ 8	08375000										
57/64	08390625										
29/32	09406250										
59/64	09421875										
15/16	09437500										
61/64	09453125										
31/32	09468750										
63/64	09484375										

Rockwell hardness	Picker's hardness	Brinell hardness		Rockwell hardness		Shore hardness
C scale 1471.0N {150kgf}		Standard steel balls	Tungsten carbide steel balls	A scale 588.4N {60kgf}	B scale 980.7N {100kgf }	

Appendix table 12: Greek alphabet list

Upright	Italic		Reading
Uppercase	Uppercase	Lowercase	
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*	Khi
Ψ	*Ψ*	*ψ*	Psi
Ω	*Ω*	*ω*	Omega